Methodological and Therapeutic Implications of Studying Intrusive Memories in Non-Clinical Populations

Benjamin Cope Plimpton

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Abstract

Intrusive memories (IMs) are repetitive, unwanted memories, characterised by their disruptiveness and often distressing content. They are most widely known as a feature of clinical conditions such as depression and post-traumatic stress disorder (PTSD), but have also been shown to occur in non-clinical populations. The majority of research on naturally occurring IMs has recruited clinical populations, and relied on questionnaires and interviews (i.e. retrospective reports). Most research with non-clinical populations has focused on analogue IMs that are induced following exposure to distressing film content (the so call "trauma film paradigm"), which participants are then asked to record in a simple diary.

The principal aim of the present thesis was to develop diary and laboratory methods – previously used to research Involuntary Autobiographical Memories (IAMs) – and apply them to the study of naturally occurring and analogue IMs in non-clinical populations. These methods have proven useful for understanding the frequency, phenomenology and triggers of IAMs, and exploration of these variables with regard to IMs was another key aim of the present thesis. A final aim was to examine the therapeutic benefit of interacting with the content of IMs using these methods.

Overall, results suggest that IMs in non-clinical populations are common and frequent. This was clearly demonstrated by the results of an initial online questionnaire (Study 1) in a general student population, and further supported by a naturalistic diary study (Study 2) which showed the frequency of IMs to be comparable to some retrospective studies in clinical populations. Finally, results of two studies using a novel laboratory method (Studies 3a and 3b), showed that it is possible to capture naturally occurring IMs reported by non-clinical participants under controlled conditions.

The triggers for naturalistic IMs show some key similarities with IAMs. For example, the IMs captured under laboratory conditions in Studies 3a and 3b were highly susceptible to

verbal cuing, as is the case with IAMs. Furthermore, personalisation of those verbal cues (based on an IM reported at screening) resulted in a greater frequency of reported IMs than was the case with non-personalised cues in Study 3b.

Results also suggest some key differences in the triggers for naturalistic IMs, analogue IMs, and IAMs. For all three types of cognition, environmental triggers were the most frequently reported, but analogue IMs registered a slightly higher proportion of 'no-trigger' reports. In addition, results suggest that writing about and rating naturalistic IMs in the lab can yield differences in subsequent diary reports of abstract/verbal versus sensory/perceptual triggers, with in-person disclosure resulting in relatively equal proportions of each trigger-type (similar to IAMs) and non-disclosure resulting in many more abstract/verbal trigger reports. By contrast, analogue IMs consistently showed a significantly higher proportion of sensory/perceptual riggers. These findings have implications for theoretical understanding of the relationship of analogue IMs to naturalistic IMs, as well as the relationship of the latter to IAMs.

Finally, results suggest that in-person disclosure of IMs may have the greatest therapeutic benefit, but that this may be augmented by a future oriented task such as keeping a diary of involuntary prospective memories. These results, however, differed from participants' subjective assessment, suggesting that both objective and subjective measures are important for assessing the impact of any intervention.

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Chapter 1: Research and Theory on Intrusive Memories and Involuntary Autobiographical Memories

1.1 Introduction

Once thought to be a rare phenomenon, involuntary memories are increasingly considered to represent a basic mode in which human cognition operates in everyday life (Berntsen, 2010; Cole & Kvavilashvili, 2019; Hintzman, 2011). Although a variety of different terms have been used to refer to them (Krans, de Bree, & Moulds, 2015; Kvavilashvili, Niedźwieńska, Gilbert, & Markostamou, 2020) the phenomenon of Involuntary Autobiographical Memory (IAM) is of greatest relevance to the present thesis. As the name suggests, these are memories from our personal past that come to mind spontaneously without any deliberate intention to recall them, often in response to some incidental internal or external cues in the environment. For example, hearing a name of a particular park, may elicit a memory of "going to the park with my nan, and feeding the ducks with my cousin", or thinking about baking an apple crumble, may suddenly bring back a memory about how "during a cooking class a student asked me to put her apple crumble in the oven because she was 'scared' and I accidentally dropped it". The content of these memories can vary greatly and may refer to specific one-off events from recent or distant past, or more general repetitive events (Berntsen, 2009; Schlagman & Kvavilashvili, 2008). Although their emotional valence is predominantly positive or neutral, they can also refer to negative events that happened in the past. Despite this diversity, one key feature that such memories share is that they often occur just once and then leave consciousness without coming to mind again (Berntsen, 2009).

Intrusive memories (IMs), in contrast, can be defined as involuntary recollections of mostly negative life events (though not exclusively), which repeatedly intrude upon consciousness. They can be difficult to control and are often disruptive to ongoing activities (Kvavilashvili, 2014). They are most widely known as one of the key diagnostic criteria for Post-Traumatic Stress Disorder (PTSD) – as well as Acute Stress Disorder (ASD) – but have

also been found to occur in depression (e.g. Brewin, Hunter, Carroll, & Tata, 2009; Brewin, 1998; Reynolds & Brewin, 1999) as well as in non-clinical populations following distressing or traumatic events (Brewin, Christodoulides, & Hutchinson, 1996; Bywaters, Andrade, & Turpin, 2004; Yeung & Fernandes, 2020). This has bolstered the increasingly prevalent view that IMs are more than an expression of psychopathology, and are in fact a common feature of human cognition (Marks, Franklin, & Zoellner, 2018).

A diverse set of experiences can precipitate IMs. These can range from events which, according to the American Psychiatric Association's (2013) Fifth Diagnostic and Statistical Manual (DSM-V), fulfil Criterion A for a PTSD diagnosis (e.g. an automobile accident, an assault)[1] to those that most, if not all, people will experience at some point in their lives (e.g. the breakdown of a relationship, the death of a loved one, a personal failure). By some estimates, however, nearly 70% of us will experience an event in our lifetimes which fulfils DSM-V Criterion A, though IMs must be experienced along with other symptoms (e.g. avoidance, fluctuations in cognition and mood, or in arousal and reactivity) for at least one month for a PTSD diagnosis to be made (Kessler et al., 2017). Although many people will experience IMs during that initial month, and beyond, they may not meet the criteria for a diagnosis of PTSD. Evidence indeed suggests that whilst memories can persist for long periods of time, the overall symptoms can remain below the threshold for a clinical diagnosis (e.g. Newby & Moulds, 2011).

The study of IMs therefore has high clinical relevance, and much of the research on IMs has been conducted with the aim of illuminating the features of PTSD (and more recently depression), whilst also offering insight into possible treatment. But given the

[1] Defined as "Exposure to actual or threatened death, serious injury, or sexual violence, in one (or more) of the following ways: 1. Directly Experiencing the traumatic event(s); 2. Witnessing, in person the event(s) as it occurred to others; 3. Learning that the traumatic event(s) occurred to a close family member or close friend. In cases of actual or threatened death of a family member or friend, the event(s) must have been violent or accidental; 4. Experiencing repeated or extreme exposure to aversive details of the traumatic event(s)…" (DSM-5, American Psychological Association, 2013, pp 271-272).

apparent prevalence of IMs in daily life, the imperative for studying them extends beyond this. In addition to contributing to our understanding of the clinical conditions with which they are associated, research into IMs also enhances our understanding of them as a feature of everyday cognition (Marks et al., 2018). This raises a methodological question, however, of how best to study this phenomenon in a way that illuminates both its clinical and non-clinical manifestations. A key proposal of the present thesis is that researching IMs in non-clinical populations, but incorporating methods borrowed from IAM research, will offer the greatest insight into their frequency, phenomenology and triggers. In addition to contributing to our understanding of IMs, it will be argued that the use of these methods – in particular a diary – have the potential to yield some therapeutic benefit as well.

What will follow in this chapter is an overview of research to date on IMs, with a primary focus on methods, and what these have revealed about the frequency of this type of cognition, but also how they are experienced by the individual, including the detection of triggers. The majority of such research has been conducted either on naturally occurring IMs using questionnaires or retrospective reports, or on 'induced' IMs using analogue laboratory methods (the so called 'trauma film paradigm"). The contribution and limitations of each approach will be discussed.

The present chapter will also include an overview of IAM research, again with a particular focus on methods used and what these have revealed about IAM frequency, phenomenology and triggers. This is done with the aim of laying the foundation for later demonstration of how IAM methods can be fruitfully applied to IM research. Of particular note, the diary has been a key methodological tool in this research area. Given the transitory nature of this type of cognition, and the concomitant difficulty of capturing it, this has been an indispensable innovation. Laboratory methods have also been developed which have

replicated and extended findings about the conditions under which IAMs tend to occur. These methods have also facilitated more targeted exploration of the nature of triggers of IAMs.

In order to further explore the relationship of IMs to IAMs, theoretical accounts of each type of memory will be reviewed. Opinion has diverged primarily on how best to account for the occurrence of IMs, and whether they result from a particular breakdown in the functioning of an autobiographical memory system, or if they are an understandable product of such a system. It has been argued that some of the empirical basis for these differing theoretical accounts may be an artefact of different methods (Brewin, 2014). Whilst the primary aim of the present thesis is not the testing of one or another of these theories, it is nonetheless the case that some findings have theoretical implications, namely, findings related to the triggers for IMs.

Finally, the present chapter will include an overview of research into the therapeutic benefits of engaging with distressing memory content, including monitoring, questionnaire completion and expressive writing. It has been found that such engagement can improve measures of psychological and physiological health. This has been perhaps most widely demonstrated with regard to the expressive writing paradigm, whereby participants engage in time-limited but detailed writing about contents of distressing memory (James W Pennebaker, 1997). It has also been found, however, that even just monitoring of thoughts over a period of days or weeks can yield such benefit, and indeed often used as part of cognitive-behavioural therapy (Cohen, Edmunds, Brodman, Benjamin, & Kendall, 2013). Similarly, a one-off completion of a questionnaire about memory content has also been shown to improve scores on measures of distress associated with that memory (Boals, Hathaway, & Rubin, 2011; Rubin, Boals, & Klein, 2010). The chapter will end with the rationale for the studies included in the present thesis, in terms of how they build upon and depart from research conducted to date on IMs.

1.2 Overview of Intrusive Memory Research

Within the literature on IMs, there has been a lack of clarity around the terminology used, although more recently there have been efforts to rectify this situation. Thus, the terms 'intrusive memory' and 'flashback' have been used interchangeably at times, despite the apparent qualitative differences of each (Kvavilashvili, 2014). Flashbacks are normally accompanied by a heightened sense of dissociation from the present, and feeling of re-experiencing the event, on which the memory is based, in the present. They are often accompanied by more acute bodily sensations, which match the physical experience from original event (Ehlers & Clark, 2000; Hellawell & Brewin, 2002). By contrast, IMs can be accompanied by bodily sensations and a sense of re-experiencing (Brewin, 2018; Hackmann, Ehlers, Speckens, & Clark, 2004), but perhaps not as consistently or acutely, particularly when they are reported by people without a diagnosis of PTSD (Kleim, Graham, Bryant, & Ehlers, 2013). Because of these qualitative differences, it has been suggested that these memories might be most usefully plotted on a continuum, with IAMs at one extreme, flashbacks at the other, and IMs in the middle (Kvavilashvili, 2014; see Figure 1.1).

	IAMs	**IM**	**Flashbacks**
Retrieval	Spontaneous	Spontaneous	Spontaneous
Repetition	Low to none	High to very high	High to very high
Valence	Positive, negative, neutral	Negative, positive	Negative
Vividness	Low to very high	Very high	Very high
Avoidance	None	High	High
Disruption	None or minimal	Significant	Significant to extreme
Distress	None to moderate	Moderate to high	High to very high
Re-experiencing event now	No	No	Yes
Population	Normal and clinical	Normal and clinical	PTSD only

Figure 1-1: *Schematic representation of different types of involuntary memories presented on a continuum and their characteristics (Kvavilashvili, 2014, p. 102).*

Evidence has shown that involuntary remembering in general is a more vivid experience that its voluntary counterpart, and this appears to be particularly the case with repetitive, distressing IMs. Indeed, IMs are thought to be primarily image-based, especially in clinical samples (Ehlers et al., 2002), which fits with theories about the neurological basis for such memorises as relying on amygdala rather than hippocampal activation (Brewin, 2001). However, in some cases intrusive images can refer to a broader temporal category of cognition oriented toward the present or the future, whilst remaining related to the traumatic event on which the intrusion is based. In these cases, the mental imagery is driven more by the individual's appraisal of the memory content (e.g. a patient with PTSD following an accident experiencing intrusive images of himself in a wheelchair as a manifestation of feelings of helplessness; Ehlers et al., 2002).

In addition, with regard to different forms of psychopathology and depression in particular, IMs may overlap with other intrusive cognitive processes such as rumination (Watkins & Roberts, 2020). For example, Pearson, Brewin, Rhodes, and McCarron (2008) asked 22 depressed participants to report on the frequency and content of their ruminative thoughts. They found that 21 of these participants reported ruminating every day, across 56 different reported topics, the majority of which (n=21) were about the past. By its nature rumination is a repetitive pattern of thought, therefore, rumination about the past might be considered a process akin or identical to the experience of IMs. Indeed it has already been pointed out that these processes are closely related, and that rumination as a cognitive style can be predictive of the experience of IMs, as well as other symptoms of PTSD (Newby & Moulds, 2012; Steil & Ehlers, 2000; Wild et al., 2020).

But is the susceptibility to involuntary cognition a critical feature of poor mental health in general? This question is important for research into involuntary cognition and psychopathology, and resonates with findings from the literature on mind-wandering. Mind

wandering has been defined as a shift of attention from the here-and-now to internal thought processes, which might include current concerns or personal goals (Klinger, 2009; Smallwood & Schooler, 2006), but also autobiographical memories and thoughts about the future (Plimpton, Patel, & Kvavilashvili, 2015). It has been found that people in low or dysphoric mood show an increased propensity for mind-wandering (e.g. Smallwood, O'Connor, Sudbery, & Obonsawin, 2007) and, in particular, mind wandering about the past (Smallwood & O'Connor, 2011). However, when the frequency and nature of IAMs was studied in dysphoric (Kvavilashvili & Schlagman, 2011) and depressed (Watson, Berntsen, Kuyken, & Watkins, 2012) participants using a laboratory and a diary method, respectively, this relationship was not found, i.e., dysphoric and depressed participants did not report more frequent IAMs than control participants. Such discrepancies in findings can be explained either by differences in the types of phenomena studied (i.e., mind wandering vs. IAMs) or by different methods used across these different fields of research. There is, however, increased realisation that various manifestations of involuntary processes, studied across diverse fields of enquiry, have many overlapping features (Cole & Kvavilashvili, 2019; Kvavilashvili et al., 2020), which may lend support to a broader approach to investigating involuntary cognitions more generally (Krans et al., 2015).

To date, the majority of IM research has been conducted either via retrospective reports or laboratory-based analogue methods. Retrospective reports have consisted primarily of questionnaires or interviews, and been used in studies of naturally occurring IMs in both clinical and non-clinical populations. The primary focus of these studies has been on the content of IMs, their frequency and characteristics (e.g. vividness, disruptiveness), as well as predictive factors for the development of PTSD and depression (see Brewin, Gregory, Lipton, & Burgess, 2010). By contrast, analogue studies have relied on the so-called trauma-film paradigm, whereby participants are asked to watch a brief film that includes distressing

content, and then record any instance of film-based images (i.e., IMs of the film content) spontaneously coming to mind over the subsequent days (Holmes & Bourne, 2008; James, Lau-Zhu, Clark, et al., 2016). Many of these analogue studies have sought to explore how certain tasks (often visuo-spatial or language based) administered at different points before, during or after the film might disrupt the encoding of distressing content, and result in a reduced number of IMs reported in the days following the laboratory session (James, Lau-Zhu, Clark, et al., 2016). Each approach has its particular strengths and limitations in terms of what has been revealed about the nature and frequency of IMs.

1.2.1 Questionnaires and Interviews

The majority of the available evidence for the content, frequency and phenomenology of IMs (including their triggers) is based on retrospective reports. Many studies on naturally occurring IMs have recruited participants with depression or PTSD and asked them to report the frequency and experience of their intrusions during the course of a semi-structured interview or via a questionnaire (see Brewin et al., 2010). This method has also been frequently used to study IMs in non-clinical populations. Due to the transient and idiosyncratic nature of IMs it is understandable that an interview or questionnaire method would be used, particularly in a clinical context, given the additional burden that it can place on participants (Schneider & Stone, 2016). However, the potential for inaccuracies and errors regarding the frequency and experience of intrusions in such retrospective reports is clear (and a limitation that is often acknowledged by researchers).

For example, in other research domains such as smoking cessation and relapse, there is evidence that retrospective reports can diverge sharply from real-time, ecological momentary assessments (EMA; Shiffman, Hufford, Hickcox, Paty, & et al, 1997; Shiffman, Stone, & Hufford, 2008). It has been suggested that these reporting errors might be based on particular cognitive biases, whereby participants report the most extreme symptoms

experienced in a given time period (Schuler et al., 2019). Similarly, direct comparisons of retrospective and diary reports of patient pain suggest that the former tend to be higher on average than the latter (Stone et al., 2003). In addition, higher pain level variability (as evidenced by diary reports), resulted in higher pain level reports via retrospective report (relative to participants reporting low variability in the diary; Stone, Schwartz, Broderick, & Shiffman, 2005).

Despite these potential biases, retrospective reports have nevertheless offered useful insights into the content of IMs. For example, retrospective studies have shown that there may be some qualitative differences in the IM content as a function of diagnostic group or symptom presentation. For example, Birrer, Michael, and Munsch (2007) compared three groups of participants: those with PTSD, with depression and experience of a traumatic event, and those with depression and without the experience of a traumatic event. Given that it forms part of the Criterion A for a PTSD diagnosis, it is perhaps unsurprising that PTSD participants most often reported that their IM was based on a traumatic event. By contrast, depressed participants without trauma reported their IMs as primarily based on critical life events (as assessed on the Post-Traumatic Diagnostic Scale (PDS); e.g. chronic insomnia, birth of a first child, loss of a job etc). Depressed patients with trauma reported just over half of their IMs as based on a traumatic event, with the remainder based on critical life events. This demonstrates the range of events upon which IMs can be based even when an individual has experienced a traumatic event that meets Criterion A (though this is perhaps particularly the case with depressed as opposed to PTSD patients).

Researchers have tended to code IM content into categories, to examine different reporting patterns within populations. In a sample of participants with depression, Patel et al. (2007) found that 28 IMs reported by 17 participants could be classed into 4 categories, with the majority (46%) relating to death, illness or injury of a family member or loved one,

followed closely by assault (or threat of assault) against the patient (24%). Threat of illness/injury to the patient, and interpersonal problems each accounted for 14% of the IMs reported. In a study with depressed and non depressed cancer patients, Brewin, Watson, McCarthy, Hyman, and Dayson (1998) found that 24 of 41 participants reported IMs (59%) that fell into the category of illness, injury or death to a relative or friend, whilst nearly half of these (46%) related to cancer. When memories regarding the self were taken into account, 76% of all reported IMs related to illness, injury or death, with 44% of these relating specifically to cancer.

Researchers have often distinguished the number of IMs reported by participants in general (often at a screening stage) and the specific frequency with which they experience these on a day to day basis (e.g., in the past week). Evidence in relation to this distinction suggests that the number of reported IMs (as distinct from their day to day frequency) does not necessarily differ according to the clinical diagnosis. For example, Birrer et al. (2007) found no group differences in the number of reported IMs among participants with a PTSD diagnosis, a depression diagnosis with a traumatic experience, and a depression diagnosis without a traumatic experience. Evidence regarding the specific frequency of IMs, however, can vary. Patel et al. (2007) found that, of 39 patients with depression, 17 (44%) reported having experienced at least one particular intrusive memory in the previous week. The majority of these (11) reported experiencing their IMs once/twice or several times a week, with a significant minority (3) reporting that they experienced the memory every day.

It is clear that IMs have a particular phenomenology that is distinct from other types of memory. They are rated as more vivid than standard IAMs, associated more strongly with negative emotions (e.g. anger and sadness) and are given relatively high ratings of re-experiencing (Patel et al., 2007). Although there are often high rates of comorbidity between depression and PTSD, questions remain about the degree to which the phenomenology of

IMs may differ in each. A recent meta-analytic review by Mihailova and Jobson (2018) found that depression correlated with distress associated with IMs, as well as avoidance, rumination, and maladaptive appraisals, but also found an insufficient number of studies to conduct meta-analytic comparison with PTSD along these variables.

Examination of individual studies suggests some convergence in ratings for these variable among different diagnostic categories, but not consistently. Birrer et al. (2007) found no group differences in IM-related distress reports between participants with PTSD, those with depression and experience of trauma, and those with depression alone. Similarly, Reynolds and Brewin (1999) found no group differences in distress reports when comparing participants with PTSD to those with depression, though Parry and Kearney (2014) found that participants with PTSD reported higher distress than depressed participants. In addition, the two studies that compared PTSD and depressed samples based on vividness scores found no group differences (Birrer et al., 2007; Parry & Kearney, 2014), as was the case with the two studies that compared groups based on avoidance scores (Parry & Kearney, 2014; M Reynolds & Brewin, 1999). Birrer et al (2007), however, found that participants with PTSD reported higher ratings of 'here-and-now' quality for their IMs compared to depressed participants with and without trauma.

There have been inconsistent findings with regard to the relationship between measures of psychopathology and the number and frequency of IMs. For example, Birrer et al. (2007) reported that there was no correlation between Beck Depression Inventory (BDI) and Diagnostic Inventory for Depression (DID) scores, and the frequency with which participants reported experiencing IMs. A study that involved interviewing depressed patients and asked them to complete a number of scales did not find any correlation between the number of IMs reported and score on the Hospital Anxiety and Depression Scale (HAD). They did, however, find that among participants who reported an experience of childhood

abuse or assault, greater depression scores did correlate with a higher number of IMs reported. In addition, length of depressive episode was related to a greater number of IMs reported (Brewin, Hunter, Carroll, & Tata, 2009). The above-mentioned meta-analysis by Mihailova and Jobson (2018) found a positive, significant correlation between depression and IM frequency. They also found that people with PTSD reported higher frequency of IMs than people with depression alone (Mihailova & Jobson, 2018).

The retrospective data on triggers has also resulted in some contradictory findings. For example, in a questionnaire study by Birrer et al. (2007), the most frequently reported trigger was participants' own thoughts. By contrast, Elhers et al. (2002) reviewed a number of studies and, in line with their '*warning signal hypothesis'*, concluded that the content of IMs was often related to triggers that shared key perceptual features with the stimuli at the time of greatest emotional impact of the traumatic event (e.g. oncoming headlights in the case of an automobile accident). In other words, triggers for the IMs were reported to align closely with these features (e.g. bright sunlight on the lawn as a reminder of headlights). This warning signal hypothesis has since received some further empirical support. After administering an interview about the content of participants' IMs, Hackmann, Ehlers, Speckens, and Clark (2004) coded that content into one of seven categories: 1) stimuli present before the traumatic event; 2) stimuli present after the event; 3) the moment before the event when everything seemed fine; 4) the moment when the meaning of the event improved; 5) participants' wish that they had acted differently during the event; 6) intrusions from a previous traumatic experience; and 7) response to a dissociative experience. They found that a majority of the events fell into the first two categories, and that 83% of reported IMs overall did not relate to the worst moments of the traumatic event itself.

1.2.2 Analogue Methods: The Trauma Film Paradigm

Because of the difficulty of capturing and studying naturally occurring IMs, the trauma film paradigm has become one of the most widely used methodologies for studying IMs. It involves recruiting participants from the general population and asking them to view distressing film content, and during the following days recording the number of images from the film, that come to mind, in a diary (analogue IMs). Across the literature, the films vary in length and content, as have the number of days during which participants are asked to keep the diary. The primary aim of research using this paradigm has been to test which pre-peri- and post-traumatic factors seem to predict subsequent occurrence of IMs (James, Lau-Zhu, Clark, et al., 2016; Marks et al., 2018).

In line with this focus, much of this research has been studying the effects of different cognitive tasks completed before, during or after viewing the film, on the number of IMs in the subsequent days. Brewin and Saunders (2001) were first to report that completing a tapping sequence whilst viewing the scenes of a road traffic accident resulted in a reduction in film related IMs reported by participants in a diary during the following two weeks after viewing the film. The aim of introducing the task had been to approximate the experience of peri-traumatic dissociation, but in fact the results lent empirical support to the dual representation theory of PTSD (Brewin, 2001; 2003; Brewin, Dalgleish, & Joseph, 1996; Brewin et al., 2010). This finding has since been replicated, and interpreted to mean that completion of a visuospatial task (e.g. keystroke patterns or sequences, the computer game Tetris) during viewing of such images may interrupt the encoding of intrusive memories (e.g. Holmes, Brewin, & Hennessy, 2004; Stuart, Holmes, & Brewin, 2006).

It is argued that engaging in visuo-spatial processing whilst viewing the distressing content interrupts the encoding of the sensory detail, thereby reducing the number of IMs experienced. As a result, the memory content is better contextualised within autobiographical narrative, is verbally accessible, and much less likely to intrude upon consciousness in a repetitive and disruptive manner. While this effect has been demonstrated with concurrent visuo-spatial tasks, it has also been found with tasks completed after exposure to the distressing film content (Deeprose, Zhang, Dejong, Dalgleish, & Holmes, 2012). This has not been shown to be the case, however, with tasks completed before viewing the film (James, Lau-Zhu, Tickle, Horsch, & Holmes, 2016).

Conversely, verbal tasks (e.g. counting aloud backwards) completed during the presentation of such images have increased the frequency of intrusive thoughts (e.g. Bourne, Frasquilho, Roth, & Holmes, 2010; Holmes et al., 2004), though not as consistently as the completion of visual-spatial tasks seems to interrupt them (e.g. Deeprose et al., 2012; Krans, Becker, & Holmes, 2009). It has been argued that engagement in such a task interrupts the contextual encoding that normally integrates memories within a larger autobiographical narrative. What is left is sensory content that is devoid of the narrative context and verbal accessibility. This results in an increase in subsequent film-related IMs, which in this respect approximates naturally occurring IMs (Holmes et al., 2004).

These findings have offered useful insight into the cognitive mechanisms underlying IMs. It has been noted that perhaps the interruption of IM encoding is due more to the cognitive load imposed by the task, rather than the particular modality (verbal or visuo-spatial) (Kvavilashvili, 2014). Indeed, there is some evidence that Eye Movement Desensitisation and Reprocessing (EMDR) – a widely employed therapeutic technique for treating PTSD (Shapiro, 2001) – may be effective due to its taxing of working memory capacity (Gunter & Bodner, 2008; Van den Hout et al., 2011). This conclusion is echoed in

results that are inconsistent or contrary to prediction (according to the dual representation theory) for verbal tasks performed during or after viewing distressing content (Brewin, 2014; Kvavilashvili, 2014; Pearson & Sawyer, 2011). There is also evidence from clinical research that asking PTSD patients to hold their traumatic memory in mind whilst counting out loud resulted in reduced reports of fear, shame and anxiety associated with that memory (Isaacs, 2004).

In addition, a criticism levelled against this method related to its ecological validity, and the comparability of film-related to naturally occurring IMs (Marks et al., 2018). That said, the primary focus of researchers using this method has not been to make inferences about the phenomenology of naturally occurring IMs. Rather, as noted, it has been used to explore the cognitive mechanisms which would seem to either supress or increase IMs following exposure to distressing images. Given these research objectives, the diary that has been given to participants after they viewed the aversive content (either film or static images) is aimed primarily at detecting frequency, and sometimes one or two other variables (e.g. distress, vividness; Ball & Brewin, 2012; Segovia, Strange, & Takarangi, 2016).

As a result, most trauma analogue studies reveal very little about the phenomenology of these analogue IMs, or information about ongoing tasks (e.g. what activities participants are engaged in at the time the IM comes to mind). This, along with reported triggers for film related IMs, would seem to be an important variable in terms of assessing how these analogue IMs compare to naturally occurring IMs and even IAMs. The latter, for example, have been found to occur most often when participants are engaged in an undemanding task that requires few executive resources (e.g. washing the dishes, walking to the bus stop; Schlagman, Kvavilashvili, & Schulz, 2007). Whilst a minority of these diaries have asked participants to record distress associated with the IM, and perhaps vividness, the attention

given to analysing these other variables has been minimal overall, and arguably represents a key oversight in this research area (Marks et al., 2018).

1.2.3 Diary Studies of Naturally Occurring IMs

Finally, there have been a small number of diary studies of naturally occurring IMs in both clinical and non-clinical populations (Berntsen, 2001; Berntsen & Rubin, 2008; Kleim et al., 2013; Rubin, Boals, & Berntsen, 2008; Rubin, Dennis, & Beckham, 2011; Williams & Moulds, 2007). This has represented a convergence of ecologically valid sampling and diary methodology, in that people have been recruited on the basis that they experience (naturally occurring) IMs rather than analogue, and asked to record their IMs in a manner that increases the likelihood of it accurately reflecting the frequency and experience of such memories. These studies have yielded intriguing findings on the nature and frequency of IMs in the daily lives of both clinical and non-clinical populations, and represent a method that is gaining increasing traction due to the potential for cognitive bias in retrospective reports (Schuler et al., 2019).

Williams and Moulds (2007) employed a mixture of laboratory-based interview and follow up diary to examine basic content and characteristics of IMs in dysphoria, as well as determine if factors which appear to contribute to the maintenance of intrusions in PTSD are also present in depression. They recruited 250 undergraduate students who underwent an interview regarding an IM they had experienced in the previous week. The mean frequency of IMs (negative, positive and neutral) per week reported at screening was 3.49 (SD=6.41). Of the 147 participants who reported a negative IM over the previous week, 60% could identify a trigger. Of the original sample, 62 returned a diary they had kept for one week (a modified version of the IM interview) which they had been asked to complete each time when the IM reported at the screening phase came to mind. Of the participants only reporting

negative IMs (n=40), the mean frequency over the course of the week was 5.92 (SD=9.56). This did not, however, correlate with levels of distress or dysphoria.

Much of the subsequent diary research on IMs conducted by cognitive psychologists has been for purposes of testing new and existing theories of the functioning of IMs in PTSD (and more broadly). For example, Rubin et al. (2008; Study 2) had 89 undergraduate students (divided into high and low PTSD symptomology groups based on PTSD Check List[2] scores) complete a 7-day diary of involuntary and voluntary autobiographical memories. To alleviate the burden on participants, they were instructed to record a maximum of 4 involuntary memories per day. They were not specifically instructed to record IMs but were asked if any of the reported involuntary memories aligned with highly distressing or traumatic memories reported earlier via the Autobiographical Memory Questionnaire (e.g. were they about the reported traumatic event, related to the event, or unrelated to it). Overall, 3% of involuntary memories were about one of participants' reported negative events, and 14% were about or related to those events. There were, however, group differences, with participants in the higher scoring PTSD Check List group reporting more involuntary (and voluntary) trauma memories than the lower scoring group. Whilst interesting, these results give an incomplete picture of the frequency of IMs in a non-clinical sample, albeit with differing levels of PTSD symptomology. Indeed, in line with their focus on testing theory, the authors compared involuntarily and voluntarily retrieved memories for highly distressing or traumatic events (isolating participants that recorded at least one of each in the diary) and argued that they did not differ along measures of mood change, rehearsal, negative valence, or intensity. The difference, they claimed, lies between memories of such events (whether voluntarily or

[2] The 17-item scale used to assess PTSD symptom severity. Responses to each question are on a scale of 1 to 5 with greater responses indicating greater symptom severity (Weathers, Litz, Huska, & Keane, 1994). The total scores can range from a minimum of 17 to a maximum of 85.

involuntarily retrieved) and memories of other life events, thereby lending support to a "basic mechanisms" theory (see below) and contradicting prevailing clinical theories.

These results were largely replicated in a study by Rubin, Dennis and Beckham (2011; Study 2) in which 86 participant who had experienced a traumatic event (59 meeting the diagnostic threshold for PTSD and 27 control) were asked to record their involuntary autobiographical memoires (of any experience and/or emotional valence), as they occurred in daily life, with an electronic device for a period of 2 weeks. For each involuntary memory recorded, participants were asked to record a voluntary memory from around the same period of time. The diary format was an abbreviated version of the Autobiographical Memory Questionnaire (AMQ)[3]. Participants in the PTSD condition recorded an average of 35.72 (*SD*=25) pairs of memories over the two weeks, whilst participants in the control condition recorded an average of 31.26 (*SD*=27.84). Across the sample, 37% of involuntary and 36% of voluntary memories related to IMs reported at screening. Again, they detected little difference in the phenomenology (e.g., emotional valence, intensity, mood change, rehearsal) of the voluntarily versus involuntarily retrieved memories for these events. The difference in these variables was between trauma related and trauma unrelated memories, not in the mode of retrieval for trauma related memories alone.

To examine differences between IMs and non-trauma IAMs, Berntsen (2001; Study 2) recruited 12 students who met diagnostic criteria for PTSD according to their responses on the Posttraumatic Diagnostic Scale (PDS; Foa, 1995). They were given a paper diary and asked to record 50 involuntary memories (related to any experience or of any emotional valence) for an open-ended period, with no more than 2 entries per day. Recording was done in two parts, with initial keyword responses to a brief set of questions shortly after noticing

[3] A self-report measure designed to assess the phenomenological properties of an autobiographical memory. Item responses are made on a 7-point scale (Rubin, Schrauf, & Greenberg, 2003).

the memory had come to mind, and later completion of a more comprehensive questionnaire. It was found that 22% of memories recorded in the diary related to the IM reported at screening. Of these, 5.2% related directly to the IM reported at screening, 1.8% were considered to be flashbacks (if given maximum ratings for vividness, high impact on mood and physical reactions) and 17.2% were coded as trauma-related (not clearly a memory for the same event but perhaps causally or thematically related). Trauma memories were rated more highly than non-trauma memoires along all the variables recorded in the diary (except for "distinctiveness").

A diary method has also been used to test the so called "reappearance hypothesis" (a term coined by Neisser, 1967/2014) that IMs represent the same memory content each time they come to mind. This is a position derived from more clinically oriented research (Ehlers, Hackmann, & Michael, 2004) though runs counter to reconstructive (cognitively oriented) accounts of autobiographical memory (Conway, 2005; Conway & Pleydell-Pearce, 2000). To test this theory (Berntsen & Rubin, 2008; Study 3) examined data for 9 of the 12 students recruited for the diary study reported in Berntsen (2001). All trauma and trauma-related memories reported in the diary were then scored by two judges according to the degree to which the contents overlapped with the memory reported at screening. Berntsen and Rubin (2008) reported that the majority of trauma memories recorded in the diary were of different time slices and details to the originally reported memory, suggesting that IMs do not repeat in a fixed fashion, but are reconstructed in a manner reminiscent of non-traumatic autobiographical memories.

A very small amount of research has been conducted with clinical samples, a notable exception being a study by Kleim et al. (2013). For their study, they recruited assault and motor vehicle accident victims who experienced at least one IM per week, some of whom met the diagnostic criteria for PTSD (n=20) as well as those that did not (n=24). Participants

were asked to record as many of their IMs as possible, but entries in the electronic diary were restricted to one per hour over the week of diary keeping. The study also incorporated an experience sampling element, in that 10 times over the course of the week, participants were also prompted by the electronic diary device to record their most frequent IM (voluntary retrieval). Participants recorded a total of 294 IMs (range 0-41). In 61% of cases participants indicated a trigger for their IM, and 48% of these triggers were identified as perceptual and sharing features with the content of the trauma memory (e.g. stimulus, person, situation; see Table 1). Whilst participants with PTSD reported marginally more IMs over the week, there were no differences in the frequency of triggers reported. There were reported differences in phenomenology, however, with PTSD participants reporting that they experienced their IMs as significantly more 'intrusive' and with a greater quality of 'nowness.' Further analysis showed this to be the case with both voluntary and involuntary trauma memoires in the PTSD group as compared to the non-PTSD group.

Table 1-1: *Percentage (frequency) of trigger reports as a function of diagnostic group and overall (from Kleim et al., 2013)*

Trigger Type	***Total Sample***	***PTSD***	***Non-PTSD***
Perceptual, similar situation, stimulus or person	47.7 (38.7)	45.7 (35.2)	49.4 (42.0)
Physiological	6.9 (19.6)	9.2 (24.5)	5.0 (14.4)
Actual Trauma Scene	2.8 (11.8)	0.4 (2.0)	4.7 (15.7)
Newspaper or TV reports	10.0 (20.2)	8.4 (14.2)	11.4 (24.4)
Trauma-related conversations	7.4 (14.7)	8.3 (14.8)	7.0 (15.0)
Trauma-related thoughts	4.1 (9.5)	2.4 (4.6)	5.6 (12.2)
Study-related cues	12.1 (21.1)	12.2 (18.7)	9.7 (21.2)
Others	8.9 (21.2)	10.6 (21.1)	7.4 (21.7)
No triggers perceived	2 (4.5)	0	2 (8.3)

Other clinically oriented applications of the diary method have directly examined the relationship of data collected in this fashion to that collected retrospectively. Most have focused on broader PTSD symptoms (and comorbidities) rather than IM frequency per se, and used once-a-day reports for the diary (Campbell, Krenek, & Simpson, 2017; Naragon-Gainey, Simpson, Moore, Varra, & Kaysen, 2012; Westermeyer et al., 2015). More recently, Schuler et al. (2019) recruited 202 first responders from the World Trade Centre disaster to an Ecological Momentary Assessment (EMA) study, and asked them to report their PTSD symptoms three times per day for seven days on an electronic device. Participants were prompted to do so at times designated as most suitable by each participant. Symptoms were reported via a modified version of the PCL-5 (reduced to eight items from the standard 20), which participants also completed at the end of the seven days of diary-keeping. Schuler et al., (2019) found that the retrospective reports aligned most closely with the day on which symptoms were the worst.

With regard to frequency, evidence shows that diary reports are higher when compared (within subjects) to retrospective reports. Priebe et al. (2013) focused on comparing IM frequency as reflected in electronic diary reports (which participants were prompted to complete every two hours between 8 am and 8 pm for one week) to retrospective reports for the same period. They found that participants reported significantly more IMs via the diary (75) than retrospectively (50). Evidence also suggests, however, that recording intervals can impact frequency reports. Using a within-subjects design Kleindienst et al. (2017) recruited 66 participants experiencing IMs related to interpersonal violence and asked them to engage in two different methods of diary keeping using a smartphone. For three days they were asked to report each instance when their IM came to mind (Event Based Sampling – EBS) and for seven days they estimated the frequency of their IMs over the previous two hours, but were only asked to do so once during the day (Time Based Sampling – TBS).

These methods were counterbalanced. Results showed significantly higher frequency of reports for the TBS than the EBS.

Of the diary studies reviewed, Rubin et al. (2011), Williams and Moulds, (2007) and Kleindienst et al. (2017) placed no restrictions on the frequency of reporting (in at least one condition). Another notable study that sought to measure the frequency of IMs through EBS was a one-week diary study by Kvavilashvili, Sari, Fong, and Brewin (in preparation). Participants nominated up to 3 IMs at screening, and over the following week were asked to make an entry in a paper diary each time one of their nominated memories came to mind. If they did not have time to make a full entry, participants were told they could record their IM by ticking in a grid printed in the inner front page of the diary. The mean number of combined memories and ticks was 23.00 (*SD*=24.25).

The study conducted by Kvavilashvili et al. was unique in its focus on the context in which IMs came to mind, and the triggers for the same. Results showed that 70% of IMs were reported when participants were engaged in monotonous, 'automatic' tasks that required few cognitive resources. In addition, 46% of diary entries included reports of an external trigger, 22% internal thoughts as a trigger, and for 32% of entries participants were unable to report a trigger. These findings offer unique insight in the frequency and phenomenology of IMs in daily life and merit replication using similar methods. In order to best achieve this, it is important to review the particular way that a diary – along with key laboratory-based innovations – have been used in the study of IAMs, and how these have contributed to our understanding of the frequency, phenomenology, and triggers of this particular cognitive phenomenon.

1.3 Overview of Involuntary Autobiographical Memory Research

Before 1996, IAMs were a largely neglected area of research within cognitive psychology, despite their early identification as a key mode of remembering (Ebbinghaus,

1885/1964). Indeed, research was focused almost exclusively on voluntarily retrieved autobiographical memories which – due to the methodological challenges of studying IAMs – may have seemed a more realistic endeavour (Rasmussen & Berntsen, 2011). Whilst a great deal of research on voluntarily retrieved autobiographical memories has been conducted in a laboratory environment (using a cue word method), the elusive nature of IAMs meant than initial (and ongoing) research in this area was well suited to a diary method (e.g. Berntsen, 1996). When research on IAMs was brought into the lab, it was largely for purposes of examining cuing and retrieval times (e.g. Schlagman & Kvavilashvili, 2008).

1.3.1 Diary method for studying IAMs

As the name would suggest, IAM are memories from a personal past that are retrieved spontaneously. Because of this, research into IAMs has benefited greatly from the use of a structured diary, which allows participants to record their IAMs as they occur in day to day life, indicating ongoing activities, cues that triggered the memory and rating memories in terms of different phenomenological characteristics (e.g., vividness, emotional valence, etc.). This research has yielded interesting findings not only about the frequency of IAMs, but also the other important variables. However, although the diary method has the potential to offer greater insight into the frequency of IAMs, studies have not always been designed in a way to obtain this information. For example, some studies have placed limits on how frequently participants are asked to record their IAMs in the diary (similar to some above-mentioned diary studies of IMs), an approach which is argued to eliminate time pressure and task demands. Participants are therefore asked to record a fixed number of IAMs over an undefined period of time with a maximum of two entries per day (e.g. see Berntsen, 1996; Berntsen & Hall, 2004; Johannessen & Berntsen, 2010).

Other studies have aimed to address this by asking that participants record their IAMs in the diary as soon as they occur, with no specified limit on number of entries over a

particular time period (Kvavilashvili & Mandler, 2004; Schlagman, Kliegel, Schulz, & Kvavilashvili, 2009; Schlagman & Kvavilashvili, 2008). In these studies, participants are usually instructed to make entries as soon as possible after noticing the memory coming to mind and if, by the time they can make a recoding, they have already forgotten some aspects of the experience, then they are given an option to acknowledge the occurrence of the memory by placing a tick in the inner front cover page of the diary. In one study, this method yielded a mean frequency of 10.05 IAMs (full entries) over 7 days (*SD*=5.46, range=1-25) and a mean of 7.16 tick entries (*SD*=10.91, range=0-44) (Schlagman & Kvavilashvili, 2008). Another adaptation of a diary method asked participants to record the frequency of their IAMs and voluntary memoires over the course of a day with a mechanical counter, and then respond to a series of summary questions at the end of that day regarding triggers, ongoing activities and emotional impact. Results showed a mean IAM frequency of 22.13 (*SD*=16.74) per day (Rasmussen & Berntsen, 2011). Whilst these different results may be a function of a method used, they could also be attributable to a shorter recording period (7 days vs. 1 day). For example, recent findings from a study by Laughland and Kvavilashvili (2018) suggest that the shorter periods of diary keeping may result in higher frequencies of IAM report.

The diary method has also provided replicable results concerning other key aspects of IAMs. For example, in comparison to voluntarily retrieved memories, IAMs tend to be more vivid, refer to more specific (time limited) events (Berntsen, 1998; Berntsen & Hall, 2004) and tend to have greater impact on mood (Berntsen & Jacobsen, 2008). It has also been reliably found that IAMs are more likely to occur when people are in diffuse states of attention (i.e. engaged in cognitively undemanding tasks or no task in particular; Berntsen, 1998; Berntsen & Jacobsen, 2008; Johannessen & Berntsen, 2010; Kvavilashvili & Mandler, 2004; Schlagman, Kvavilashvili, & Schulz, 2007).

In addition, numerous diary studies have shown that that a high proportion IAMs have identifiable triggers (Kvavilashvili & Mandler, 2004). The majority of these are identified as environmental (37% to 56%), though a sizable minority are triggered by internal thought processes (24% to 26%), or a mixture of the two. The proportion of reported IAMs for which there is no identifiable trigger varies considerably (7% to 28%), and may be an artefact of method, and with older adults a function of age (Berntsen, 1996, 2001, 2007; Berntsen & Hall, 2004; Schlagman & Kvavilashvili, 2008; Schlagman, Kvavilashvili & Schultz, 2007).

Mace (2004) built upon the internal/external classification to test the then-common Proustian view that IAMs were primarily triggered by sensory/perceptual cues. For this study, 20 participants were asked to keep a diary of their IAMs for 14 days. They reported at total of 811 IAMs, but 10% of these had no identifiable cue, and were removed from further analysis. Of the remaining IAMs, participants identified 37% of cues as internal, 49% as external and 14% as mixed (though the latter two were combined for purposes of analysis - following Berntsen (1998) – resulting in a significant difference with the proportion of internal cues). However, participants were also asked to indicate whether the identified trigger for their IAM was abstract and language based (a category which would by definition also include internal thoughts), sensory perceptual (taste, smells, sounds, images etc), or was an emotional or physiological state (e.g. feeling hungry or sad). Of all internal cues, 95% were abstract (thought based) and only 5% an emotional or physiological state. Of the external/mixed cues, 51% were abstract and language based, whilst 49% were sensory/perceptual. Therefore, across all reported cues, 68% were abstract, 30% were sensory/perceptual, and only 2% were state. In Mace's (2004) assessment, these results showed that “direct retrieval of recollective information is more likely to occur with cues that are more cognitively elaborate” (p. 898).

Another study that examined the frequency of these cue classifications in a sample of younger and older adults found that they occurred in relatively equal proportions. Schlagman et al. (2007) recruited 11 younger (between 20 and 28 years of age) and 10 older (between 64 and 80 years of age) adults and asked them to keep a diary of their IAMs for seven days. Among other variables, participants were asked to report if they could identify a trigger for their memory, and if so whether it was internal or external (they were also asked to describe the trigger in their own words). In contrast to Mace (2004), two researchers coded all reported triggers as abstract/verbal, sensory/perceptual, state or undecided (for those that could not be categorised). They found that across the entire sample, 47% of reported triggers were abstract and 44% were sensory/perceptual (with state and undecided cues representing only 4 and 5% respectively). There were no differences as a function of age, though differences between proportions reported in this study and Mace (2004) could be a function of researcher coding versus participant coding. There could also be differences as a function of the population accessed (Mace, Bernas, & Clevinger, 2014).

Whilst important contributions to the study of IAMs, some key limitations of the diary method prompted some researchers to develop laboratory techniques to study them under controlled conditions. This has resulted in ecologically valid methods that offer greater insight into the nature of cuing in IAMs, mood congruency effects, and retrieval times in particular.

1.3.2 Laboratory-based research on IAMs

A key laboratory technique for the study of IAMs was developed by Schlagman and Kvavilashvili (2008).[4] Drawing from the literature on mind-wandering and task-unrelated

[4] The vigilance task developed by Schlagman and Kvavilashvili (2008) has become widely used in laboratory-based IAM research. It was preceded by methods developed by Mace (2006) and Ball (2007) who employed the concepts of memory-chaining and "semantic memory chaining", respectively, in their development of tasks to elicit IAMs in the lab.

thoughts (TUT) (e.g. Giambra, 1989, 1995) they developed a monotonous, computer-based vigilance task to engage participants for an extended period of time in an undemanding task requiring minimal cognitive resources. Participants were required to detect infrequent target slides (featuring arrangements of vertical lines) from a continuous stream of hundreds of non-target slides (with arrangements of horizontal lines). Slides were presented for 1500 millisecond each, with no interstimulus interval between consecutive slides. In addition, this method simultaneously exposed participants to a steady stream of verbal cues, which were balanced for positive, negative and neutral valence, and appeared in the centre of each slide (e.g. 'friendly boss,' 'missed opportunity,' or 'crossing the road'). Participants were told that they could ignore the cue phrases and just concentrate on the lines, and that a different condition was being asked to read the phrases. Whilst the phrases are peripheral to successful completion of the vigilance task, the minimal cognitive resources required by the task means that participants almost inevitably read the cues. These cues have been shown to reliably trigger IAMs, and participants were asked to interrupt the task to report these if they arose during the vigilance task (Kvavilashvili & Schlagman, 2011; Schlagman & Kvavilashvili, 2008).

The first published paper, based on this laboratory method, yielded several novel findings. Firstly, retrieval times for IAMs were found to be much faster than for voluntary memories. This comparison was made possible by calculating the number of slides that had appeared from the occurrence of trigger (cue phrase), reported by participants for their IAMs, to the point where the participant stopped the presentation to report the memory. In addition, it was discovered that significantly more IAMs were triggered by negative as opposed to positive or neutral cue words. That being said, there was overall congruence between the emotional valence of cue phrases reported as triggers, and participants' own rating of the valence of their memory (e.g. negative cues triggered negative memories and positive cues triggered positive memories), although this did not differ according to retrieval methods (voluntary versus

involuntary). The study also replicated important findings from diary research into IAMs, particularly that they tend to be more specific than voluntarily retrieved memories (Schlagman & Kvavilashvili, 2008).

This method has since been adapted in a number of ways that has facilitated further exploration of the properties of IAMs. For example, a subsequent adaptation - to remove demand characteristics - incorporated a probe-caught (as opposed to self-caught) method, whereby participants were stopped at fixed points during the vigilance task and asked to report the contents of their minds. Whilst this resulted in reports across the temporal spectrum, the majority were autobiographical memories (Plimpton et al., 2015). A similar study manipulated the instructions given to participants and the method of thought collection, such that half received an explanation of IAMs and half did not, and half were told to stop the presentation when an IAM came to mind, and half were advised that the presentation would stop them and they should record their thoughts in that moment (4 experimental conditions). Results indicated a main effect of instruction type and method of thought collection, but no interaction between the two (Vannucci, Batool, Pelagatti, & Mazzoni, 2014).

Two further adaptations of this vigilance task demonstrated the impact of abstract cuing on eliciting IAMs, as well the role of cognitive load. Mazzoni, Vannucci, and Batool (2014) had participants complete a shortened version of the same vigilance task, but exposed participants in one condition to a selection of "highly imaginable and concrete verbal cues" which were drawn from a pool of 800 used in previous version of the task. In the other condition, participants were exposed to matched colour photos for each of the cue phrases. Analysis of participants self-caught (and coded) thought probes showed that those in the verbal cue condition reported almost twice as many IAMs as participants in the pictorial cue condition. This finding was replicated with simple object words and matched photographs, demonstrating the overwhelming impact of abstract verbal cues on IAM triggering. It has been

suggested that this level of abstraction increases the likelihood of perceived overlap between the phrase and the memory content, which is difficult to achieve in the case of a photographic image, some details of which will inevitably be different to the memory (Conway & Pleydell-Pearce, 2000).

In terms of the effects of cognitive load, whilst verbal cues are particularly effective at eliciting IAMs, there is a point at which it seems possible for verbal information to overwhelm the retrieval system. Vannucci, Pelagatti, Hanczakowski, Mazzoni, and Paccani (2014) compared three conditions – 450 trials with 90 cue phrases, 300 cue phrases and 210 mathematical formulas along with 90 cue phrases – and found that fewer cue phrases (and no mathematical formulas) in the presentation produced more self-caught IAMs. It has been argued that the additional verbal and numeric information places sufficient cognitive load such that the associative, bottom up process that results in a cue triggering an IAM, gets interrupted. Conversely, less cognitive load in the form of verbal or numeric information allows this process to complete and the contents of an IAM to enter consciousness (Conway & Pleydell-Pearce, 2000).

1.3.3 Research into IAMs and Psychopathology

Whilst the exact relationship of IMs to IAMs remains a point of contention (see below), there is increasing acknowledgment of the role of autobiographical memory – including IAMs – in the onset and maintenance of certain psychopathologies (Watson & Berntsen, 2015). An early example of this, albeit in the realm of voluntary autobiographical memory, was the observed tendency of participants, who had recently attempted suicide, toward reporting overly general autobiographical memories (OGM) in response to cue words even when explicitly asked to retrieve specific memories of events that happened at a particular time and place (Williams & Broadbent, 1986). The OGMs lack temporal detail and can be characterised either as extended, i.e., referring to an event occurring over a period

longer than one day (e.g. "*when I was in sixth form*") or categoric, i.e., referring to a repeated event without a person being able to recall a particular episode (e.g. "*the auditions when I wasn't called back*") (Williams & Dritschel, 1992). A large body of replicable results suggests that people with depression, low mood, a history of trauma and/or PTSD have a tendency to recall more OGMs, especially in response to positive cue-words, although specificity is also impaired in the retrieval of negative memories relative to controls (Ono, Devilly, & Shum, 2016; Williams et al., 2007; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988). Moreover, results of some studies suggest that OGM may be reflective of a broader inability of depressed or dysphoric people in particular to engage in goal-directed retrieval of different types of autobiographical memory (e.g. specific, categorical; Dritschel, Beltsos, & McClintock, 2014; Hitchcock et al., 2019).

And whilst involuntary memory in psychopathology was long assumed to manifest primarily as IMs, evidence shows this to not necessarily be the case. In a diary study of involuntary and voluntary autobiographical memories in depressed and never-depressed participants, Watson, Berntsen, Kuyken, and Watkins, (2012), found that even for the depressed participants 50% of their memories were positive and 14% neutral, highlighting for the researchers that a high proportions of memories recorded were not IMs. Separate analysis of the same data by Watson et al. (2013) found that depressed patients took significantly longer to record the requested number 10 instances of each type of memory. In terms of specificity however, no group differences were found, with both depressed and never depressed reporting more specific involuntary than voluntary memories. Similarly, in a laboratory study with dysphoric and non-dysphoric participants, Kvavilashvili and Schlagman (2011) found no group differences in IAM frequency or retrieval time, or the vividness, specificity or rehearsal of reported IAMs. Group differences did emerge with regard to participants own assessment of the emotional valence of their memories, with

dysphoric participants reporting more negative memories than non-dysphoric. In addition, the dysphoric group reported more memoires triggered by internal thoughts compared to non-dysphoric controls.

The particular way in which non-intrusive IAMs manifest in PTSD compared to depression alone, may differ. Schönfeld and Ehlers (2017) recruited participants who had experienced a Stressor Criterion A traumatic event. In their final sample, 26 participants had PTSD and 26 participants did not. All were asked to keep a diary of their IAMs for one week with no limitations placed on recording frequency. The PTSD group reported many fewer IAMs in the diary than the non-PTSD group, as well as significantly fewer non-trauma memories and more trauma memories. In the PTSD condition, there were also fewer specific and more general memories reported, suggesting that some of the over generality observed in voluntary autobiographical memories extends to IAMs as well (Schönfeld & Ehlers, 2017).

1.4 Theoretical accounts of IMs and IAMs

Debate has arisen about how best to account for our experience of IMs, particularly within the context of PTSD, though these theoretical accounts have implications for how we account for IMs in non-clinical populations as well. Controversy has hinged on whether we can account for IMs with the existing (and standard) models of autobiographical memory system (and IMs are a predictable, if enhanced, output of that system) or whether IMs can only be explained by the existence of a separate system, with a particular breakdown within that system resulting in repetitive, disruptive and often distressing memories.

In relation to IMs, it has been suggested that the re-experiencing and arousal following a traumatic event may represent an adaptive response. For example, soldiers who develop PTSD following combat experience may arguably rely on the hypervigilance associated with their IMs for continued survival, and this only becomes maladaptive when they return to civilian life (Chemtob, Roitblat, Hamada, Carlson, & Twentyman, 1988). A

similar line of thinking could be applied to IMs that occur outside of the context of a PTSD diagnosis. There is considerable evidence that heightened emotion during an experience results in enhanced encoding and greater subsequent accessibility (McGaugh, 2013). Indeed emotional and physiological arousal during an analogue (virtual reality) trauma has been found to be predictive of the later frequency of IMs for that content (Malta et al., 2020). In line with this, clinical theories of traumatic memory posit that details of a traumatic event are only partially inaccessible to voluntary recall, whilst being highly accessible to involuntary recall (Brewin et al., 2010). Cognitive psychologists cite evidence to the contrary, arguing that there is parity in voluntary and involuntary access to the memory (Berntsen, 2012).

1.4.1 Clinical theories of IMs

As with empirical research on IMs, many earlier theories about the functioning of this type of memories were largely concerned with explaining the phenomenon in the context of clinical presentation, namely PTSD. One notable theory by Ehlers and Clark (2000) posits that IMs are a normal response to trauma, and will be experienced by many people following such an event. There are, however, those for whom the IMs will persist, and develop into PTSD. These people, they argue, are more likely to be engaged in negative, ruminative appraisal of the trauma and its aftermath (largely in the form of negative assessments of what the experience of the event and its fallout says about them – e.g. that they are weak, that they deserve punishment etc). In addition, the memory would have been poorly incorporated into the broader autobiographical memory narrative and would be resistant to integration because of the individuals' efforts to avoid or suppress the memory (due to the abovementioned painful associations). This type of associative memory and perceptual priming for reminders of the event, would account for the repeated, intrusive and distressing nature of these memories, and seemingly incidental nature of some reported trigger (Ehlers & Clark, 2000; Foa & Rothbaum, 1998).

Another clinical theory that accounts for the experience of IMs is the Dual Representation Theory of PTSD. The original version of the theory posited two memory systems – verbally accessible memory (VAM) and situationally accessible memory (SAM). Standard encoding processes would have events captured by both systems in parallel, and the representation would be linked in the memory system. The VAM system is available to voluntary (top down) recall, and the SAM supplies perceptual features to memories retrieved in this fashion (Brewin, Dalgleish, & Joseph, 1996). More recently, these have been recast as s-reps (sensory representations) and c-reps (contextual representations) to account more broadly for intrusive images in a range of clinical presentations. With particular regard to IMs, the peri-traumatic dissociation that occurs during a traumatic event means that memory encoding via the c-rep system can be disrupted, and dislodged from the s-rep. This results in fragmentation to voluntary recall for the event that seems to be a characteristic of PTSD, as well as the repeated intrusion of sensory detail for the event via the s-rep system (Brewin et al., 2010).

In this conception the s-rep almost behaves like a 'free radical', breaking into consciousness unexpectedly and disruptively until it can be relinked with the c-rep and better incorporated into the broader narrative memory (Brewin et al., 2010). Conceptually, these are arguably similar to the 'free radicals' that Tulving (1983) described with regard to semantic memory fragments recalled by amnesic patients that had become detached from their episodic context (e.g. a patient reporting certain words coming to mind for no apparent reason and not realising that these words were presented as part of an experimental task earlier). Tulving (1983) said there was no evidence of such memories in normally functioning memory, but Kvavilashvili and Mandler (2004) have suggested that some instances of mind pops may represent free radicals. The first author (L.K.) kept a diary of involuntary semantic memories over a period of four months, and reported instances of seemingly random words

(e.g. ‘el diablo’) or names of places (e.g. ‘Acapulco’) would reach consciousness without any accompanying episodic detail for how this information had entered long term memory. Similarly, IMs have both pathological and healthy presentation. Tulving's (1983) conception, however, posits free radicals as unintegrated into both semantic and episodic systems, whereas the IM as free radical suggests a failed pairing of s-rep with c-rep, but not necessarily failed integration of the s-rep within the perceptual memory system.

According to the updated dual representation theory, s-reps come to be the predominant drivers of the recollective process during a flashback. In Figure 1.2, the boxes with bold green outlines represent the cognitive architecture of c-reps, and the bold green arrows represent the top-down, c-rep driven process in deliberate recall, which is managed by the prefrontal cortex. The dashed red lines represent the subordinate role of s-reps in the retrieval process. This is inverted in Figure 1.3, with the bold red lines representing the enhanced role of s-reps, relative to the now dashed lines for the structures which support c-reps. In these circumstances, the prefrontal cortex is no longer managing the overall process and is therefore not represented. What is unclear according to this schema, is if this process maps on to that of IMs, as a potentially distinct process to flashbacks, and how the two might differ from standard IAMs.

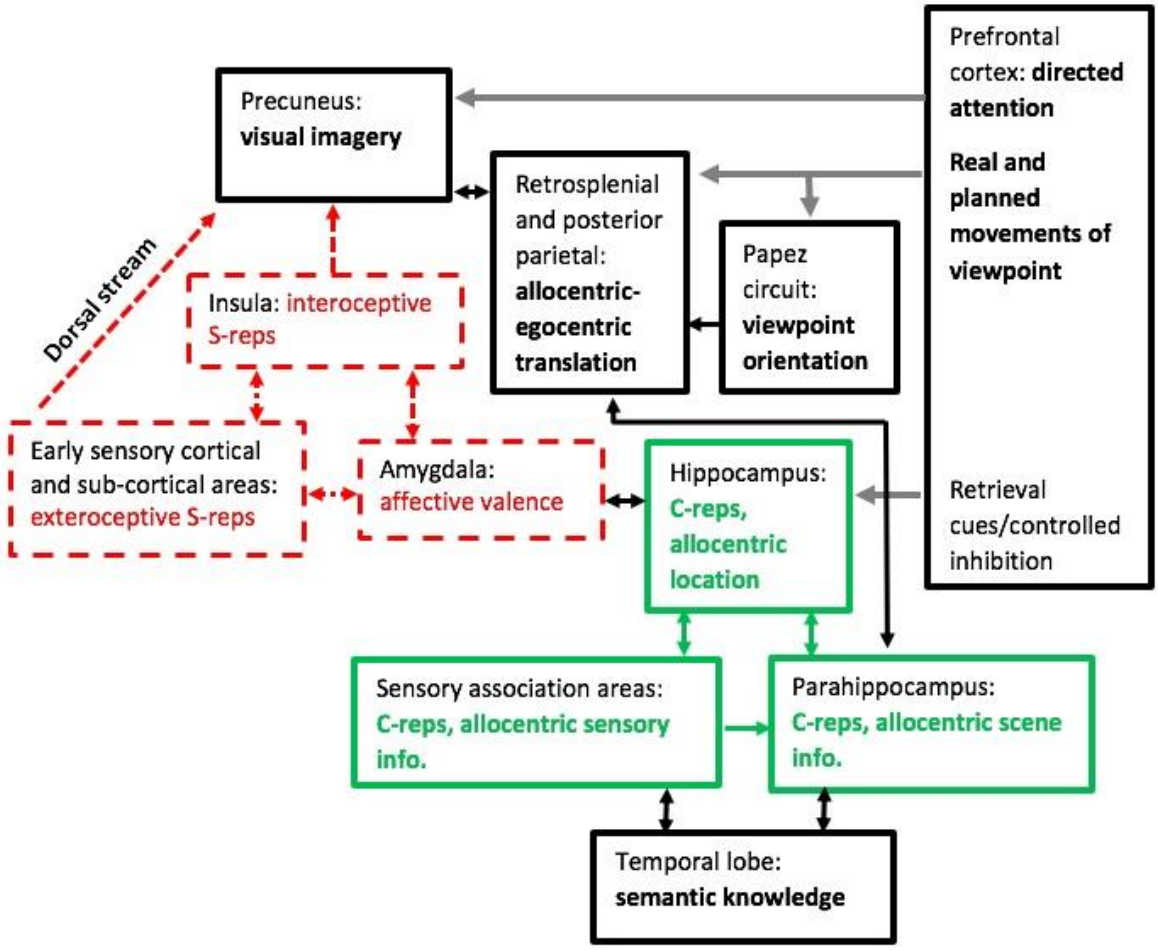


Figure 1-2: *Schematic representation of deliberate visual recall according to the updated dual representation theory (Brewin et al., 2010)*

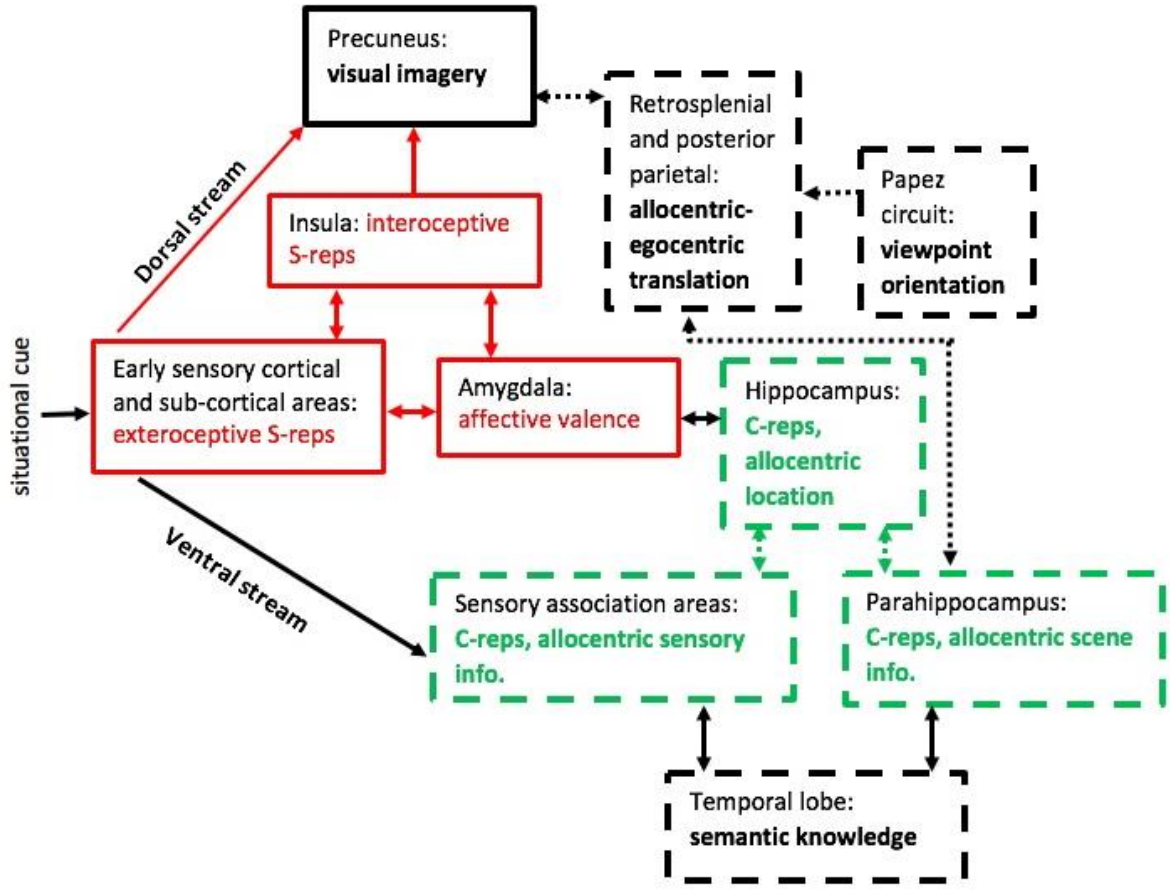


Figure 1-3: *Schematic representation of "involuntary flashback of a traumatic event" according to the updated dual representation theory (Brewin et al., 2010)*

1.4.2 IM Theories Developed by Cognitive Psychologists

The divergence between clinically and cognitively developed theories for PTSD in general (and the manifestation of IMs in particular) has sometimes been posited as arguments for 'special mechanisms' versus 'basic mechanisms' views on IMs. That said, this characterisation itself is contentious (Brewin, 2014; Rubin, Boals, & Berntsen, 2008). As suggested by these labels, 'special mechanisms' implies that IMs occur because of a particular break down in the functioning of the autobiographical memory system during the coding of a highly distressing or traumatic event. An example of another 'special mechanism' account of memory has been the 'now print!' theory of flashbulb memories (FBMs),

proposed by (Brown & Kulik, 1977). This was a theoretical means of accounting for the apparently particular way in which highly emotive yet shared experiences (e.g. learning of the assassination of President Kennedy) were encoded, resulting in enhanced access to memory detail over time, particularly for the circumstances in which one found oneself at the time of learning the news. Empirical research on the consistency of FBMs over time has, however, resulted in the view, adopted by many cognitive psychologists, that they are a standard output of a normally functioning autobiographical memory system, and do not require special mechanism for their explanation (e.g., Hirst & Phelps, 2016; Talarico & Rubin, 2018).

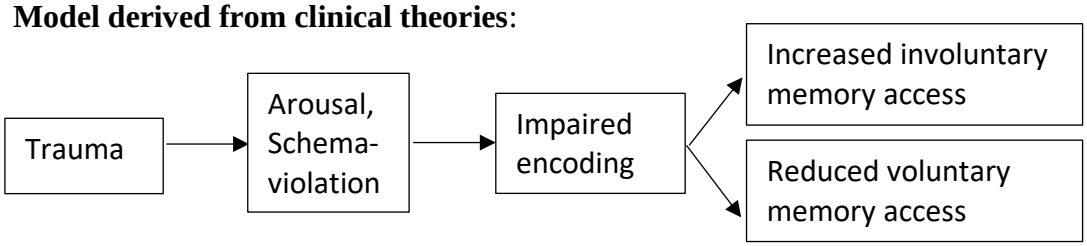
Similarly, the basic mechanisms view posits that we can account for IMs within existing theories of autobiographical memory. Proponents of this view do not dispute the distressing nature of trauma memoires, only assert that they are an enhanced version of non-trauma IAMs instead of a distinct phenomenon. This enhanced encoding during the original event and resultant IMs do not represent aberrant functioning of the autobiographical memory system, but rather a predictable output of that system (see Figure 1.4; Berntsen, 2009).

Key to the basic mechanisms view is a refutation of the clinical observation that trauma memories are subject to high levels of involuntary retrieval (IMs) but are relatively inaccessible to voluntary retrieval. To study this dissociation, Rubin et al. (2008) recruited 89 American undergraduates who were grouped according to their low (under 25) or high (over 40) scores on the PCL, and asked them to record their involuntary memories for one week on an electronic device. For each involuntary memory recorded they were asked to retrieve a voluntary memory as well. Results showed that participants who scored high on the PCL reported more trauma-related memoires than the low PCL group, but there was no difference in the frequency with which these were involuntary versus voluntary. In addition, IMs and

voluntary memories for trauma did not differ in their impact on mood or centrality to the life story as measured by the Centrality of Events Scale (CES; see also Berntsen & Rubin (2006)). With particular regard to the latter scale, they have argued that its correlation with measures of PTSD symptomology provide evidence against the notion that voluntary recall for a traumatic event is fragmentary and inaccessible to the individual. More recent experimental evidence using a trauma film paradigm, however, has showed that it is possible to reduce the frequency of film related IMs (using a post encoding visuo-spatial task) without impacting the voluntary recall for the same content. This has been interpreted as lending support to the so called special mechanisms (aka 'separate trace) account over the basic mechanisms (aka 'single trace account; see Lau-Zhu, Henson, & Holmes, 2019).

There are several other core assertions of the basic mechanisms view with regard to IMs. One is that positively and negatively valanced (non-trauma) memories can share phenomenological characteristics with IMs in terms of vividness, sense of reliving and impact on mood (see Berntsen, 2001, 2009). Another is that IMs are not exact replicas of each other, but consist of different elements or time slices of the event, suggesting that IMs are subject to the same reconstructive processes as ordinary IAMs (Berntsen & Rubin, 2008). Finally, in contrast to the 'warning signal hypothesis' (Ehlers et al., 2002), it has been argued that central features of IMs align with what participants recall as the most emotionally intense parts of the event (and not features of the environment present just before the event; Berntsen & Rubin, 2008).

Model derived from clinical theories:



Model derived from general memory theories:

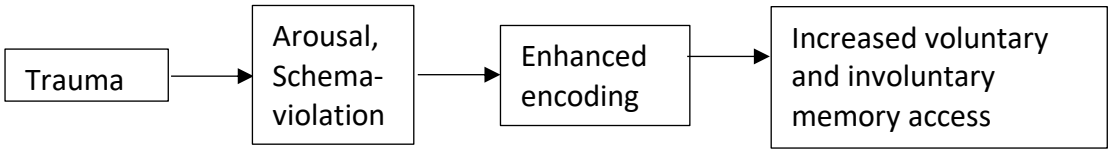


Figure 1-4: *Schematic representation of the differences between clinically derived theories of IMs and cognitively derived theories (from Hall and Berntsen (2008))*

Some have questioned the usefulness of the 'special' and 'basic' mechanisms distinction. Brewin (2014), in reviewing the evidence for the parallel existence and interaction of perceptual and episodic memory systems in the generation of IMs in both clinical and non-clinical samples, notes that "to invoke special mechanisms implies that we have a good scientific understanding of how memory behaves under normative conditions (p. 90)". Furthermore, he argues that the suggestion that special mechanisms theories are derived solely from a narrow focus on PTSD research does not bear out, and that evidence for such a system can be found across a number of different research streams.

1.5 Writing for Therapeutic Benefit

There is a considerable amount of evidence showing that writing about traumatic and distressing life events can be beneficial to both physical and mental health (see Baikie & Wilhelm, 2005; Frattaroli, 2006; Pennebaker, 1997). This effect was first demonstrated by Pennebaker and Beall (1986), who asked student participants to write about one or more traumatic life events for 15 minutes for four consecutive evenings. Participants were asked to either focus on their emotions related to these events, the facts of the events, or both, whilst

the control group was asked to write about a trivial topic assigned to them. Results showed that the conditions writing about their emotions related to the traumatic event(s) reported better overall health at a six month follow-up, and that the condition that wrote about emotions and facts made fewer health centre visits. Studies using this method have demonstrated similar improvement in measures of immune response (Petrie, Fontanilla, Thomas, Booth, & Pennebaker, 2004), blood pressure (McGuire, Greenberg, & Gevirtz, 2005) and pain (Rosenberg et al., 2002), as well as depression (Gortner, Rude, & Pennebaker, 2006; Koopman et al., 2005) and anxiety (Shen, Yang, Zhang, & Zhang, 2018). It is important to note that these results have not always been replicable (e.g. Niles, Haltom, Mulvenna, Lieberman, & Stanton, 2014; Zachariae & O'Toole, 2015), providing a sometimes mixed evidentiary picture, to which subsequent meta analyses have added some clarity by showing a more robust effect across studies (e.g. Frattaroli, 2006).

Similarly, initial results on the benefits of expressive writing for people experiencing PTSD has been somewhat mixed, but the accumulation of evidence may be providing a clearer picture. Some studies have found no main effect of writing condition (experimental versus control) on PTSD symptoms (Sloan, Marx, & Greenberg, 2011), but at the same time did find improvement in depression scores (Koopman et al., 2005) as well as mood and post-traumatic growth (Smyth, Hockemeyer, & Tulloch, 2008). Another study recruiting new mothers found that those assigned to the expressive writing condition showed significantly lower post-traumatic symptoms at 3 month follow-up relative to controls, suggesting that this method may be most effective in cases of sub-clinical presentation (Di Blasio et al., 2015). A more recent meta-analytic review, however, found small to medium effect sizes of expressive writing on post-traumatic stress symptoms of avoidance, intrusion and hyperarousal in non-clinical populations, but medium effect sizes in clinical populations (Pavlacic, Buchanan, Maxwell, Hopke, & Schulenberg, 2019).

In terms of method, when administered in its standard format, the expressive writing task requires a certain amount of sustained attention (i.e. 15-20 minutes of writing, over 3-5 sessions). There have been some manipulations of this structure, which have shown that writing for 15 minutes for three intervals, separated by only 10 minutes, can yield similar improvement to 15 minute writing intervals separated by 24 hours (Chung & Pennebaker, 2008). Other studies have manipulated the number and duration of expressive writing sessions, either reducing (e.g. one, 30-minute writing session; Greenberg, Wortman, & Stone, 1996) or increasing both (e.g. five, 45-minute writing session; Schoutrop, Lange, Hanewald, Duurland, & Bermond, 1997), with both adaptations showing measurable benefits for participants.

With particular regard to Greenberg et al. (1996), other brief, one-off interactions with the content of distressing memory have been shown to produce similar therapeutic benefits. Some studies have found that even the administration of one-off questionnaires about negative events (e.g. the Autobiographical Memory Questionnaire – AMQ) can reduce distress associated with that event (Boals et al., 2011; Rubin et al., 2010). Whilst not engaging people in an extended writing task, the AMQ does ask participants that they rate emotions associated with their memory on a scale. It remains unclear, however, with the AMQ as with expressive writing more broadly, what specific mechanisms produce this benefit. It has been posited that it may not be entirely one or the other, but is perhaps a combination of exposure/emotional processing (whereby the emotional impact of the memory is reduced through repeated and/or prolonged interaction with its content) or cognitive adaptation (reappraisal of how the event is though about, often reflected in changes to the language used to describe it; Sloan & Marx, 2004).

Evidence suggests that even shorter interactions with the content of distressing memory can produce similar outcomes. Briefly recording other types of intrusive cognition as

they arise (e.g. hallucinations, ruminative thoughts, suicidal ideation) has been shown to reduce of frequency of these thoughts and sometimes the distress associated with them (e.g. Clum & Curtin, 1993; Frederiksen, 1975; Rutner & Bugle, 1969). It has yielded similar effects with regard to certain behaviours (e.g. smoking; McFall, 1970). Referred to as self-monitoring in a therapeutic context, this intervention nonetheless follows largely the same pattern as diary keeping in IAM (and to a lesser degree, IM) research. Using either electronic or paper formats, therapist will ask clients to monitor and record either target behaviours or thoughts between sessions, which then form the basis for discussion during those sessions. The data collected can offer the client important insight into the frequency with which they exhibit the target behaviours or cognitions, as well as the precipitating events, and impact on emotional state (Cohen, Edmunds, Brodman, Benjamin, & Kendall, 2013).

The therapeutic benefit of using a diary to record IM has been underexplored generally. This method has been used along with cognitive behavioural interventions as a basis assessing new interventions for depression (e.g. Newby, Lang, Werner-Seidler, Holmes, & Moulds, 2014) but even then participants were instructed to record in the diary at least once per day regardless of whether they experienced an IM (Lang, Moulds, & Holmes, 2009). In addition, as has been the case with diaries used in analogue 'trauma film' studies, these diaries have not asked about vividness, triggers or concurrent activity. This departs from cognitively oriented diary methods, which aim to assess the frequency with which the memory occurs along with other characteristics of memories. That said, initial findings using such a method with a non-clinical sample have shown a significant improvement in mood scores over time. (Kvavilashvili, Sari, Fong, & Brewin, in preparation).

These findings broadly align with the evidence-based therapies used to treat clinical manifestations of IMs. Particularly trauma focused Cognitive Behavioural Therapy focuses on incorporating the memory for the traumatic event into the broader 'memory system' to

reduce the incidence of intrusive memories for the event coming back in a disruptive and unbidden pattern. This is achieved through repeated 'exposure' to the memory content through relating it the therapist, and addressing some of the cognitive appraisals of the memory that are thought to contribute to PTSD symptom maintenance (Foa & Rothbaum, 1998). Other therapeutic interventions, such as Eye Movement Desensitisation and Reprocessing (EMDR) also rely on people consciously bringing their IM to mind, but seem to function based on visuo-spatial suppression of the IM, in a matter similar to that seen in trauma film paradigm studies, in alignment with the dual representation theory (Gunter & Bodner, 2008).

1.6 Rationale

The literature review presented above has outlined research to date on IMs and IAMs, with a particular focus on methodology, and how the resultant findings have informed existing theories. One of the aims of this review was to suggest that IM research might benefit from greater incorporation of diary and laboratory methods primarily used in the study of IAMs. Another aim was to examine how the use of these methods might yield some therapeutic benefits for people experiencing IMs, and the higher rates of depression and PTSD symptomology which often accompany them.

The following six chapters will present data from seven different studies. Chapter two presents the results of an online questionnaire survey of IMs, completed by an undergraduate student population (Study 1). The aim was to establish the prevalence of IMs in a non-clinical sample by asking participants to report an IM and rate it along a number of scales (e.g. frequency, vividness, distress, disruptiveness, and avoidance). It was anticipated that such memories would be common, thereby providing a sound justification for further investigation of IMs within this population.

Chapter three presents the results of a two-week diary study of IMs in a non-clinical population (Study 2). To date, only a limited number of studies have employed a diary method to study intrusive memories (Berntsen & Rubin, 2008; Kleim et al., 2013; Rubin et al., 2008, 2011; A. D. Williams & Moulds, 2007). Given the reliability of this method for studying IAM, it seems readily applicable to the study of IM, particularly for purposes of examining the frequency, phenomenology and triggers for IMs in daily life. Indeed, the limited use of a diary method to address these questions has already provided promising results. For example, a 1-week diary study of IM in a non-clinical population suggests that these may occur more frequently than suggested by previous research (Kvavilashvili, et al., in preparation). In addition, evidence suggests that keeping such a diary could have therapeutic benefit for people experiencing IMs (Dewey et al., 2015). But given that screening questionnaires alone can produce such a benefit (Boals et al., 2011; Rubin et al., 2010), the diary study in the present thesis has been designed to examine the effect of the diary in isolation and in conjunction with such questionnaires, to assess their independent and additive effect.

Chapter four seeks to address the almost total absence of studies which examine naturally occurring IM under controlled laboratory conditions. The majority of studies that have investigated IMs in the laboratory, have done so with induced IMs often via exposure to negative imagery in the form of photos and films (Oulton & Takarangi, 2018; Takarangi, Nayda, Strange, & Nixon, 2017; Takarangi, Strange, & Lindsay, 2014). Because IAMs have been successfully examined under controlled laboratory conditions (Kvavilashvili & Schlagman, 2011; Plimpton et al., 2015; Schlagman & Kvavilashvili, 2008), the two studies (Studies 3a and 3b), presented in this chapter, adapted a method used for this purpose to the study of IM. Based on the findings for IAMs, it was anticipated that the use of this method would demonstrate that it is possible to elicit naturally occurring IMs in the laboratory if

participants are exposed to relevant incidental verbal cues. In addition, it was hypothesized that personalized cues would be more effective for triggering IMs that non-personalised, incidental cues. Finally, it was anticipated that recording one's IMs through participation in the laboratory task would have a therapeutic benefit for participants.

Chapter five will present data from two analogue studies (Studies 4a and 4b) which incorporate the use of a comprehensive structured diary to examine not just the frequency of the film-related IMs but also their triggers, vividness and other associated phenomenology. The aim was to examine the triggers for analogue IMs as well as ongoing activities, to provide some basis for comparison with naturally occurring IMs and IAMs. In addition, a secondary aim was to explore the effect of a briefer but thematically consistent film on the frequency and phenomenology of film-related IMs reported in the structured diary.

Chapter six presents the results of a within-subjects diary study of IAMs and analogue IMs (Study 5). A key aim was is to explore relationships between the frequency of IAMs and IMs, which was predicted to be positive and significant. A second aim was to conduct a within subject analysis of the nature of triggers in both types of cognition but also the conditions of which each come to mind.

Finally, Chapter seven will summarize the primary aims and key findings of the studies presented in the thesis. The discussion of findings will focus in particular on what the results reveal in terms of the benefits/limitations of studying naturally occurring IMs in non-clinical populations, the therapeutic benefits of diary keeping, and the triggers for naturally occurring and analogue IMs. Some limitations of the studies will also be discussed as well as possible avenues for future research.

Chapter 2: The Nature and Frequency of Intrusive Memories in a Student Population: A Pilot Study with an Online Questionnaire (Study 1)

2.1 Introduction

There is growing evidence to suggest that IMs are a common phenomenon non-clinical as well as clinical populations. They are one of the key diagnostic criteria for PTSD, but they have also been found in depression, and not only in cases of co-morbidity (Reynolds & Brewin, 1999). Importantly, IMs have also been found to occur in non-clinical populations, in response to a range of life events. Some of these life events meet Criterion A ins the DSM-V for traumatic events (American Psychiatric Association, 2013), with data suggesting that up to 70% of people will experience this type of event at some point in their lifetime (e.g., an automobile accident, an assault, or other type of near-death experience; Brewin, 2003). There are also other highly distressing events that fall outside the A2 criterion, but can nonetheless give rise to IMs, including experiences that most, if not all, of us will have at some point in life (e.g., the death of a family member or loved one, the breakdown of a relationship, a personal failure; (Brewin et al., 1996; Bywaters et al., 2004; Yeung & Fernandes, 2020).

The rates at which people experience events which might form the basis of IMs suggests that a high proportion of the population could be experiencing them at any one time. And the results of some studies – particularly those focusing on IMs in depression - suggest that the prevalence of IMs does not differ according to the presence (or absence) of a clinical diagnosis. For example, Spenceley and Jerrom (1997) recruited a sample of depressed, recovered and never-depressed women, and administered a revised version of the Impact of Events Scale (asking that participants only report traumatic memories based on events before age 16). They found no statistical difference in the commonality of IMs between the groups, with 70% of depressed women, 55% of recovered and 78% of controls reported experiencing an IM. Similarly, Newby and Moulds (2011) recruited a sample of 85 university students who were screened for current or past depression (25 were classed as depressed, 30

recovered, and 30 never-depressed). They found that 96%, 80% and 73% of participants in each group, respectively, reported experiencing an IM, again with no group differences.

Whilst it appears that large parts of the population experience IMs, that is not to say that all IMs are experienced equally. For example, whilst Spenceley and Jerrom (1997) found that reports of experiencing an IM did not differ among depressed, recovered and control groups, the frequency of the reported IM was significantly higher in the depressed group than in the other two groups. By contrast, as reported earlier, Newby and Moulds (2011) did not find any differences in reported frequency of IMs over the previous week in their sample of depressed, recovered and never-depressed participants. At the same time, Spenceley and Jerrom (1997) found that measures of avoidance were higher in both the depressed and recovered group than they were in the control participants. Similarly, Newby and Moulds (2011) found that their depressed group reported higher levels of vividness, distress and interference associated with their IM than recovered or never-depressed participants, but there were no group differences in levels of "nowness/reliving" of the event.

Furthermore, some studies suggest that there may be differences in the content of the IM in people with PTSD, depression and non-clinical controls. In a study involving participants with both PTSD and depression, Reynolds and Brewin (1999) found that 93% of IM-related memories could be placed into 4 categories: "*family death, illness or injury*," "*Illness or injury to the patient*," "*assault on the patient*," and "*interpersonal problems*". Participants with PTSD were more likely to report illness, injury or assault in relation to themselves, while depressed patients were more likely to report death, illness or injury in relation to a family member, or interpersonal problems (see Table 2-1). A study comparing the frequency of IMs and rumination in a sample of participants with major depressive disorder also found that a high proportion (73.7%) of reported IMs fell into the interpersonal problem/event category (Newby & Moulds, 2012). Finally, application of similar content

analysis with dysphoric participants drawn from the general population (with scores greater than 12 on the BDI-II) showed that the majority (60%) reported an interpersonal event as the basis of their IM (Newby et al., 2014).

Whilst there is some evidence that IMs are experienced differently in clinical and non-clinical populations, this evidence appears to be inconsistent. Ongoing efforts to compare the clinical and non-clinical presentation of IMs has merit, but documented similarities suggest that it is also worthwhile using one to understand the other. This lends credibility to studying IMs in (much more accessible) non-clinical populations as a means of understanding the phenomenon more broadly.

Yet, there have been only a handful of studies that have exclusively examined the frequency, phenomenology and content of IMs in non-clinical populations. For example, Brewin, Christodoulides, and Hutchinson (1996) recruited a random sample of students and asked them to report their five most frequent intrusive memories and five most intrusive thoughts experienced in the past two weeks (negative or positive, with the order of reporting memories versus thoughts counterbalanced). Participants also estimated the frequency of each nominated thought/memory over the 2-week period, listed three emotions associated with each thought/memory, and rated it for pleasantness on a 10-point scale (1=very unpleasant, 10=very pleasant). Results showed no differences in the frequency with which participants reported negative versus positive IMs. The most frequent IM was reported to have occurred 32.9 times over the previous two weeks when reported before thoughts, and 22.1 times when reported after (again with no differences in frequency between negative and positive memories). Mean pleasantness ratings for IMs varied slightly depending on whether participants reported thoughts first (5.96) or IMs first (5.07), though this difference was not statistically significant.

Other studies that have examined IMs in non-clinical populations have screened all or part of the sample for dysphoric mood (using the BDI or BDI-II). Newby et al. (2014) recruited a sample of 60 participants from the general public who reported experiencing an IM over the previous week, and had a BDI-II score suggesting dysphoria (12 or more). At baseline, participants reported their IM as occurring an average of 4.12 times per week and an average of 129.8 weeks since the event upon which the IM was based. In comparison, Bywaters et al. (2004) recruited 40 participants (both dysphoric and non-dysphoric) with a BDI lower than 3 or greater than 9. In a lab session, they were asked to report as many IMs as possible from the previous two weeks (pleasant and unpleasant). Participants reported a mean of 2.75 IMs, with 1.15 that were pleasant and 1.60 were unpleasant, but dysphoric participants reported experiencing their nominated IMs more frequently than non-dysphoric participants.

The above-mentioned studies make a valuable contribution to our understanding of the frequency, phenomenology and content of IMs in non-clinical populations, but none have offered insight into the true prevalence of this phenomenon. Indeed, only one of these studies looked at IMs in a population that was not pre-screened for dysphoric mood, or used as a control (Brewin et al., 1996). Furthermore, only one study appears to have looked at the content of IMs in a non-clinical population, but again this sample was screened for dysphoric mood (Newby et al., 2014). Therefore, in order to further address the questions about the commonality of IMs in a non-clinical population, as well as their content, frequency, and phenomenology, the present study distributed an online questionnaire within an undergraduate psychology student population. Participation was invited from people who experienced an IM at least once a day. They were asked to describe their most frequent IM in writing, and rate it on a number of scales (for frequency, duration, vividness etc).

Despite its broadly exploratory nature, several predictions were made in this study. For example, given previous findings suggesting that IMs may be a common phenomenon (Brewin et al., 1996; Bywaters et al., 2004; Yeung & Fernandes, 2020) , it was expected that a large number of undergraduate psychology population would nominate an IM and complete a questionnaire. With regard to frequency of nominated IMs, it was expected that results of the present study would broadly align with some of the previous findings on non-clinical populations. Given inconsistent findings regarding phenomenology, it is difficult to predict how these might compare to previous studies, but it was anticipated that measures of phenomenology would correlate highly with each other. In terms of the content categories devised by Reynolds and Brewin (1999), based on previous results with non-clinical populations, it was anticipated that reported IMs would fall more into the categories of 'interpersonal problems', as opposed to the categories of death, 'death/illness of another person', 'illness/injury to oneself', or 'assault/abuse to oneself' (Newby et al., 2014).

2.2 Method

2.2.1 Design

The study was exploratory in nature, and simply asked that prospective participants completed an online questionnaire about an intrusive memory that they had experienced at least once per day over the previous week.

2.2.2 Materials

Online Screening Questionnaire (adapted from Reynolds & Brewin, 1999; see Appendix I)): Through the online platform Qualtrics, participants were asked to complete an online screening questionnaire regarding the content of their currently experienced most intrusive memory and a number of characteristics associated with that memory. In a text box on the questionnaire, they were asked to describe the content of their nominated IM and

indicate how long ago the event occurred on which the memory was based. Then they were asked a series of questions about characteristics associated with the memory including: 1) the frequency with which they experienced the IM over the previous week (*never, once or twice a week, 3 or 4 times a week, once a day, 2-3 times a day, 3-5 times a day, more than 5 times a day)*; 2) approximately how long the memory lasted when it came to mind (*seconds, minutes, up to an hour, several hours, constantly);* 3) how clear and vivid was the memory (*1=not vivid, vague, 7=extremely vivid);* 4) whether the memory was accompanied by any physical sensations *(no physical sensations, some physical sensations)*; 5) the temporal vantage point when the memory came to mind *(reliving the event as occurring here and now, looking back at the past)*; 6) how distressing the memory was *(1=not at all distressing, 7=very distressing);* 7) how much the participant felt it disrupted their daily activity *(1=not at all disruptive, 7=very disruptive);* 8) how much the participant avoided thinking about the event *(1=not at all, 7=as much as possible);* and 9) how much the participant avoided reminders of the event *(1=not at all, 7=as much as possible).*

2.2.3 Participants

Participants were psychology students from the University of Hertfordshire (UH) and were granted 0.2 credit hours in exchange for completion of the questionnaire. The age range of psychology students at UH is late teens and early 20s. Of 622 total records, 399 (64%) were excluded for being incomplete, duplicate entries, or not meeting the criteria for intrusive memories (see below). This left a final sample of 223 unique entries (one per participant) which represented approximately 36% of the psychology department year one and two student population.

2.2.4 Procedure

The online questionnaire was advertised via the University of Hertfordshire Intranet ('StudyNet') as well as the online research participation website operated by the Psychology Department (the 'SONA' system). Responses were collected between December 2014 and April 2016. On the first page of the online questionnaire, participants were advised that the aim of the study was to examine the impact of IMs on mood and concentration in daily life, and therefore that anyone who experienced such memories frequently was eligible to participate (an indicative frequency of one IM a day was suggested). Participants were then asked to provide an email address, and if appropriate, their SONA number (for receipt of the 0.2 hours of credit participants received in exchange for completing the questionnaire). At the end of the first page it was stipulated that by clicking 'next' they were consenting to participation in this portion of the study. Based on their responses, some participants were invited to participate in two subsequent lab studies of naturally occurring IMs, which ran during two consecutive academic years, 2014-15 and 2015-16 (see Chapter 4).

2.3 Results

The participants included in the analysis were those who completed the full questionnaire and were deemed to have reported a valid IM. Of 622 records obtained via the online questionnaire, 289 were incomplete (47%) and were therefore excluded from further analysis, leaving 333 records. It is plausible that some of the participants who decided not to complete the questionnaire were engaging in characteristic avoidance of their IM. Others may simply have decided, upon reading about the nature of IMs and the aims of the study, that they were not experiencing such memories, or not with sufficient frequency to meet the inclusion criteria.

Out of the 333 completed records, 110 were not deemed to be IMs by the first coder (B.P.) because of the reported content or because the event upon which the memory was

ostensibly based was too recent (less than one month). Examples of records excluded on content grounds were autobiographical memories that were rated two or below on the seven point scales for distress, disruptiveness and avoidance, combined with low frequency ratings and content that did not suggest an IM (e.g., "*being told walk into the garage on Christmas morning and finding a bike wrapped up*" or "*I travelled to [another country] to compete in a dance competition. There were many professional dancers competing in the same category I was competing in and I thought I wouldn't progress far within the competition, however I managed to get to the finals and win the whole dance category*.") Other records were excluded as they were too recent and/or qualified more as intrusive thoughts than IMs, (e.g., "*I always think about whether I had fed the dog prior to leaving my house to attend university*" or "*I very often think about the course work that I have to do, like the content of read articles in relation to the assignment that I have to write down and the other tasks that I have to complete soon...*").

All 110 initially rejected reports were also examined by the second coder (L.K.). There were only three reports about which coders disagreed, resulting in 97% agreement between coders. Two of the three reports about which coders disagreed were reclassed as IMs, resulting in 108 exclusions. Of the 223 reports deemed as IMs by the first coder, 124 were also reviewed by the second coder. Coders agreed in 88% of cases, and all disagreements were resolved through discussion. This resulted in an additional 13 reports being coded as non-IMs (and one identified as a duplicate entry) resulting in 122 exclusions overall and a final sample of 211 unique IM reports.

Reported IMs were then coded by the first coder (B.P.) according to content categories developed by Reynolds and Brewin (1999): "*death/illness of another person*", "*illness/injury to oneself*", "*assault or abuse to oneself* ", "*interpersonal problems*" and "*other*" (see Table 2-1). The second coder reviewed the same 124 memory descriptions as

above and coded these memories into the same content categories. There was very good inter-rater agreement ($\kappa = 0.87$). Although the largest percentages of memories (28%) fell into the category of "*interpersonal problems*" and "*other*" (22%), exactly 50% of nominated IMs were equally distributed among the categories of "*death/illness of another person*", "*illness/injury to oneself*" and "*assault or abuse to oneself*". The results of two separate chi square analyses on content categories showed there to be differences in reporting frequencies by participants recruited to the present study and two clinical groups tested by Reynolds and Brewin (1999): depressed $\chi^2(4, N=256)=15.18$, $p=.004$ and PTSD $\chi^2(4, N=253)=26.71$, $p<.001$. This appears to be due to the number of cases in the present study that were coded as 'other,' though there were also clear differences in the frequency with which participants in the present study and PTSD participants in Reynolds and Brewin (1999) reported interpersonal problems as the basis for their IMs.

Table 2-1: *Percentages of content categories for IMs nominated by participants, and as reported in depressed patients in Reynolds and Brewin (1999).*

	Death/illness of another person	*Illness/injury to oneself*	*Assault or abuse to oneself*	*Interpersonal problems*	*Other*
Screening Questionnaire (*n*=223)	19% (41)	18% (37)	13% (28)	28% (59)	22% (46)
Depressed Patients [a] (*n*=45)	38% (17)	7% (3)	18% (8)	33% (15)	4% (2)
PTSD Patients [a] (*n*=42)	24% (10)	33% (14)	33% (14)	3% (1)	7% (3)

Note: *n* refers to the number of memories reported.
[a] From Reynolds and Brewin (1999).

In addition, participants rated their IMs on a number of scales, including frequency, vividness, and distress. The mean frequency (see Table 2-2) was three to four times a week, though it is apparent in Figure 1 that the majority of participants reported experiencing their

IM once or twice a week. This aligns with minimum frequency criteria previously adopted for designation as an IM with a clinical population (Reynolds & Brewin, 1999). It is worth noting, however, that 15 participants (7%) indicated that their IM had not occurred in the previous week, but they were included in the data set because the description of the event and the associated distress ratings aligned with what would be expected from a genuine IM.

In addition, some accompanying measures align with what might be expected from genuine IMs, including high ratings of vividness, distress and avoidance. A majority of questionnaire respondents reported their memory as being accompanied by bodily sensations (69%), though a minority (30%) reported a sense of reliving the event rather than looking back at the past. Ratings for disruption and avoidance of reminders fell closer to the middle of the scale. Average ratings for duration and age of the IMs show them lasting for minutes and being between one and five years old.

Table 2-2: *Mean (standard deviation) ratings for each variable on the questionnaire.*

Characteristic	Variable Rating	Variable Description
Frequency [a]	2.96 (1.30)	Three or four times a week
Vividness [b]	5.51 (1.24)	Highly vivid (1-7 scale)
Distress [b]	5.26 (1.43)	Highly distressing (1-7 scale)
Disruption [b]	3.62 (1.68)	Moderate disruption (1-7 scale)
Avoid thinking [b]	5.10 (1.83)	High avoidance (1-7 scale)
Avoid reminders [b]	4.92 (1.90)	Moderate/High avoidance
Duration [c]	1.87 (0.82)	Minutes
Mean age of memory	51.89 (54.92)	Months

[a] Frequency ratings were made on a 7-point scale: 1=*none*, 2=*once or twice a week*, 3=*three or four times a week*, 4=*once a day*, 5=*two to three times a day*, 6=*three to five times a day*, 7=*more than five times a day*

[b] Ratings were made on a 7-point scale: 1=*not at all*, 7=*extremely*

[c] Duration ratings were scored on a 5-point scale: 1=*seconds*, 2=*minutes*, 3=*up to an hour*, 4=*several hours*, 5=*constantly*.

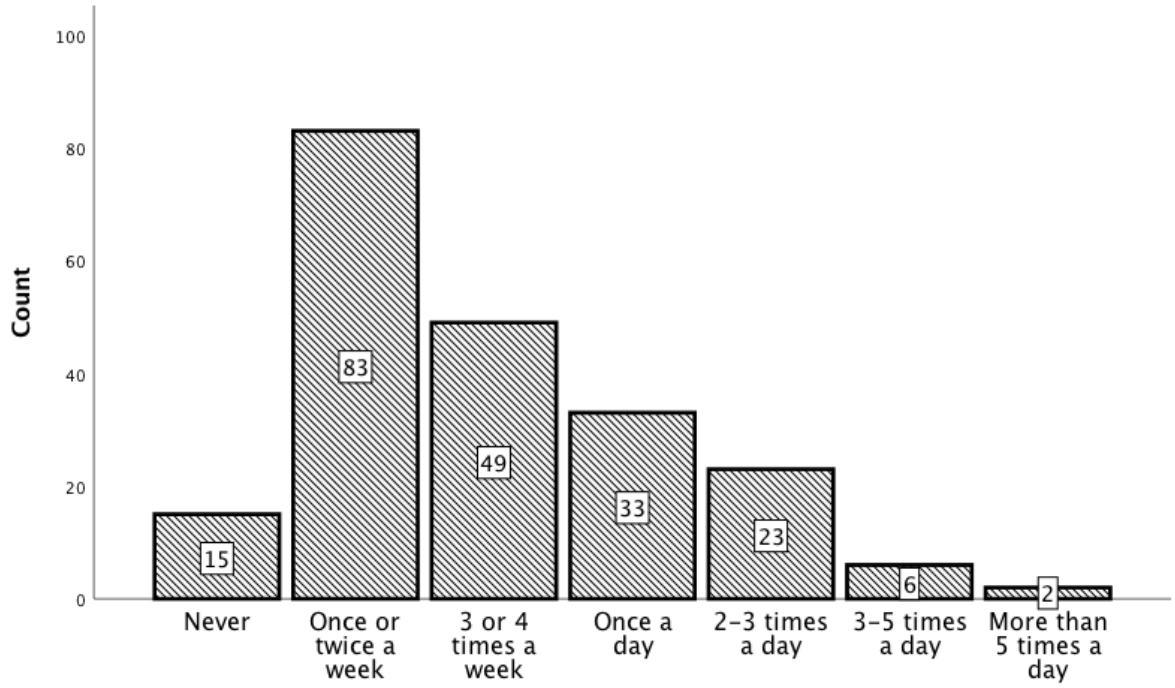


Figure 2-1: *Reported frequency with which the IM came to mind over the previous week*

A number of Pearson's correlations were run for the questionnaire measures that were rated on a scale. For this analysis, a more stringent p-value of 0.01 was used to account for the number of correlations run (see Table 2-3). In particular, distress ratings correlated positively with all other measures on the scale except for the age of the memory. This is understandable as older and newer memories could be equally distressing. Ratings for disruption correlated highly with all other measures except for memory age and ratings of vividness. Avoidance scores (avoiding thinking about the event and avoiding reminders of it) similarly did not correlate with memory age, but did correlate highly with each other. It seems plausible that the lack of relationship between these measures and the age of the IM can be explained in a similar manner (e.g. that newer and older memories could be rated highly on these scales). However, IM age correlated negatively with the reported frequency of the memory, suggesting that older memories may be experienced less often than newer memories.

Table 2-3: *The results (r-values, and n) of two-tailed Pearson's correlations between the scale items on the online questionnaire.*

	Mem. Age	**Freq.**	**Duration**	**Vividness**	**Distress**	**Disrupt**	**Avoid thinking**	**Avoid reminders**
Mem. Age								
Freq.	-0.25** 193[1]							
Duration	-0.04 193[1]	0.03 211						
Vividness	0.03 114[2]	0.15 128[2]	0.09 128[2]					
Distress	-0.06 193[1]	0.22** 211	0.28** 211	0.27** 128[2]				
Disrupt	-0.13 193[1]	0.35** 211	0.30** 211	0.13 128[2]	0.46** 211			
Avoid thinking	-0.14 193[1]	0.21** 211	0.10 211	0.08 128[2]	0.39** 211	0.32** 211		
Avoid reminders	-0.15 193[1]	0.14 211	0.13 211	0.12 128[2]	0.39** 211	0.35** 211	0.67** 211	

**Significant at 0.01

[1] In a limited number of cases, participants failed to record the age of their IM.

[2] A problem with online questionnaire resulted in a failure to record vividness data for approximately half of participants.

2.4 Discussion

A number of important findings emerged from the present study. Firstly, the high number of responses to the questionnaire from the cohort of undergraduate psychology students suggests that IMs are a common phenomenon among a general student population. Secondly, ratings for frequency, duration and other aspects of phenomenology were aligned with some previous clinical findings, and tended to correlate with each other. And the content of IMs reported in the present study aligned with previous clinical samples in some key ways. The latter point in particular bolsters the argument for studying IMs in a general non-clinical

population, both as a means of understanding them as a standard feature of human cognition, but also gaining insight into their clinical presentation.

2.4.1 Implications

The content of the reported IMs in the present study showed some interesting overlap with Reynolds and Brewin's (1999) clinical sample of patients diagnosed with depression and PTSD. In particular, the percentage of IMs coded as "*death/illness of another person"* in the present study (19%) tracked closely with the percentage reported by PTSD patients (24%). In addition the percentage of IMs that were based on "*interpersonal problems*" the present study (28%) was similar to the percentage reported in the depressed sample (33%). The same was true for "*assault or abuse to oneself"* – 13% in the present study and 18% in the depressed sample.

Perhaps the most notable difference was the high proportion (22%) of reported IMs in the present study that did not fit any of the categories used by Reynolds and Brewin (1999), and were therefore coded as other. Some of the thoughts that fell into the '*other*' category consisted of personal failure (e.g., "*not getting into medical school*" or "*Walking into an exam hall at for a GCSE at secondary school and sitting at the desk turning over the paper and not knowing how to answer any of the questions*"). Other studies that used personal failure as an explicit category with dysphoric participants found that it accounted for 11.8% of IMs reported (Newby et al., 2014). Other IMs reported in the present study did not seem to easily fit under the other headings (e.g., "*my house being burgled*," or "*being caught shop lifting in secondary school*").

It is interesting that analysis of Reynolds and Brewin's (1999) sample showed that the content of IMs reported by participants with depression differed somewhat from the content of IMs reported by those with PTSD. This difference seemed to hinge primarily on the proportions of memories that fell into the categories of *"illness/injury to oneself"* and

"*assault or abuse to oneself"* (higher in the PTSD group) and the *"interpersonal problems"* category (higher in participants with depression). At the same time, the most notable similarity between the present study and Reynolds and Brewin's (1999) data is the broad similarity between the proportions of IMs that fell into the *"interpersonal problems"* category. This suggests that the present sample may well score high on measures of depression (but not PTSD), had these data been collected (see below).

In terms of the phenomenology of the reported IMs, ratings for vividness, distress and avoidance in particular suggest that these are genuine intrusions. The mean vividness rating for the present study was well above the midpoint (5.51) with a modest standard deviation (1.21), suggesting that a large proportion of participants in the present study gave vividness ratings above the mid-point on the 7-point scale. This is also well above previously reported vividness ratings for IAMs (using the same scale) in dysphoric (M=4.89, SD=0.99) and non-dysphoric (M=5.00, SD=1.21) samples (Kvavilashvili & Schlagman, 2011). Direct comparison with previous results in other studies is rendered somewhat difficult by the differences in scales used. For example, Reynolds and Brewin (1999) found that 88% of IMs reported by participants with depression and PTSD were rated as vivid (rather than 'some detail' or 'unclear' on a 3-point scale), and the mean distress rating was 7.9 out of 10 with no group differences.

Other variable ratings yielded results comparable to previous studies. For example, 62% of the depressed group in Reynolds and Brewin's (1999) study reported physical sensations accompanying their IM, compared to 66% of participants in the present study. In addition, Reynolds and Brewin (1999) reported that 77% (n=99) of the IMs collected in their study occurred several times a week or more with 23% (n=30) occurring once a week or less. This scale is slightly different from that reported in the present study, which showed the majority of participants reporting their IM as occurring once or twice a week (39%), and the

second highest frequency as 3-4 times per week (23%). In addition, 16% of participants reported experiencing their IM once per day, 11% reported experiencing it two to three times per day, 3% three to five times per day, and 1% more than five times a day. This amounts to 93% of participants in the present study experiencing their IM at least once per week. These findings suggest that frequency represents another variable showing important overlap in clinical and sub-clinical manifestations of IMs.

2.4.2 Limitations

As the study was originally conceived of as a screening tool for another study (for details, see Chapter 4), certain demographic information such as sex, age and occupation was not collected. It is certainly the case that most, if not all, of the participants were undergraduate psychology students in their first and second year of study, who completed the questionnaire in exchange for course credit. There may have been also a small number of psychology master's students. The absence of sex data, however, restricted some potentially useful analyses, such as gender differences in reported content, frequency and phenomenology of IMs.

There is evidence that younger people are at higher risk for mental ill health, and maybe students in particular, which means that this sample may not be entirely representative of the general population (Andrews & Wilding, 2004; Blanco et al., 2008; Castillo & Schwartz, 2013; Reavley, Mccann, & Jorm, 2012). This does not negate the fact that it has been possible to capture genuine IMs, and in this respect is may be no disadvantage for psychology researchers that this type of cognition may be more prevalent among the student populations they will be primarily recruiting to participate in their research.

No measures of depression or PTSD symptoms were gathered alongside the questionnaire. Had this been done, it would have made possible a number of correlations with

variables such as frequency and distress ratings, which would in turn have offered a fuller picture of the data collected.

2.4.3 Conclusions

The results of the present exploratory pilot study point to a number of different avenues for future research. Only a limited number of studies have recruited non-clinical participants who experience naturally occurring IMs. The present findings suggest this is a fruitful method, that participants could be readily recruited in this fashion. Given the limitations of retrospective reports for assessing the true frequency and phenomenology of IMs, a diary method would be the most appropriate approach to employ with this type of sample. This argument will be elaborated in Chapter 3, and evidence presented to support it.

Chapter 3: A Diary Study of Naturally Occurring Intrusive Memories in Non-Clinical Population (Study 2)

3.1. Introduction

The diary method has been used to study a range of involuntary cognitions, perhaps most notably IAMs, but also involuntary semantic memories, and task-unrelated thoughts or mind-wandering. Studying the frequency, content, phenomenology and triggers of such thoughts in daily life requires a method that facilitates their recording shortly after they come to mind (Laughland & Kvavilashvili, 2018). Despite its demonstrated usefulness, a diary has only been used a limited number of times for the study of IMs, which have instead been investigated primarily via interviews and questionnaires. The findings from these studies have contributed to our understanding of IMs, but the acknowledged limitations of retrospective reports suggest that greater use of a diary method could add an important facet to that understanding. Given that IMs are a common cognitive phenomenon, as suggested by the results of Study 1 in Chapter 2 (see also Brewin et al., 1996; Bywaters et al., 2004; Yeung & Fernandes, 2020), a compelling case can be made for a greater use of diaries for the study of naturally occurring IMs.

3.1.1 Studying IAMs with a Diary Method

Diary studies of IAMs have shown that these memories are a common occurrence in everyday life. Frequency reports have differed depending on the recording instructions given to participants, with results suggesting that shorter periods of recording may yield more entries. For example, mean numbers of recorded IAMs have varied from 17.21 IAMs recorded in a 7-day paper diary (with the option to make tick entries if full entries were not possible) (Schlagman & Kvavilashvili, 2008), to 22.13 over a 1-day period using a simple mechanical counter to acknowledge the occurrence of IAMs without recording any relevant details of the experience (Rasmussen & Berntsen, 2011). A recent comparison of IAM frequency over a 1-day period of diary keeping and on Day 1 of 7-day diary keeping found that participants made significantly more fully recorded entries during the shorter 1-day diary

study (*M*=5.82 versus *M*=2.82; Laughland & Kvavilashvili, 2018). In comparison, however, a recent experience-sampling study estimated that we may experience as many as 14 IAMs per hour (approximately every 4 minutes; Gardner & Ascoli, 2015).

Diary research has been important for illuminating other phenomenological aspects of IAMs. For example, it has been demonstrated that their content is of varied emotional valence, with positive, neutral and negative presentation (Berntsen, 1996). The majority of cues for reported IAMs are environmental (external), though people also report memories that are triggered by their own thoughts, or which have no identifiable triggers (Berntsen, 1996; Berntsen & Hall, 2004; Kvavilashvili & Mandler, 2004, Study 4; Schlagman & Kvavilashvili, 2008). Of all triggers, the majority are abstract and verbal rather than sensory perceptual, which runs counter to popular conceptions of IAMs from literature (such as Marcel Proust's description of a vivid involuntary memory triggered by the taste of a Madeline dipped in tea; Mace, 2004; Schlagman, Kvavilashvili, & Schulz, 2007).

3.1.2 Studying IMs with retrospective self-reports

Much of the available data on IM frequency is from clinical studies that ask participants, either via questionnaire or interview, to estimate the frequency with which they experienced a nominated IM within a given time period. For example, Birrer, Michael, and Munsch (2007) administered a questionnaire asking participants with PTSD (n = 26), depression with trauma (n=20), and depression without trauma (n=19) to rate the frequency of their IM on a scale of one to three (1=*once or more per day*, 2=*once or more per week*, 3=*once or more per month*). They found the mean ratings given by participants in the PTSD group (*M*=1.65, *SD*=0.63), the depression with trauma group (*M*=2.05, *SD*=0.89) and the depression without trauma group (*M*=2.07, *SD*=0.80) did not differ from each other. By contrast, Steil and Ehlers (2000) found that participants who had experienced a motor vehicle accident reported experiencing their IM between 19 (*SD*=27; Study 1) and 35 times per

month (*SD*=74; Study 2). Similarly, in a sample of 129 IMs, nominated by participants with depression and PTSD (not comorbid), Reynolds and Brewin (1999) found that 30 memories (23%) were reported as occurring once a week or less, and 99 (77%) were reported as occurring several times a week or more (with significantly higher frequency in the PTSD group). Hackmann, Ehlers, Speckens, and Clark (2004) recruited 22 patients with chronic PTSD, and found that in the week prior to beginning a course of cognitive behavioural therapy, they reported experiencing a mean frequency of between four and five IMs per week. Finally, in a sample of 31 patients with PTSD (9 with comorbid depression), Speckens, Ehlers, Hackmann, Ruths, and Clark (2007) found that the median IM frequency over the previous week was 3 (*range* = 0-25), whilst Speckens, Ehlers, Hackmann, and Clark (2006) found that 44 patients with PTSD reported a mean frequency of 5.38 (*SD*=5.69) IMs per week. It is also interesting that frequency reports were slightly higher in one non-clinical study, with participants across two counterbalanced conditions reporting a mean of 37.95 IMs over the previous two weeks (Brewin et al., 1996). It therefore appears that even in clinical samples an average rate of IM frequency is once per day or less.

Although at least two non-clinical studies have investigated IMs with positive content (Brewin et al., 1996; Bywaters et al., 2004), they are primarily thought to be associated with negative life events. Some studies have recruited on the basis of both diagnosis as well as the criterion A experience of the prospective participants (such as people who have been in a motor vehicle accident; Speckens et al., 2006; Steil & Ehlers, 2000). Other studies that recruited participants, based on PTSD diagnostic criteria alone, have nevertheless sought to clarify the experiences on which the IMs were based, noting either the broad categories into which they fell (e.g., *assault, motor vehicle accidents, other accidents*; Hackmann et al., 2004) or coding them into defined content categories to determine the proportion of total IMs that fell into each category (e.g., *family death illness or injury, illness or injury to the patient*,

assault on the patient, or *interpersonal problems*; Reynolds & Brewin, 1999, see Chapter 2, Table 1).

Retrospective studies have also asked participants to report on key phenomenological aspects of their IMs, including vividness, distress, and feelings of 'nowness', and avoidance. Results vary by study and scale used, with some participant samples reporting mean ratings well above the mid-point (Reynolds & Brewin, 1999; Speckens et al., 2006), and some reporting means that fell below (Birrer et al., 2007). Nonetheless, these measures were subject to the same retrospective bias as estimates of frequency, making the use of a diary for the recording of such memories a particularly worthwhile undertaking.

Finally, triggers have received some attention in the literature as well, though participant reports in studies employing only interview or questionnaire methods would have suffered from the same retrospective bias. Birrer et al. (2007) found that participants reported the majority of their IMs being triggered by ruminative thoughts (70%), though they also reported other internal processes such as feelings (43%) and brief, intrusive thoughts (39%). Reported external triggers included people (57%), places (50%), television programs (23%), clothes (13%) and sounds (11%). These proportions contrast with other clinical evidence that most IM triggers are in fact environmental, and overlap with peripheral perceptual elements of the environment in which the traumatic even took place (Ehlers et al., 2002; Hackmann et al., 2004).

3.1.3 Studying IMs Using a Diary Method

The relative paucity of IM diary research has arguably limited our knowledge of important aspects of this cognitive phenomenon, including frequency. Though diaries are one of the best available tools for approximating true frequency of fleeting phenomena, several of the published IM diary studies only asked that people record a certain number of IMs, with the understandable aim of not to burden them (Berntsen & Rubin, 2008; Rubin, Boals, &

Berntsen, 2008). Two diary studies that did ask participants to record all of their IMs found a mean frequency of 5.92 (SD=9.56) IMs per week (Williams & Moulds, 2007) and approximately 13.2 (SD=10.3) over two weeks (Rubin et al., 2011). Other studies have prompted participants to estimate the frequency of their IMs over a brief time interval. A more recent electronic diary study recruited adult females with PTSD related to childhood sexual abuse, and prompted them every two hours between 8 am and 8 pm to estimate the number of IMs or flashbacks they had experienced during the previous two hours. When the data was aggregated, they found that participants reported a mean frequency of 74.45 (SD=62.02) IMs over a week. This was significantly higher than the retrospective estimate (M=49.52, SD=18.44) made at the end of the week of diary keeping (Priebe et al., 2013).

Existing diary studies have looked at triggers to a very limited degree. Williams and Moulds (2007) found that 60% of participants in their study could identify a trigger for their IM, but no additional information about the nature of those triggers was reported. Kleim et al. (2013) have done perhaps the most comprehensive analysis of triggers to date using a diary. All participants in their study had experienced an assault or motor vehicle accident, but 20 out of 44 had a diagnosis of PTSD, and no group differences were found in the triggers reported. Across the sample, the majority of triggers (47.7%) were "perceptual, similar situation, stimulus or person" (p.1001). Other external triggers included the actual trauma scene (2.8%), newspaper or TV reports (10%), trauma-related conversations (7.6%) and study-related cues (12.1%). Only a very small minority of the reported cues might be classed as internal, including physiological triggers (6.9%) and trauma related thoughts (4.1%).

In terms of the conditions under which IMs occur, the only study that would appear to examine this (Kvavilashvili et al., *in preparation*), found that 70% of reported IMs (n=69) came to mind when participants were engaged in an automatic, habitual activity (such as walking to university or washing up). The remaining 30% of IMs were reported as coming to

mind when participants were engaged in more controlled activities that required greater cognitive resources for successful completion (e.g. studying, having a conversation). It was found that these proportions did not differ significantly from those reported for IAMs by Berntsen (1998) and Schlagman et al. (2007).

3.1.4 Possible Therapeutic Effects of Diary Keeping

There is a substantial body of evidence demonstrating the psychological and physiological benefits of expressive writing (see Pennebaker, 1997). The application of this method to PTSD has produced encouraging results, though the intervention appears to improve participant mood but not necessarily symptoms of PTSD (Koopman et al., 2005; Sloan et al., 2011; Smyth et al., 2008).

There is some evidence, however, that other forms of interaction with the content of IMs may reduce symptoms. Dewey et al. (2015) recruited 32 university students who had experienced at least one traumatic event and had a minimum score of 44 on the Post Traumatic Stress Disorder Checklist - Civilian Version (PCL-C). Participants kept an android smart phone with them for a period of two weeks and were prompted six times per day to complete an adapted version of the PCL-C regarding the IM they reported at screening, and rate the intensity with which they were experiencing the emotions of fear, anger, guilt, shame, and sadness. In addition, participants were administered a paper and pencil version of the PCL-C three times – at screening, at the beginning of the two-week period of diary keeping, and at the end. Mean PCL-C scores recorded at the third administration (M = 46.97, SD = 13.19) were significantly lower than those recorded at screening (M = 57.16, SD = 10.06) and the beginning of the diary keeping (M = 55.72, SD = 10.87). A limitation of the study – which the authors themselves note – was the absence of a control condition that either monitored a different type of cognition over the same time period, or did not monitor their thoughts at all.

Other researchers have also found a relationship between monitoring and therapeutic effect. Kvavilashvili and Brewin (2013) asked non-clinical participants who reported experiencing at least one IM per day to keep a diary for one week. Participants underwent an interview at the first meeting, during which they were asked to nominate up to three IMs, and rate them on a number of scales (for frequency, vividness, avoidance etc.). The experimental condition (n=13) involved completing a 12-item questionnaire on a diary page each time their nominated IM came to mind, whilst participants in the control condition (n=14) simply placed a tick in a grid in a diary each time this occurred. The Beck Depression Inventory and Spielberger State-Trait Anxiety Inventory (STAI) were administered at the beginning and end of the one week of diary keeping. Scores on both scales dropped significantly between the first and second administrations for both the experimental and control conditions. This raised the question of whether the diary keeping (whether full or tick) was producing the therapeutic effect, or if it was the IM interview during the initial meeting, or both.

Indeed there is evidence that even a one-off administration of questionnaires about negative memories can produce therapeutic benefit. Rubin, Boals, and Klein (2010) asked participants to nominate a very negative event, and then randomly assigned them to either write about that event (expressive writing condition), or what they had done the day prior (control condition). All paticipants also completed the Autobiographical Memory Questionnaire (AMQ) and the Impact of Events Scale (IES). They found that participants showed reductions in the intrusiveness of the memories and associated distress levels in both expressive writing and control conditions, a finding they replicated acorss three studies. This led the authors to conclude that completion of the AMQ and IES created therapeutic benefit, and that the mechanism by which this occurred was similar enough to expressive writing that participation in that condition did not show any additional benefit above and beyond control participants. In a follow-up study (Experiment 4), participants in the experimental condition

were asked to complete the AMQ and IES in relation to their nominated negative memory, whilst the control group simply nominated a memory, but did not complete these meaurses. The same improvements were evident in the experimental condition as in the previous three studies. The results were also replicated in Experiment 5, where the experimental group completed the measures in relation to their negative memory, whilst the control group – the measuers in relation to a postive memory. Again the experimental group showed improvement while the control group did not (Boals, Hathaway, & Rubin, 2011).

3.1.5 Aims and Design

In summary, there is a clear need for research that explores the true frequency of IMs in daily life. This has been underexplored generally, and particularly with regard to non-clinical populations. A diary method such as the one used in IAM research is very well suited to this purpose and in addition to frequency, will facilitate 'real time' exploration of the triggers for IMs as well the conditions in which they arise in daily life, and how these compare to standard IAMs. Finally, available evidence suggests that interaction with the contents of an IM, either through expressive writing, questionnaire completion, or monitoring has some therapeutic benefits on participants. Questions remain, however, about the mechanisms driving the observed improvement, and how to activate these mechanisms most effectively for maximum therapeutic benefit. For example, if exposure is the primary means by which distress is reduced (Rubin et al., 2010), is the most efficient way of achieving this through completion of an expressive writing task, or can a questionnaire or monitoring activate the same mechanism, potentially in a less time consuming and confronting fashion?

In order to address these questions, a between-subjects study with three conditions was designed, which recruited participants from the general population (primarily students at UH) who reported experiencing IMs at least once a day. In two of the three conditions, participants were asked to record their IMs in a structured diary for two weeks (based on the

finding of Kvavilashvili & Brewin, 2013, described above, that one week of diary keeping had reduced measures of depression and anxiety). To isolate the potential therapeutic effects of being exposed to IMs by recording them in a diary, participants in the third, control condition were asked to keep a diary of their involuntary prospective memories (PMs). Involuntary PMs come to mind spontaneously like IAMs, but their content relates to a future intention or task that has yet to be completed – e.g., suddenly remembering that you need to make an important phone call or book accommodation for an upcoming holiday in the evening when you finish your shift at work (see Kvavilashvili & Fisher, 2007). This was selected as a control in the present study because in Kvavilashvili and Brewin (2013) the intended control (a tick diary of IMs) produced the same therapeutic benefit as the experimental condition (a full diary of IMs). Based on this design, it was predicted that participants who recorded their IMs in the structured diary would show greater improvement in measures of depression, anxiety and PTSD symptoms than participants who recorded their involuntary PMs.

However, as described earlier, therapeutic benefits could also result by simply reporting and rating IMs during an initial interview with the researcher even without keeping a dairy (Boals et al., 2011; Rubin et al., 2010). Therefore, we also manipulated the presence or absence of initial IM interview across the three conditions. In particular, before keeping a dairy of IMs, participants in the first *IM-interview/diary* condition, completed an IM interview modelled after Reynolds and Brewin (1999), whereby they nominated up to three of their most distressing IMs, provided a written description of each and rating them along a number of scales (for frequency, vividness, avoidance etc.). In contrast, participants in the second *IM-keywords/diary* condition only nominated their IMs by writing three to four keywords, thereby interacting only minimally with the content. Participants in the third *IM-*

interview/PM-diary condition completed the same IM interview as in the first condition, but then kept a diary of their PMs instead of nominated IMs.

Based on previous findings, it was expected that the IM interview could also produce therapeutic benefits (Boals et al., 2011; James W Pennebaker, 1997; Rubin et al., 2010). If the impact of IM interview was greater than that of the IM diary, then participants who completed the IM interview and the PM diary would show similar levels of improvement as participants in the IM-Interview/diary condition, and both of these conditions would demonstrate higher therapeutic benefits than participants who completed the IM diary but only nominated their IMs by keyword. Finally, whilst available evidence did not give grounds to predict an additive effect between the IM interview and the IM diary (Rubin et al., 2010), this possibility was not ruled out in the present study.

Additional predictions relate to frequency, triggers and phenomenology of reported IMs. Because of the limitation often placed on reporting frequency during diary or EMA studies, it might be expected that the present study would yield a greater number of reports, based on the absence of such restrictions. This should be balanced, however, against recent findings from IAM research that shorter periods of diary keeping may yield a higher number of reports (Laughland & Kvavilashvili, 2018). With regard to triggers it was anticipated that the majority of these would be external (in the surrounding environment) rather than internal (in one's own thoughts). In addition, the majority of IM triggers were expected to be sensory perceptual rather than abstract and verbal. As in case with the majority of involuntary cognitions, it could also be predicted that a majority of IMs would come to mind when people were in diffuse state of attention and engaged in cognitively undemanding tasks, and that this would not necessarily differ from PMs. Finally, IMs were predicted to show some other important phenomenological differences to PMs, namely greater rates of emotion and bodily sensation.

3.2 Method

3.2.1 Design

A mixed experimental design was used, whereby participants were randomly allocated to one of three different conditions, and then completed a series of parallel tasks involving questionnaire completion in the lab at different time points, a two-week period of diary keeping, and a 4-week follow-up by email. Table 3-1 below outlines the sequence completed in each condition. (The names given reflect the primary distinguishing features of each condition, though common procedural tasks between conditions within each column, depicting a given timepoint, are highlighted).

Table 3-1: *Experimental design and conditions*

	First Meeting	**2-week Diary**	**Second Meeting**	**4-week follow-up**
IM-interview/ diary *n*=22	Detailed written description of IM and questionnaire; mood scales	Intrusive Memory Diary	Diary-compliance questionnaire; mood scales	Mood scales
IM-keywords/ diary *n*=19	Keyword nomination of IM; mood scales	Intrusive Memory Diary	Full description of IM; diary-compliance questionnaire; mood scales	Mood scales
IM-interview/ PM-diary *n*=22	Detailed written description of IM and questionnaire; mood scales	Involuntary Prospective Memory Diary	Diary-compliance questionnaire; mood scales	Mood scales

3.2.2 Participants

A total of 105 participants were recruited from the University of Hertfordshire student body and staff, as well as from the community. The study was advertised via a number of means: the online psychology student research participation (SONA) system; the University

of Hertfordshire intranet (StudyNet); a research newsletter circulated by email within UH; social media; and posters placed around the University. Psychology students were offered 3 hours of participation credit, but participants from outside the department were not offered payment for participation. Participants were self-selecting and were advised that the only inclusion criterion was that they experienced at least one IM per day.

A total of 23 (non-psychology) participants did not return the diary after attending the first session. Some did not return for the second meeting and did not respond to further communication from the primary researcher. Others indicated that they wished to discontinue their participation based on finding the diary keeping too difficult or time consuming. One attended the second session but never returned the diary. On seven occasions, participant failure to return the diary made it unclear to which condition they had been assigned. Of the remaining 16 participants that dropped out, six had been assigned to the *IM-interview/diary* condition, six to the *IM-keyword/diary* condition, and four to the *IM-interview/PM-diary* condition.

Of the remaining 82 participants, an additional 19 were excluded for a number of reasons which resulted in a final sample of 63 participants (54 female). At screening, five participants nominated what appeared to be intrusive thoughts or current concerns rather than IMs, and were excluded on that basis. One additional participant was excluded because of the recency of the event in memory (which had to be at least four weeks old, to best approximate the cut-off for a PTSD diagnosis). Four were excluded for their non-compliance with PM diary task, either failing to make full entries, or recording thoughts other than PMs (e.g. IAMs, IMs, ongoing tasks, general thoughts about the future). An additional eight participants were excluded because of poor IM diary compliance (recording either current concerns/intrusive thoughts that did not align with their IM reported at screening, making incomplete entries, or reporting that they failed to keep the diary with them at least half the

time). Finally, one participant in the *IM-keyword/diary* condition was excluded because their full memory description was not collected (see procedure below) and it was therefore not possible to assess whether the content of IMs reported in the diary aligned with this description.

In the final sample of 63 participants, there were 22 participants in the *IM-interview/diary* condition, 19 participants in the *IM-keywords/diary* condition, and 22 participants in the *IM-interview*/*PM-diary* condition (see Table 1). As indicated in Table 3-1, a number of scales, measuring state- and trait-anxiety (STAI), depression (BDI) and PTSD (PCL-C) were administered before and after the 2-week period of diary keeping (see full descriptions of the measures below). Table 3-2 presents the mean (*SD*) scores on these scales administered at the first meeting. A series of one-way ANOVAs showed no group differences in the STAI-State scores $F(2, 62) = 1.33$, $p = 0.27$, STAI-Trait scores $F(2, 62) = 2.53$, $p = 0.08$, nor the BDI scores $F(2, 62) = 1.04$, $p = 0.36$ or PCL-C scores $F(2, 62) = 1.22$, $p = 0.30$. The mean age of participants was 23.4 (*SD* = 6.79, range 17 - 49) with no group differences ($F < 1$).

Table 3-2: *Mean (SD) preliminary scores on scales administered during first meeting.*

	IM-interview/diary	*IM-keywords/diary*	*IM-interview/PM-diary*
STAI-State	39.14 (9.47)	44.68 (12.87)	41.47 (10.59)
STAI-Trait	52.36 (10.05)	54.63 (8.99)	48.05 (9.60)
BDI	19.09 (8.47)	20.89 (11.07)	16.73 (8.38)
PCL-C	45.23 (9.10)	50.37 (11.43)	46.95 (11.31)

3.2.3 Materials

IM Nomination Questionnaire: This questionnaire was adapted from Reynolds and Brewin (1999; see also the online screening questionnaire described in Chapter 2).

Participants in the *IM-interview/diary* and *IM-interview*/*PM-diary* conditions were asked to nominate up to three of their most IMs by providing a sufficiently detailed written description of content of their IM, and an indication of how long ago that event occurred. For each IM nominated, participants were asked to complete a brief questionnaire about their memory, including: 1) the frequency with which they experienced the IM over the previous week (*never, once or twice a week, 3 or 4 times a week, once a day, 2-3 times a day, 3-5 times a day, more than 5 times a day)*; 2) approximately how long the memory lasted when it came to mind (*seconds, minutes, up to an hour, several hours, constantly);* 3) how clear and vivid was the memory (*1=not vivid, vague, 7=extremely vivid);* 4) whether the memory was accompanied by any physical sensations *(no physical sensations, some physical sensations)*; 5) the temporal vantage point when the memory came to mind *(reliving the event as occurring here and now, looking back at the past)*; 6) how distressing the memory was *(1=not at all distressing, 7=very distressing);* 7) how much the participant felt it disrupted their daily activity *(1=not at all disruptive, 7=very disruptive);* 8) how much the participant avoided thinking about the event *(1=not at all, 7=as much as possible);* and 9) how much the participant avoided reminders of the event *(1=not at all, 7=as much as possible).*

As in the *IM-interview/diary* and *IM-interview/PM-diary* conditions, participants in the *IM-keywords/diary* condition were asked to nominate up to three of their most intrusive IMs, but instead of providing full descriptions, were asked only to write 3-4 keywords on the nomination form. Participants in this condition did not complete an accompanying questionnaire about the frequency, duration, vividness and other characteristics of their nominated IM. At the end of the 2-week period of diary keeping, they were asked to provide a full written description of the IMs nominated during the first meeting. All of the participants included in the final sample were able to do so.

Diaries (see Appendix II): Participants in all three conditions received A5 booklets in which to record their memories over a 2-week period. Participants in the *IM-interview/diary* and *IM-keywords/diary* conditions were given identical diaries, in which they were asked to record their IMs. Participants in the *IM-interview/PM-diary* condition were asked to record their involuntary PMs in a similar diary. Both types of diary consisted of 32 pages, though participants were advised that if they ran out of space they would be provided with another booklet.

In the two IM diary conditions, participants had to record the time and date that the IM was experienced, and the time and date it was recorded in the diary. They then provided a brief written description of the memory in the space provided and indicated whether there was any trigger (*in your thoughts, in the environment, no trigger*). If there was a trigger, they were asked to describe what it was. Participants also described the activity they were involved in and rated their levels of concentration (1=*not at all,* 5=*fully concentrating*). Vividness was rated on a 7-point scale (1=*very vague, almost no image,* 7=*extremely vivid, almost like normal vision*). Next, participants indicated if the memory evoked any emotions (*yes/no*) and physical sensations (*yes/no*) and described these in their own words if the 'Yes' response was ticked. Participants then indicated how long ago the event in the memory occurred and whether they had had the memory of this event before (*never*, *only a few times*, *sometimes*, *often*, *very often*). Finally, if participants had had this memory before, they had to indicate whether this memory was '*exactly the same as previous memories of this event*' or whether the memory was '*of the same event but from a different detail or time segment of the event*'.

The diary of involuntary PMs followed an identical format but omitted the last three questions regarding how long ago the event in memory occurred, whether the memory for the event had been experienced before, and whether the memory detail was the same or different

from previous times it was experienced. Instead, participants were asked to indicate when they formed the intention upon which their involuntary PM was based, and when they planned to carry out their intended task in the future. Both types of diary had a grid within the front cover page, and participants were advised that if an IM or involuntary PM came to mind, but they did not have an opportunity to record a full diary entry immediately (e.g., they were driving), and later they had forgotten some details of the experience, they could make a tick in the grid next to corresponding day to indicate this.

Post-diary Compliance Questionnaires (see Appendix III): Participants in all three conditions answered several questions designed to measure compliance with the diary method, and what benefit they felt they derived from keeping the diary, if any. For example, participants had to indicate on how many days (out of 14) they forgot to keep a diary with them, and indicate the percentage of their IMs that they were able to record in the diary. Participants were also asked to indicate how difficult they found keeping a diary of their IMs or PMs (*very easy, somewhat easy, somewhat difficult, very difficult),* whether they found the process of recording their memories at all useful, and if they felt it had any effect on their mood (*1=made me feel a lot worse, 4=no effect, 7=made me feel a lot better).* They were also asked to indicate whether they felt recording their IMs or involuntary PMs had any effect on the frequency, intensity or controllability of their nominated IMs (*overall more, overall the same, overall less, not sure).*

Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970: see Appendix IV): This is a 40-item measure of anxiety. The first 20 items assess participants' anxiety in the present moment (state anxiety). Items including "I am tense," "I am comfortable," and "I feel nervous," are scored on a four-point rating scale (*1*=not at all, *2=somewhat, 3=moderately so, 4=very much so*). The second set of 20 items assess participants' general tendency towards feeling anxious (trait anxiety). Items including "I

inclined to take things hard" and "I lack self-confidence" are similarly scored on a four-point rating scale (*1=almost never, 2=sometimes, 3=often, 4=almost always*). Some items on the scale are reverse scored, and overall scores range from 20 to 80, with higher scores indicating greater anxiety. The STAI has high test-retest reliability, with one study registering an *r* value of .97 for the state scale and .45 for the trait scale. It has also been found to be a valid means of differentiating between state and trait anxiety, with statistical differences emerging between groups (one of which was exposed to a stressor, one of which was not) in state scores ($p<.025$), but not trait scores (Metzger, 1976).

Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; see Appendix V): The BDI is a 21-item self-report measure of depression that has been shown in previous research to have good reliability and validity. The questions align with clinically observed attitudes and symptoms characteristic of depression (e.g. sense of failure, guilty feeling, crying spells, irritability etc.). Participants select from a number of optional responses to a given item, to indicate the severity with which they are experiencing that symptom (e.g. Question C: *0 – I do not feel like a failure, 1 – I feel I have failed more than the average person, 2a – I feel I have accomplished very little that is worthwhile or that means anything, 2b – As I look back on my life all I can see is a lot of failures, 3 – I feel I am a complete failure as a person (parent, husband, wife)*. There is a numerical value assigned to each response (with some given equal weight, e.g. *2a* and *2b*), which are added with other responses to arrive at the final score. The scores range from 0 to 63 with higher scores indicating greater levels of depression. Scores of 10 to 18 are generally thought to indicate mild depression, 19 to 29 moderate depression, and scores of 30 and over indicate severe depression. The BDI has been shown to be a highly reliable measures, and in one review of 25 studies was found to have a mean coefficient alpha of 0.86 with psychiatric populations, and 0.81 with non-psychiatric (Beck, Steer, & Carbin, 1988). It has also demonstrated high

rates of validity, with significant correlations between BDI scores and clinician estimated depth of depressive symptoms (Beck et al., 1961).

PTSD Check List – Civilian Version (PCL-C; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; see Appendix VI): The PCL-C is a 17-item questionnaire used to assess the severity of DSM-IV symptoms associated with Post-Traumatic Stress Disorder. In contrast to the military (PCL-M) and specific (PCL-S) versions, the PCL-C asks general questions and is therefore suitable for use with samples from the general population. Participants are advised that each item represents a problem or complaint that people sometimes report after a stressful experience. Participants indicate on a 5-point scale (*1=not at all, 2=a little bit, 3=moderately, 4=quite a bit, 5= extremely*) whether they are experiencing, for example, "repeated, disturbing *memories, thoughts or images* of a stressful experience from the past?" or "trouble *remembering important parts* of a stressful experience from the past?" Items one through five correspond to criterion B in the DSM entry for PTSD (intrusion symptoms), questions six through 12 correspond to criterion C (avoidance) and questions 13 through to 17 correspond to criterion D (negative alterations in cognition and mood). Scores range from 17 – 85, with higher scores indicating greater severity of symptoms. A score of 44 has been recommended as a clinical cut-off for a diagnosis of PTSD. Previous uses of the PCL with non-clinical populations has shown it to have good consistency (α=.94) and test-retest reliability (r=.66). It demonstrates good validity, reflected in high correlations with other measures of symptomology, including the PTSD Civilian Mississippi Scale (r=.60) and the Trauma Symptoms Checklist (r=.61; Conybeare, Behar, Solomon, Newman, & Borkovec, 2012)

3.2.4 Procedure

When confirming their attendance at the lab session, participants were randomly allocated to one of three conditions, represented in Table 1. Upon arriving in the lab,

participants were given a verbal definition of intrusive memories as “involuntary, spontaneous memories of a (mostly) negative event, that repeatedly intrude upon consciousness, often against your will, are hard to control, and may disrupt your ongoing activities,” and asked to confirm that they did indeed experience this type of memory.

After obtaining consent and some demographic information, participants were asked to complete the STAI, BDI, and PCL-C. Participants were then asked to nominate up to three intrusive memories. It was stressed that there was no necessity to nominate more than one, but that some people reported having more than one IM on a daily basis. For participants in the *IM-interview/diary* and *IM-interview/PM Diary* conditions, the form given for this purpose asked that, for each memory nominated they described the content of their memory in ‘sufficient detail’ and an indication of how long ago the event occurred. Participants in these experimental conditions also completed an accompanying questionnaire for each IM nominated, which asked that they rated memory on a number of measures including frequency, duration, vividness, etc. For the *IM-keyword/diary* condition, participants nominated their IM using just 3-4 keywords rather than a full description. In all three conditions, if participants nominated more than one IM, they were asked to record their most distressing and troublesome memory first, at the top of the sheet.

Participants were then given detailed instructions of how to keep a diary of their nominated IM or involuntary PM over a period of two weeks. They were advised that, each time a memory came to mind, they should take a moment and fill out an entry in the diary. At times when this was not possible, they had the option of recording a tick in the grid on the front cover of the diary. It was stressed that there was no maximum or minimum reporting requirement, but that they should simply monitor their thoughts and record only the genuine instances of IMs or involuntary PMs, which popped into mind without them trying to deliberately recall or think about them. The researcher went over each question in the diary

with participants to ensure that they understood, and indicated the start and end date for the period of dairy keeping on the front cover. Participant were told to start recording the following morning and carry on for 14 full days.

At a follow-up meeting two weeks later participants returned their diaries, completed the STAI, BDI and PCL-C again and were asked to complete a diary-compliance questionnaire on how well they had adhered to the diary keeping, and whether they felt it had been useful to them. After this they received a partial debrief on the aims of the study, excluding the hypothesis about therapeutic benefit. Four weeks following the second meeting, participants received an email with a link to a final set of questionnaires (STAI, BDI and PCL-C). Once completed, they received a full and final debrief regarding all the aims of the study.

3.2.5 Data Preparation

The data was prepared for analysis in line with standard practice in diary studies. Items from the diary that were recorded on a scale (e.g., vividness, concentration) were calculated as means across the number of recorded memories before being entered into the ANOVA. Dichotomous items or those with discrete categories (e.g., whether the memory evoked any emotions or bodily sensations, whether the memory was exactly the same as on previous occasions or if it was focused on a different detail of the event) were calculated as proportions out of total recorded memories.

In addition, all memories recorded in the diaries were reviewed by two researchers to determine whether participants had followed the instructions. Reported memories were coded as either PM, actual IM, IM-related or non-IM, with a very good degree of inter-rater reliability (Cohen's Kappa =.89). After participant exclusions, there were 265 involuntary PMs recorded by participants in the *IM-interview*/*PM-diary* condition. Just two of these were excluded from further analysis because – contrary to participant instructions to begin

recording the next day - the entries were dated the same day as the lab meeting. This left a final total of 263 PMs. However, some of the memories recorded in *IM-interview/diary* and *IM-keywords/diary* conditions did not meet the criteria for actual IMs. A total of 99 memories were coded as IM-related, because they referred to the event upon which the nominated IM was based, but which did not represent the actual instance of the nominated IM. For example, "*thinking about hospitals; the time I spent there and the emotions it evoked*" when the nominated IM was about the death of a loved one in the hospital, or "*Being with George*[5] *in his kitchen…*" when the memory was about the death of a family member following a motorbike accident. Finally, the additional 68 descriptions were coded as non-IMs because their content did not align with the content of the nominated IM, or the associated characteristics were not what would be expected from a genuine IM (e.g., participants would say that they had never had this memory before). In fact, many non-IMs were standard IAMs or more ruminative thoughts. Examples might be "*sitting on the floor in a sunbeam with my grandparent's old dog Ben*" when the nominated intrusions had been about a car accident and exam failure, or "*No messages, lonely*" when the nominated IM was about the breakup of a relationship following an automobile accident. The exclusion of IM-related and non-IMs resulted in a total of 264 actual IMs. All subsequent analysis of IMs is based on these reports.

3.3 Results

All participants nominated at least one IM at screening and kept a diary for two weeks (either of their IMs or PMs), although there was considerable variability in reported frequency of diary entries (see below). All participants also completed the BDI, STAI and PCL-C at screening and two-week follow-up (to return the diary). However, a significantly smaller number completed the third online version of these questionnaires. For all inferential analysis, the alpha level was set to 0.05. In cases where Mauchley's Test was found to violate

[5] Name changed to protect anonymity.

the assumption of sphericity, degrees of freedom were corrected using Greenhouse-Geisser (ε < .75) or Huyhn Feldt (ε > .75) estimates of sphericity (Field, 2013).

3.3.1 Nominated IMs

All participants nominated at least one IM at the first meeting, but 27 participants (43%) nominated two IMs, and 23 (37%) nominated 3 IMs. The mean number of memories nominated in the *IM-interview/diary* condition (M = 2.23, SD = 0.87), *IM-keywords/diary* condition (M = 2.32, SD = 0.67), and the IM-interview/*PM-diary* condition (M = 1.95, SD = 0.65) did not differ from each other, $F(2, 62) = 1.36$, $p = 0.26$.

All nominated IM were classed into one of five categories (see Reynolds & Brewin, 1999): death/illness to another person, illness/injury to oneself, assault or abuse to oneself, interpersonal problems, and other. The rates at which different categories of memory were nominated is represented in Table 3-3. There were no group differences for the first nominated memory, $\chi^2(8, N = 63) = 6.37$, p = 0.61 nor were there any for the second $\chi^2(8, N = 48) = 9.27$, p = 0.32, or the third $\chi^2(8, N = 22) = 12.10$, p = 0.15.

Table 3-3: *Percentage (frequency) for the first (of three) nominated IM as a function of event category*

	Event Category				
	death/illness to another person	illness/injury to oneself	assault or abuse to oneself	interpersonal problems	other
IM-interview/diary	18% (4)	27% (6)	9% (2)	41% (9)	5% (1)
IM-keywords/diary	16% (3)	11% (2)	21% (4)	41% (8)	11% (2)
IM-interview/PM-diary	27% (6)	18% (4)	23% (5)	32% (7)	0% (0)

In the *IM-interview/diary* and *IM-interview*/*PM-diary* conditions, participants were also asked to rate their nominated IM on a number of scales including the frequency with which they experienced the memory over the previous week, how long it lasted, and how disruptive they found it when the memory came to mind (see Table 3-4). Participants in the *IM-keywords/diary* condition were not asked to complete these scales when writing out a full description of their memory during the second meeting. It seemed the case that this data was unlikely to be comparable to that collected during the first meetings in the *IM-interview/diary* and *IM-interview*/*PM-diary* conditions, so the decision was taken to not collect it from participants in the *IM-keywords/diary* condition.

If nominating more than one IM, participants were asked to start with their most intrusive IM. The mean ratings for the first nominated IM in the *IM-interview/diary* and *IM-interview*/*PM-diary* conditions are presented in Table 3-4. A series of one-way ANOVAs revealed no group differences in the ratings for different variables. In addition, 73% of participants' first nominated IMs in the *IM-interview/diary* condition were reported as be accompanied by bodily sensations, whilst this was the case for 76% of participants' first nominated IMs in the *IM-interview*/*PM-diary* condition. There were no group differences $\chi^2(1, N = 43) = 0.07$, $p = 0.80$.[6] In the *IM-interview/diary* condition, 46% of participants reported their first nominated IM to be like "reliving the event as occurring here and now" rather than "looking back at the past." In the *IM-interview*/*PM-diary* condition, 55% of participants indicated their first nominated IM was accompanied by this sense of reliving. Again there were no group differences $\chi^2(1, N = 44) = 0.36$, $p = 0.55$.

[6] One participant in the *IM-interview*/*PM-diary* condition failed to report whether they experienced bodily sensations with their nominated IM, resulted in lower degrees of freedom for the chi-square analysis.

Table 3-4: *Mean (SD) ratings for characteristics of first nominated IM, and the results of a One-way ANOVA.*

	Condition			
Characteristics	IM-interview/ diary	IM-interview/ PM-diary	Variable description	*p*
Frequency [a]	2.82 (1.79)	2.41 (1.50)	Between 1 and 4 times per week	0.42
Vividness [b]	5.59 (1.56)	5.09 (1.27)	Highly vivid (1-7 scale)	0.25
Distress [b]	5.45 (1.79)	5.22 (1.19)	Highly distressing (1-7 scale)	0.62
Disruption [b]	4.27 (1.88)	3.86 (1.46)	Medium disruption (1-7 scale)	0.43
Avoid thinking [b]	6.27 (1.03)	6.0 (1.41)	High avoidance (1-7 scale)	0.47
Avoid reminders [b]	5.32 (2.06)	5.27 (1.89)	High avoidance (1-7 scale)	0.94
Duration [c]	1.0 (1.02)	1.05 (0.84)	1 = seconds, 2 = minutes	0.87
Age of memory	46.4 (76.1)	45.9 (48.8)	Months	0.98

[a] Frequency ratings were made on a 7-point scale: 1=*none*, 2=*once or twice a week*, 3=*three or four times a week*, 4=*once a day*, 5=*two to three times a day*, 6=*three to five times a day*, 7=*more than five times a day*

[b] Ratings were made on a 7-point scale: 1=*not at all*, 7=*extremely*

[c] Duration ratings were scored on a 5-point scale: 1=*seconds*, 2=*minutes*, 3=*up to an hour*, 4=*several hours*, 5=*constantly*.

3.3.2 Diary compliance

Overall, the self-reported diary compliance was good with 55% of participants in the *IM-interview/diary* condition, 53% in the *IM-keywords/diary* condition and 50% in the *IM-interview*/*PM-diary* condition reporting that they kept the diary with them every day during the 14 days of diary keeping. A chi square analysis showed no group differences $\chi^2(2, N = 63) = 0.92$, $p = 0.95$. The mean number of days (out of 14) that participants in the *IM-interview/diary* condition failed to keep the diary with them was fairly low at 1.05 (*SD* = 1.69, *range* = 0 - 5), and did not differ from those reported in the *IM-keywords/diary* condition (*M* = 1.25, *SD* =1.59, *range* = 0 - 4), or in the *IM-interview*/*PM-diary* condition (*M*

= 1.66, *SD* = 2.37, *range* = 0 - 9) (*F* < 1). Finally, participants in the *IM-interview/diary* condition reported being able to recorded on average 72.50% (*SD* = 23.74) of all the IMs experienced during the two weeks of diary keeping, which did not differ from mean percentages reported by participants in the *IM-keywords/diary* condition (*M* = 72.63, *SD* = 23.06) and in the *IM-interview*/*PM-diary* condition (*M* = 67.68, *SD* = 25.72) (*F* < 1). These percentages are comparable to those found in recent studies comparing paper and smartphone diary compliance for recording transient cognitive phenomena other than IMs (in this case IAMs and Everyday Memory Failures) (Laughland & Kvavilashvili, 2018).

3.3.3 Memories recorded in the diary and their characteristics

In all three conditions, there was considerable variability in the frequency with which participants recorded in the diary (see Table 3-5) as evidenced by large standard deviations and ranges. Therefore, analyses were run on square root transformed values for these variables (e.g., see Laughland & Kvavilashvili, 2018). The results of a one-way ANOVA showed a main effect of group $F(2, 60) = 8.62$, $p = .001$, $\eta^2 = .22$. Bonferroni corrected post-hoc analysis revealed that significantly more PMs were reported than IMs in the *IM-interview/diary* ($p = .001$) and *IM-keywords/diary* ($p = .007$) conditions, but the latter two did not differ from each other ($p = 1.0$). [7] However, the three groups did not differ in terms of the number of recorded tick entries ($F < 1$). [8]

[7] It is worth noting, that these group differences result from the removal of memories that were coded as IM-related from this analysis. If IM-related memories are retained and then combined with IMs for the *IM interview/diary* (*M* = 8.45, *SD* = 7.49) and *IM Keywords/diary* (*M* = 9.32, *SD* = 9.03) conditions, the results of a one-way ANOVA show no group differences when compared to the *IM interview/PM-diary* condition, $F(2, 60) = 1.30$, $p = 0.28$.

[8] It is also interesting that the number of fully recorded diary entries decreased from week 1 to week 2 of diary keeping in all three conditions. The results of a 3 (experimental group) x 2 (week of diary keeping) mixed ANOVA on the square root transformed values of fully recorded entries showed a significant main effect of week of diary keeping $F(1, 60)=11.43$, $p=.001$, $\eta^2=0.16$. With regard to tick entries, however, there was no significant main effect of week ($F<1$).

Table 3-5: *Mean frequency, SD and range of full, tick, and combined full and tick diary entries.*

	Full Entries			Tick Entries		
	Mean	*SD*	*Range*	*Mean*	*SD*	*Range*
IM-interview/diary	5.64	3.24	1-13	9.86	13.95	0-49
IM-keywords/diary	7.37	8.83	3-32	8.32	11.64	0-45
IM-interview/PM-diary	11.95	5.77	3-28	5.45	6.88	0-24

3.3.4 Assessing the Therapeutic Benefit of Recording IMs in a Diary

3.3.4.1 Assessing Therapeutic Benefit with Measures of Psychopathology

A key aim of the present study was to examine the potential therapeutic benefits of recording IMs in a structured diary. The BDI, STAI and PCL-C were administered three times during the course of the study – at the beginning of the first and second lab sessions, and via online questionnaire four weeks after completion of the diary keeping. At the third administration, 17 participants in the *IM-interview/diary* condition, 12 in the *IM-keywords/diary* condition and 14 in the *IM-interview/PM-diary* condition completed the final set of online questionnaires for a total of 43 participants overall. This represented a drop-out rate of five participants for the *IM-interview/diary* condition, seven for the *IM-keywords/diary* condition, and eight for the *IM-interview/PM-diary* condition, for a total of 20 participants. This rate of non-completion did not differ by experimental condition $\chi^2(2, N=63)=1.27$, $p=0.53$, but due to loss of power Time 3 scores were not included in the final analysis.

Table 3-6: *Mean (SD) scores on scales administered before (T1) and after diary keeping (T2)*

	IM-interview/ diary		*IM-keywords/ diary*		*IM-interview/ PM diary*	
	T1	T2	T1	T2	T1	T2
STAI-State	39.14 (9.47)	38.64 (11.86)	42.72 (9.89)	44.33 (11.10)	41.00 (10.59)	38.41 (11.09)
STAI-Trait	52.36 (10.05)	50.50 (10.20)	54.63 (8.98)	54.74 (11.39)	48.05 (9.59)	45.64 (9.35)
BDI	19.09 (8.47)	16.27 (9.22)	20.89 (11.07)	21.10 (12.88)	16.73 (8.38)	12.63 (7.51)
PCL-C	45.09 (9.31)	42.14 (9.78)	50.37 (11.43)	50.89 (13.65)	46.95 (11.31)	39.32 (11.01)

Scores on all measures were square root transformed in order to normalize the data. A series of 3 condition (*IM-interview/diary*, *IM-keywords/diary*, *IM-interview/PM-diary*) by 2 time (baseline and follow-up) mixed ANOVAs were run for each of the psychopathology scales. With regard to STAI-State, there were no differences between the first and second time of administration ($F < 1$), though group differences were approaching significance $F(2, 60) = 2.69$, $p = .08$, $\eta^2 = .08$. There was no interaction between group and time of administration ($F<1$).

For the STAI-Trait scale, there was a similar pattern, with no difference between the first and second administration $F(1, 60) = 2.57$ $p = .11$, $\eta^2 = .04$, though there were group differences $F(2, 60) = 3.64$, $p = .03$, $\eta^2 = .11$. There was not however, any interaction between group and time of administration ($F < 1$). Pairwise comparisons (LSD) show that STAI-Trait scores recorded in the *IM-keywords/diary* condition were significantly higher than in the *IM-interview/PM-diary* condition ($p = .01$), but not the *IM-interview/diary*

condition (p = .28). There were also no differences in the scores recorded in the *IM-interview/PM-diary* condition and *IM-interview/diary* condition (p = .11).

With regard to the BDI, there was a main effect of time of administration $F(1, 60) = 6.26$ p = .02, η^2 = .09, with scores dropping significantly between Time 1 and Time 2 across all three conditions. As can be noted from Table 3-6, however, the largest such drop was recorded in the *IM-interview/PM-diary* condition. There was, however, no main effect of group $F(2, 60) = 2.40$ p = .10, η^2 = .07, nor was there an interaction between time of administration and group $F(1, 60) = 1.16$ p = .11, η^2 = .04.

Finally, with regard to the PCL-C, there was a main effect of time of administration $F(1, 59) = 6.58$ p = .01, η^2 = .10, with scores dropping significantly from Time 1 to Time 2. There was a significant main effect of group $F(2, 59) = 3.55$ p = .04, η^2 = .11, as well as a marginally significant interaction between group and time of administration $F(1, 59) = 2.88$ p = .06, η^2 = .09. [9] Tests of simple main effects show a significant drop in PCL-C scores from Time 1 to Time 2 in the *IM-interview/PM-diary* condition (p = .001) but not the *IM-interview/diary* condition (p = .201) or the *IM-Keyword/diary* condition (p = 919; see Figure 3-1).

[9] Because a number of questions were left unanswered, it was not possible to score the second PCL-C for one participant.

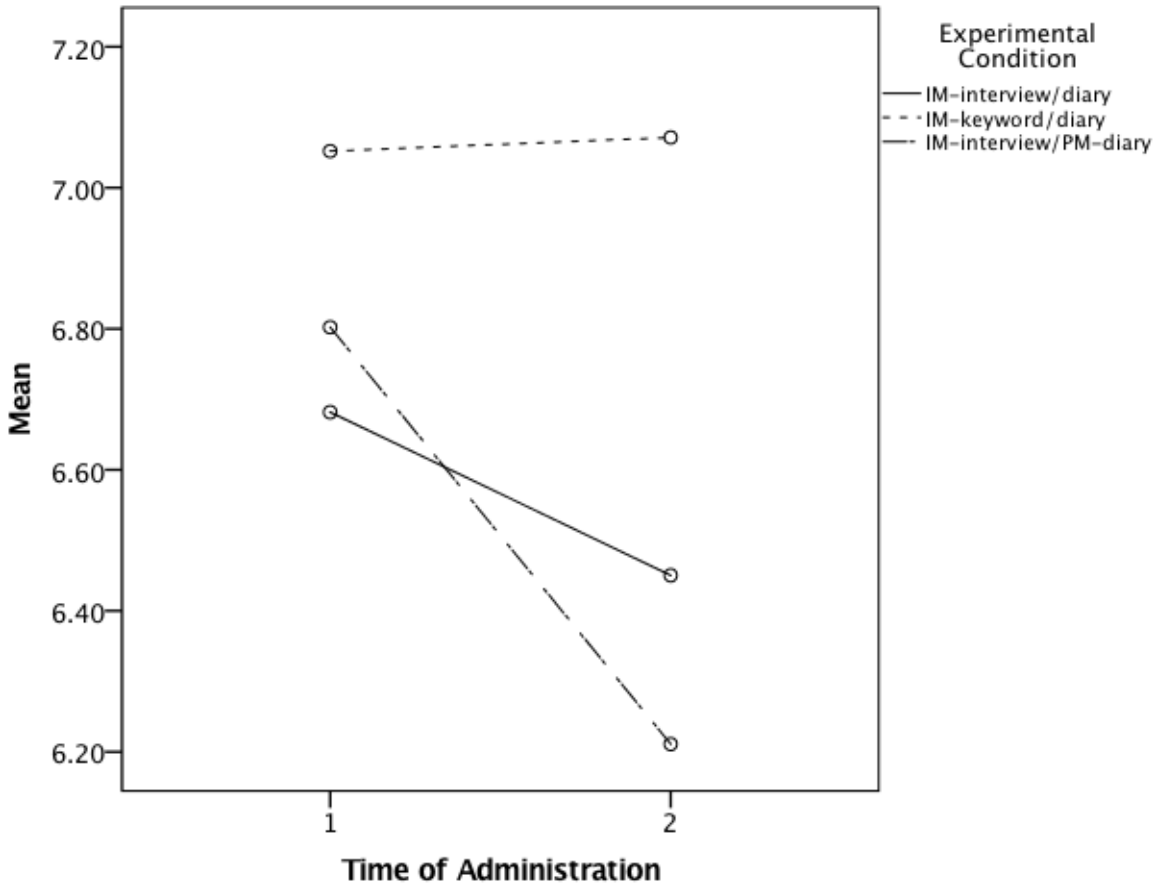


Figure 3-1: *Mean PCL-C scores as a function of experimental group and time of administration*

To further explore the relationship between IM and PM diary keeping and scores on the PCL-C, additional analyses were conducted on its subscales measuring Criteria B (intrusion symptoms), C (avoidance) and D (negative changes in cognition and mood) (see method section above). The square root transformed scores on each of these subscales were again entered into a 3 condition (*IM-interview/diary*, *IM-keywords/diary*, *IM-interview/PM-diary*) x 2 time (baseline and follow-up) mixed ANOVA.

Table 3-7: *Mean (SD) scores PCL-C subscales from first and second administrations*

	IM-interview/ Diary		*IM-keywords/ diary*		*IM-interview/ PM diary*	
	T1	T2	T1	T2	T1	T2
PCL-C Subscale B	13.32 (3.76)	13.14 (4.18)	15.42 (2.65)	15.05 (4.47)	15.23 (4.30)	11.23 (4.36)
PCL-C Subscale C	18.32 (5.67)	16.24 (4.15)	19.95 (6.05)	21.0 (7.08)	17.86 (5.63)	15.95 (5.92)
PCL-C Subscale D	13.59 (3.53)	13.14 (4.90)	15.0 (5.04)	14.84 (4.84)	13.86 (3.75)	12.14 (4.30)

For the Criterion B subscale (measuring intrusion symptoms), results show a main effect of time of administration $F(1, 60) = 10.35$ $p = .002$, $\eta^2 = .15$, a marginally significant effect of group $F(2, 60) = 2.46$, $p = .09$, $\eta^2 = .08$, and a significant interaction between the two $F(1, 60) = 6.25$ $p = .003$, $\eta^2 = .17$. [10] Tests of simple main effects show a significant drop in Criterion B subscale scores in the *IM-interview/PM-diary* condition ($p = .001$) but not the *IM-interview/diary* condition ($p = .802$) or the *IM-keyword/diary* condition ($p = .545$; see Figure 3-2).

For the Criterion C subscale (measuring avoidance symptoms) there was no main effect of time of administration $F(1, 59) = 1.65$ $p = .20$, $\eta^2 = .03$, but there was a marginally significant effect of group $F(2, 59) = 3.06$ $p = .06$, $\eta^2 = .09$. There was not, however, a significant interaction between time of administration and group $F(1, 59) = 1.34$ $p = .27$, $\eta^2 = .04$. Post hoc comparisons (LSD) show that participants in the *IM-keyword/diary* condition reported higher Criterion C subscale scores overall than either the *IM-interview/diary* ($p =$

[10] The participant whose full PCL-C score could not be calculated for the second administration, did respond to the initial five questions, so the Criterion B subscale score for this participant was included in the analysis.

.052) condition and the *IM-interview/PM-diary* condition ($p = .025$). The latter two conditions did not differ from each other ($p = .758$).

Finally, for the Criterion D subscale (measuring negative changes in cognition and mood), results show a marginally significant effect of time $F(1, 59) = 3.26$ $p = .08$, $\eta^2 = .05$, but not of group $F(2, 59) = 1.93$ $p = .31$, $\eta^2 = .04$. There was also no interaction ($F < 1$). Pairwise comparisons (LSD) show a significant drop in Criterion D subscale scores for the *IM-interview/PM-diary* condition ($p = .047$) but not the *IM-interview/diary* ($p = .309$) or *IM-keyword/diary* ($p = .888$) conditions.

In summary, whilst changes to the STAI scores did not improve significantly between the first and second administrations, the BDI and PCL-C results both showed a significant drop across the three conditions. Only in the case of the PCL-C, however, was this modified by a marginally significant interaction, showing greater improvement in the *IM-interview/PM-diary* condition than in the *IM-interview/diary* condition (which showed numerical improvement that was no statistical significance) and the *IM-keyword/diary* condition (which showed no improvement). Further analysis of the PCL-C subscales suggest that the improvement in scores in the *IM-interview/PM-diary* condition is primarily driven by a drop in Criterion B (intrusion symptoms scores).

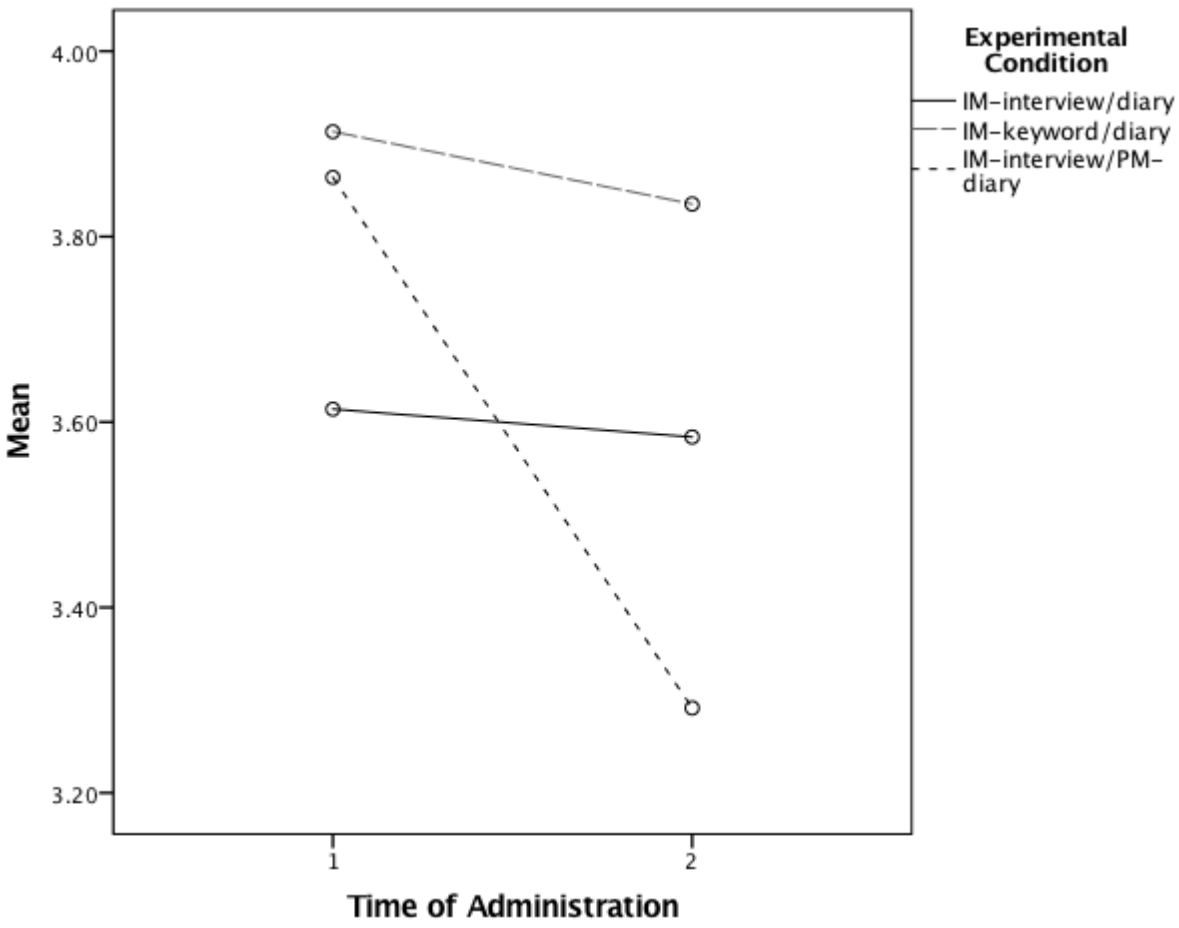


Figure 3-2: *Time 1 and 2 scores on the Criterion B subscale of the PCL-C as a function of experimental condition.*

3.3.4.2 Subjective assessment of therapeutic benefit

In addition to diary compliance, the debriefing questionnaire that participants were asked to complete included items designed to capture their subjective assessment of the usefulness of recording their memories in a diary. On a 7-point scale they indicated whether they felt that keeping a diary of their IMs or PMs had any effect on their mood (1=made me feel a lot worse, 4=no effect, 7=made me feel a lot better). Responses, as a function of experimental group, are presented in Table 3-8. For purposes of data presentation, responses in the 1 to 3 range were grouped together as indications of negative effect, whilst responses in the 5-7 range were grouped together as indications of positive effect. Results of a chi-square

analysis show a strong effect of experimental group on subjective assessment of the mood effects of diary keeping $\chi^2(4, N = 63) = 20.55$, $p < .001$. More than half of the participants in the *IM-keywords/diary* condition reported that the diary keeping made them feel worse overall, whilst nearly the same proportion of participants in the *IM-interview/diary* condition reported that the diary improved their mood overall. The majority (73%) of participants in the *IM-interview/PM-diary* condition reported that the diary keeping had no effect on their mood.

Table 3-8: *Percentage (frequency) of reported mood effects of diary keeping*

	Worse overall	No effect	Improved overall	Total
IM-interview/diary	18% (4)	36% (8)	46% (10)	100% (22)
IM-keyword/diary	53% (10)	31% (6)	16% (3)	100% (19)
IM-Interview/PM-Diary	0% (0)	73% (16)	27% (6)	100% (22)
Total	22% (14)	48% (30)	30% (19)	100% (63)

Participants also responded to questions about whether recording their memories (either IMs or PMs) had any impact on the frequency, intensity or controllability of the IM that they nominated during the first session. For each variable, participants indicated whether their IM was more frequent/intense/controllable, less so, about the same, or if they were not sure. The majority of participants in the *IM-interview/diary* (46%), the *IM-keyword/diary* (58%) and *IM-interview/PM Diary* (55%) conditions reported that they found the frequency of their nominated IMs overall the same as before they began the two weeks of diary keeping $\chi^2(6, N = 63) = 2.92$, $p = .82$. In addition, over 70% of participants in each of the three conditions reported that the intensity of their nominated IM was overall the same, $\chi^2(6, N = 63) = 5.93$, $p = .43$. Finally, with regard to controllability, in the *IM-keywords/diary* condition, 21% of participants reported that their IMs were overall more controllable, while 37% reported that they were less so. In contrast, 32% of participants in the *IM-*

interview/diary condition said their IMs were more controllable, while 14% said they were less so. In the *IM-interview/PM Diary* condition 68% of participants said controllability of their IM was overall the same. There was no relationship between experimental condition and response to this item $\chi^2(6, N = 63) = 13.16, p = .11$.

In summary, subjective assessment of the benefits of diary keeping aligned more with original predictions, in that a majority of the participants in the *IM-interview/diary* condition reported an improvement in their mood, whilst the majority of participants in the control *IM-interview/PM-diary* condition reported no effect. By contrast, participants in the *IM-keyword/diary* condition reported a negative effect on their mood, suggesting there is something about the initial interview that produces benefit that the diary alone cannot.

3.3.6 Conditions in which IMs were recorded

3.3.6.1 Triggers for IMs

A majority of the reported triggers for both IMs and PMs were environmental (see Table 3-10). To account for variability in the data, the proportions of each type of trigger were entered into a 3 (experimental condition) x 3 (trigger type) ANOVA. The results showed a main effect of trigger type, $F(2, 118) = 12.59, p < .001, \eta^2_p = .18$, but not group ($F < 1$), or their interaction $F(4, 118) = 1.10, p = .36, \eta^2_p = .04$ (see means presented in Table 3-10). Pairwise comparison (LSD) showed that environmental triggers were reported more frequently than internal thoughts ($p = .001$) or reports of no trigger ($p < .001$). The frequency with which internal thoughts and no triggers were reported did not differ from each other ($p = .231$).

Table 3-9: *Mean proportions (SD) of triggers reported as a function of trigger category and condition.*

	Trigger Category		
	Environment	*Own Thoughts*	*No Trigger*
IM-interview/diary	53.68 (30.35)	29.27 (25.52)	17.06 (22.97)
IM-keywords/diary	44.39 (23.55)	32.72 (22.79)	22.89 (26.87)
IM-interview/PM-diary	46.36 (18.01)	25.06 (16.49)	29.94 (17.26)

In addition, participants' descriptions of triggers were coded according to a scheme developed by Mace (2004) into the categories of 'abstract/verbal,' 'sensory/perceptual,' 'physiological/psychological state' and 'undecided/unclassifiable.' Abstract triggers were those that arose internally (thoughts as triggers for memories) or in response to verbal information in the environment (written words or conversation). Sensory/perceptual cues represented more concrete sensory information from the immediate environment (e.g. sounds, smells, objects) which aligned with some feature of the memory triggered. Physiological/psychological states that acted as triggers were primarily emotions/feelings or endogenous states or experiences of which we can be conscious of (e.g. hunger, fatigue, pain). Any trigger for which there was insufficient or ambiguous information was coded as "undecided/unclassifiable." Over half of the trigger descriptions were double coded by two independent raters, with a high level of agreement (κ =.73). All coding disagreements were resolved through discussion.

To account for the fact that the number of recorded IMs varied across participants, the proportions of each type of trigger were calculated for each participant, and these proportions were entered into a 3 (experimental condition) by 3 (trigger modality) ANOVA with repeated measures on the last factor. (Due to the low number of triggers coded as "unclassifiable," these were excluded from the analysis). Results showed a significant main effect of trigger

modality $F(1.31, 77.47) = 46.59$, $p < .001$, $\eta^2_p = .44$, but not experimental group $F(2, 59) = 1.07$, $p = .35$, $\eta^2_p = .04$. The overall proportion of abstract cues was greater than sensory/perceptual cues ($p = .006$). The proportion of abstract and sensory/perceptual cues was each greater than physiological/emotional state cues (both $p < .001$).

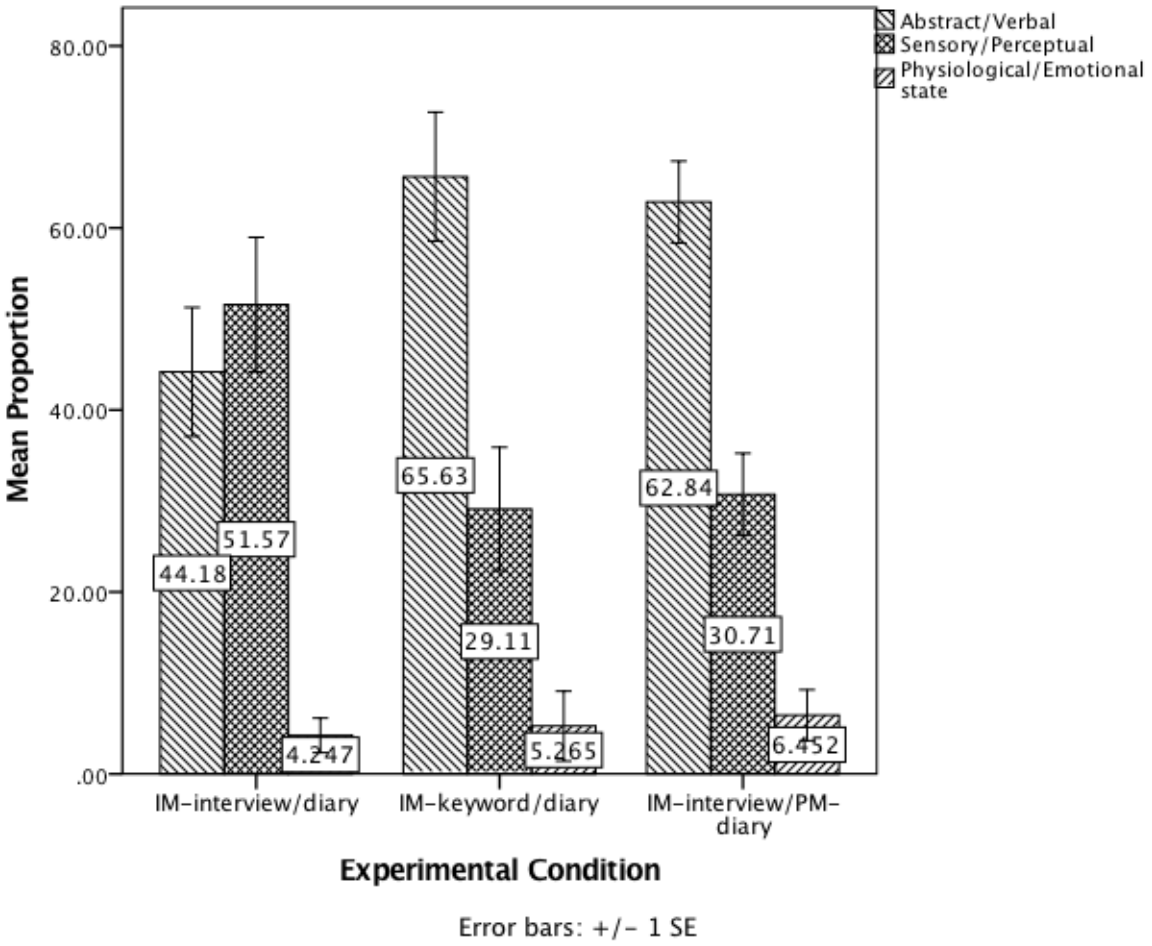


Figure 3-3: *Mean proportions of triggers reported, as a function of modality and experimental condition*

However, this main effect was qualified by a significant experimental condition by trigger modality interaction $F(2.63, 77.47) = 3.39$, $p = .03$, $\eta^2_p = .10$. As can be noted in Figure 3-3, the pattern of means for different trigger modalities in the *IM-interview/diary* condition was different from that in the other two conditions. The proportions of abstract/verbal ($M = 44.18$) and sensory/perceptual ($M = 51.57$) triggers were not significantly different from each other in the *IM-interview/diary* condition ($p = .54$). By

contrast, in the *IM-keywords/diary* and *IM-interview/PM-diary* conditions the mean proportions of abstract triggers (M = 65.63 and M = 62.84, respectively) were significantly higher than sensory/perceptual triggers (M = 29.11 and M = 30.71, respectively) (p = .006 and p = .011, respectively). In addition, participants in the *IM-interview/diary* condition reported higher proportion of sensory/perceptual cues than participants in the *IM-keywords/diary* (p = .02) and *IM-interview*/*PM-diary* (p = .02) conditions, which did not differ from each other (p = .86). Conversely, participants in the *IM-interview/diary* condition reported significantly fewer abstract/verbal cues than those in the *IM-keywords/diary* condition (p = .02) and the *IM-interview/PM-diary* condition (p = .04). The *IM-keywords/diary* and *IM-interview/PM-diary* conditions did not differ in the proportions of reported abstract triggers (p = .76). Finally, there were no group differences in reports of physiological/emotional state cues (all p > .05).

3.3.6.2 Ongoing activities and self-reported concentration levels

The activities in which participants reported being engaged when they experienced an IM or PM were coded as either automatic and habitual (and therefore requiring little concentration for successful completion, e.g., "*walking to uni*, *making tea*, *tidying"*) or controlled (demanding greater concentration, e.g., "*in my living room watching TV"* and *"studying, talking to family, writing a lab report"*). Due to the positively skewed data, a 3 (experimental condition) x 2 (automatic versus controlled activity) mixed ANOVA was run on the proportions of these variables. Results showed a significant main effect of activity type, $F(1, 60) = 6.72$, p = .01, η^2_p = .10 (see Figure 3-4), but no main effect of condition or an interaction (both F < 1). Across the sample, regardless of condition, automatic activities were reported more often than controlled activities.

Concentration levels across all three conditions were comparable and close to mid-point of the 5-point scale with the mean ratings of 3.31 (SD = 0.66) in the *IM-interview/diary*

condition, 3.22 (*SD* = 1.10) in the *IM-interview-keyword* condition, and 2.92 (*SD* = 0.44) in the *IM-interview/PM-diary* condition. The results of a one-way ANOVA revealed no group differences $F(2, 60) = 1.55$, $p = .22$, $\eta^2_p = .05$.

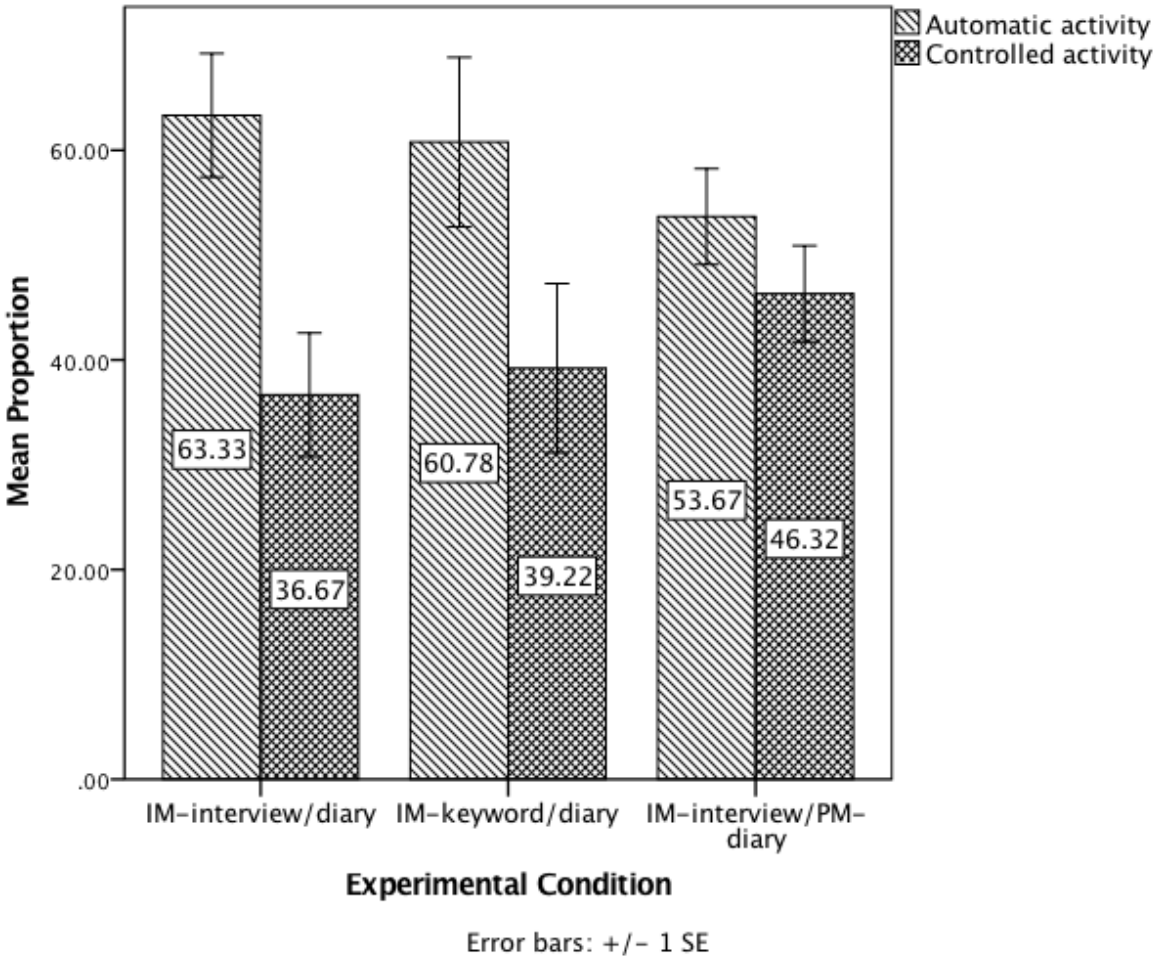


Figure 3-4*: Mean proportions of automatic versus controlled concurrent activities reported, as a function of experimental condition.*

3.3.7 Additional findings

Participants rated their IMs and PMs along a number of additional variables (see Table 3-10). With regard to vividness, despite evident numerical differences in the ratings given by participants who recoded IMs versus those who recorded PMs, there were no significant group differences ($F<1$). The results of a one-way ANOVA, however showed group differences in the proportion of IMs and PMs that were accompanied by bodily

sensations $F(2, 60) = 4.42$, $p = 0.02$, $\eta^2_p = 0.13$. Post hoc comparisons showed that the *IM-interview*/*PM-diary* condition reported a lower proportion of bodily sensations than the *IM-interview/diary* ($p = .021$) or *IM-keywords/diary* ($p = .009$) conditions, which did not differ from each other ($p = 0.67$).

Of the 264 actual IMs reported in the diary, 219 (83%) evoked emotions, and in 98% of cases these were negative (e.g. sadness, anger, disgust or embarrassment). By contrast, only 43% (n=113) of reported PMs were accompanied by an emotional response, though in 82% of cases these too were negative emotions. The results of a 3 (experimental condition) x 2 (proportion of negative vs positive emotions) mixed ANOVA showed a main effect of emotions reported $F(1, 55) = 498.90$, $p < .001$, $\eta^2_p = 0.90$, with a much greater proportion of reported memories being negative. There was no effect of group ($F < 1$), but there was a significant interaction $F(1, 55) = 3.56$ $p = .04$, $\eta^2_p = .12$. Tests of simple main effects showed that participants in the *IM-interview*/*PM-diary* condition reported a lower proportion of negative emotions than the *IM-interview/diary* (p=.021) or *IM-keywords/diary* (p=.030) conditions, but a higher proportion of positive memories than the *IM-interview/diary* (p=.026) or *IM-keywords/diary* (p=.024) conditions.

Finally, with regard to IMs alone, there were no differences between the *IM-interview/diary* and *IM-keyword/diary* conditions in the mean rehearsal ratings reported (F<1). In terms of the varied nature of IM content, 123 of the IM reports (47%) were designated as exactly the same as previous occasions when the memory came to mind, whilst 139 (53%) were said to be of the same event but focused on a different detail or time segment. There were no differences between the proportions of each memory category, nor were there differences between experimental conditions (both F<1).

Table 3-10: *Mean (SD) diary ratings and proportions for memory characteristics*

	IM-interview/diary	*IM-keyword/diary*	*IM-interview/PM-diary*
Vividness	4.46 (1.65)	4.60 (1.05)	4.11 (1.27)
Bodily Sensations [a]	45.09 (39.36)	49.87 (38.49)	19.79 (27.56)
Negative Emotions [b]	97.50 (11.18)	96.87 (7.24)	85.82 (23.07)
Identical IM Content [c]	48.80 (37.06)	44.23 (24.50)	NA
Rehearsal [d]	4.08 (0.79)	4.17 (0.63)	NA

[a] Mean proportion of IMs/PMs that were reported to be accompanied by bodily sensations
[b] Of the total number IMs/PMs reported as being accompanied by emotions, the mean proportion of instances where these were coded as negative.
[c] Proportion all IMs reported
[d] Rated on a 5-point scale (1=*never*, 2=*once or twice*, 3=*a few times*, 4=*several times*, 5=*many times*)

3.4 Discussion

Several important findings emerged from the present study. For example, just a handful of previous studies have shown that it is possible to recruit participants for IM studies from a non-clinical population (Brewin et al., 1996; Bywaters et al., 2004). The results of this study reinforce this finding and underline the usefulness of accessing such a population for purposes of studying IMs. Indeed, the results of the present study, combined with those of Chapter 2, show that these memories are reasonably frequent in the general population without the clinical diagnosis of PTSD.

In addition, the present study demonstrates the usefulness of a diary method to study IMs in general and in a non-clinical population. As noted above, given the reliability of the diary method in other research areas, it is odd that it has not been used more for the study of IMs (Kvavilashvili, 2014). And diary ratings of frequency, emotion, and bodily sensations in the present study suggest that the IM reported at screening were successfully captured. In addition, compliance with the diary method in the present study was generally good and comparable to what has been reported in previous diary studies on other spontaneous phenomena (see Laughland & Kvavilashvili, 2018). Furthermore, like in previous studies,

participants in both IM diary conditions (*IM-interview/diary* and *IM-keywords/diary*), as well as in the *IM-interview/PM-diary* condition, reported a greater number of entries during the first week compared to the second week of diary keeping (see Laughland & Kvavilashvili, 2018). Most importantly, findings concerning combined number of entries (i.e., fully recorded IMs and tick entries) suggest that non-clinical participants were experiencing their IMs slightly more frequently than once a day.

With regard to the conditions under which IMs were reported to occur, results showed that the majority of IMs arose when participants were in a diffuse state of attention (e.g. engaged in a cognitively undemanding activity), a finding that was also supported by the examination of mean concentration ratings, which were around the mid-point of the 5-point scale. In addition, the majority of triggers were environmental rather than internal, with a minority being reported as having no trigger. Further examination of the nature of triggers revealed that in the *IM-interview/diary* condition there were fewer abstract/verbal than sensory/perceptual triggers (though this difference was not significant) while in the *IM-keyword/diary* and *IM-interview/PM-diary* conditions, the proportion of abstract/verbal triggers was much higher than sensory/perceptual. Thus only the first condition aligned with what has been previously found in IAM research, while the other two conditions diverged considerably.

However, the results for therapeutic benefit did not align with predictions. There were no main effects of time of administration for the STAI-State or the STAI-Trait, though group difference were approaching significance for the former and reached significance for the latter. For the BDI, there was a significant change in score between the first and second administrations of the scale, but group difference did not emerge. The PCL-C was the only scale for which there was a main effect of time of administration and experimental condition, as well as a marginally significant interaction. However, this was because T2 scores in the

IM-interview/*PM-diary* condition were significantly lower than in the *IM-interview/diary* or *IM-keywords/diary* conditions. Given that keeping the PM diary was introduced to serve as the control condition, this finding was unexpected. Closer examination of the three subscales of the PCL-C showed that this overall effect seemed to be primarily driven by a significant drop in Subscale B scores. But again the difference between T1 and T2 Subscale B scores reached significance in the *IM-interview*/*PM-diary* condition, but not the *IM-keywords/diary* or the *IM-interview/diary* conditions.

3.4.1 Implications

The number and frequency of IMs reported at screening would seem to align with that found in other retrospective studies, even with some clinical populations (Reynolds & Brewin, 1999). The diary data, however, suggests more frequent reports of approximately once per day. Given the acknowledged limitations of retrospective reports, this high frequency of IMs as reported in the diary suggests that previous estimates may have been low (Kvavilashvili et al., in preparation). However, a recent direct comparison of retrospective and diary reports (collected 3 times per day over one week) of PTSD symptoms suggests that retrospective reports tend to align with the highest levels of symptom severity as reported in the diary (Schuler et al., 2019). Although the diary method is not perfect, and carries with it both problems of compliance and meta-awareness (e.g. participants failing to note that they have experienced an IM and therefore failing to record it; Green, Strange, Lindsay, & Takarangi, 2016), it still may be able to reflect more accurately true frequency of IMs in everyday life than retrospective self-reports and questionnaires, especially if participants are also encouraged to simply acknowledge the occurrence of IM in those cases when immediate recording is not possible (i.e., tick entries).

Given the population accessed and lack of clinical cut-off, it could reasonably be asked to what degree these memories map on to those experienced by people with clinical

levels of depression and PTSD. Some measures in the present study suggest that, based on mean ratings, they might be a different phenomenon, particularly the data on vividness – which did not differ from that reported in the control group for PMs. It may therefore be appropriate to plot these memories on a continuum as suggested by Kvavilashvili (2014), with the memories reported in a non-clinical population perhaps lying somewhere between IAMs and IMs in PTSD in terms of their associated characteristics.

The conditions of retrieval for IMs would seem to square largely with the conditions reported for research on IAMs and other types of involuntary cognition such as involuntary semantic memories and mind-wandering, which is a replication of previous findings in this area (Kvavilashvili et al., in preparation). Results from previous studies show that such thoughts are much more likely to pop to mind when we are in a state of diffuse attention (Kvavilashvili & Mandler, 2004). Furthermore, for IAM research in particular, reported triggers are more often environmental than internal, and most are identifiable (i.e. participants do not report that many instances of 'no trigger'; Berntsen, 1996; Schlagman et al., 2007). On the basis of this finding, with regard to cuing, these results would suggest that IMs function in manner broadly similar to IAMs.

Finally, findings concerning therapeutic effects of diary keeping were unanticipated, given that a PM diary was adopted as a control condition for the recording of IMs. However, there is some evidence to suggest that training in goal setting and fulfilment has some therapeutic benefit (Sergeant & Mongrain, 2014). The 4-point drop in the mean BDI score in the *IM-interview/PM-diary* seems to be primary driver of the overall drop in scores from Time 1 to Time 2 (see Table 3-7). By contrast, the *IM-interview/diary* condition showed some numerical improvement, while the *IM-keyword/diary* condition showed none. It is possible that the act of recording small goals in the diary in the form of PMs has some therapeutic benefit, particularly if these small goals are achieved. This may have constituted

sufficient lift in mood (and/or occupied sufficient cognitive resources) to interrupt the negative appraisals that are part of IM maintenance (Ehlers & Clark, 2000; Ehlers et al., 2004), in turn resulting in the significantly improved scores on the PCL-C. To that end, it would be interesting for future research, would be an indication from participants of whether they completed on their intentions that they recorded in the diary.

Another possible explanation is that there was some particular benefit derived from disclosing the IM in the lab – writing about it and rating it on a number of scales – and then moving onto something more adaptive in focus, such as the PM diary. In this respect, it seems possible that the length of the IM diary keeping was too long in duration, either adding no benefit to that derived from the laboratory-based interview, or perhaps even eroding some therapeutic gains made during the initial period of diary keeping. The effect of this extended period of diary keeping would seem to be particularly apparent in the *IM-keyword/diary* condition where participants did not have the opportunity to disclose their IM in the lab, but then kept the same IM diary for two weeks. This group showed no statistical or numeric improvement in their STAI, BDI or PCL-C scores.

The above may be one way of accounting for the divergence between the results regarding therapeutic benefit in this study as compared to a one-week study that tested this effect. Kvavilashvili et al. (in preparation) found that one week of IM diary keeping resulted in marked (and statistically significant) drops in depression and anxiety scores in both full entry and tick entry conditions. This was unanticipated, as the tick entry (e.g., simply placing a tick in a grid each time one of the nominated IMs came to mind, instead of completing a full entry) was chosen as a control. This interesting finding led to the suggestion that some interaction with the memory content (even if it was minimal in case of ticked entries), might result in therapeutic benefits, and that one week of improvement would only be increased as a result of two weeks. There could therefore be several reasons that this did not replicate in the

case of a two-week diary. Perhaps structured, but time limited interaction (for one week) with the memory yields benefit, but there is something about more prolonged interaction of two weeks with the content that counteracts this.

The results obtained from participants' subjective assessment of the benefits of diary keeping suggests that there is something important about disclosing the contents of the IM in person. This is most clearly reflected in the responses from participants in the *IM-keywords/diary* condition, more than half of whom (53%) reported that the diary keeping made them feel worse overall, with relatively few (16%) reporting that it improved their mood. In contrast, in the *IM-interview/diary* condition just under half (46%) of participants reported that the diary keeping improved their mood overall, with 18% reporting that it had made them feel worse. And whilst disclosure may be important, it is interesting that 73% of participants in the *IM-Interview/PM-Diary* condition reported that the diary keeping had no effect on their mood. The condition which subjectively reported the best outcomes engaged in both an IM interview and IM diary keeping, suggesting some element of an additive effect, despite this not being predicted (Boals et al., 2011; Rubin et al., 2010).

In addition, it is difficult to account for the apparent divergence between subjective assessment of the therapeutic benefit of diary keeping, and the results obtained from the STAI, BDI, and PCL-C. Participants in the *IM-Interview/PM-Diary* condition showed the greatest improvement, even if not on all scales, yet were the group who most often reported that the diary keeping had no effect. Conversely, participants in the *IM-interview/diary* condition subjectively reported overall improvement in mood and yet this was not reflected in their scores on the scales administered. Only the *IM-keyword/diary* showed some congruence between scores on the STAI, BDI, and PCL-C and their subjective assessment of the impact of diary keeping on their mood.

3.4.2 Limitations

In Study 2, there was a relatively high drop-out rate as well as exclusion rate. The majority of drop-outs came from people who were not psychology students and were therefore not receiving credit for their participation. There was no reward or reimbursement for participants outside of the psychology department and contemplation of this at the time of original ethics application might have gone some way toward retaining these participants for the duration of the study. That said, a handful of participants did report finding the recoding highly unpleasant, and therefore declined to continue.

Exclusions, as mentioned in the method section, resulted from self-selecting participants later being determined to be unsuitable for the study. The experimental procedure was such that it was only possible to scrutinize IM reports and questionnaire scores after participants had left the first session. The aim was to recruit people who experienced at least one such memory per day, but it was noted from the screening data at the beginning of the results section that this was not consistently achieved. Cut-off criteria in terms of participant inclusion were not rigidly employed but used with a certain amount of discretion, such that a few participants were included that had not experienced their memory in the past week, but reported content, distress and vividness that suggested a genuine IM. In addition, only participants for whom the event on which the memory was based was more than one month old were included in the study. Some of the difficult concerns about screening, however, could be avoided through use of an online screening process, using similar measures, which would then inform decision about who to invite to the laboratory.

3.4.3 Conclusion

The present study offers important methodological insight into how best to study IMs. Additional burdening of clinical populations can be avoided, whilst not having to resort to analogue studies alone. Recruiting non-clinical participants to a diary study of IMs offers

insight into the frequency and phenomenology of this type of memory, as well as what therapeutic benefit might be derived from diary keeping. This method has also provided important information on triggers, about which there are nonetheless some outstanding questions, particularly with regard to the reactivity of these memories, and their susceptibility to cuing from the type of abstract/verbal trigger, which is most often reported in the case of IAMs. These questions guide the subsequent lab studies into naturally occurring IMs, the results of which will be presented in Chapter 4.

Chapter 4: The Role of Cues in Eliciting Naturally Occurring IMs in a Non-Clinical Population: A Laboratory Study (Studies 3a and 3b)

4.1 Introduction

As demonstrated in Chapter 3, diaries have been instrumental to the study of IAMs, and as a methodology have much to contribute to our understanding of IMs. There are, however, limitations to this method, mainly that it does not enable researchers to systematically manipulate variables (Vannucci, Batool, et al., 2014). This limitation is best addressed through the use of controlled laboratory methods. Such methods have been developed for the study of spontaneous off-task thoughts in general, including IAMs, and studies employing them have replicated and extended key findings from diary research (e.g., Kvavilashvili & Schlagman, 2011; Plimpton et al., 2015; Schlagman & Kvavilashvili, 2008). In particular, they have facilitated deeper exploration of the type of cues that tend to trigger IAMs (Mazzoni et al., 2014; Vannucci, Pelagatti, & Marchetti, 2017), and the impact of cognitive load on the frequency of memories reported (Vannucci, Pelagatti, et al., 2014).

4.1.1 Studying IAMs Under Controlled Laboratory Conditions

The laboratory method of studying IAMs more commonly used at present was originally developed by Schlagman and Kvavilashvili (2008). Their ongoing vigilance task required that participants detected rare target slides, with vertical line patterns, among hundreds of slides with non-target horizontal line patterns. In addition, each slide contained a brief word phrase in the middle of the slide (e.g., “window shutters,” “devoted friend,” “sun burn”), which participants were asked to ignore (with a cover story that participants in another condition were being asked to monitor the words and ignore the line patterns). It was expected that exposing participants to incidental verbal cues while they were engaged in an undemanding and boring task would mimic the conditions in which IAMs were reported to occur in diary studies (i.e., during undemanding habitual activities and in response to incidental cues in the environment) (Berntsen, 1996; Mace, 2004). As in the diary studies, participants were given a comprehensive definition of IAMs, and asked to monitor their

thoughts during the vigilance task. If at any time an IAM popped into their mind, they were instructed to press the space bar, thereby stopping the presentation sequence, and to record their thoughts in that moment. What set this apart from previous methods for investigating off-task thoughts or mind-wandering was the incorporation of incidental verbal cues in the ongoing task, which was found to reliably trigger IAMs (Schlagman & Kvavilashvili, 2008).

The method has since been adapted in a number of ways, in order to further explore the role of demand characteristics. Vannucci, Batool, Pelagatti, and Mazzoni, (2014) used a two-by-two design to manipulate the instructions that participants received and the method of thought capture during the vigilance task. Participants who were instructed to monitor only their IAMs reported significantly more IAMs than participants who were instructed to monitor the occurrence of any off-task thoughts during the vigilance task. In addition, participants who were stopped by the experimenter and asked to record their thoughts reported more IAMs than participants who stopped themselves. These findings were replicated and extended by Barzykowski and Niedźwieńska (2016) who similarly found that participants who were instructed to report only IAMs (rather than monitor for any task-unrelated thoughts during the vigilance task) reported their IAMs as more vivid, clearer and accompanied by more physical sensation.

Additional adaptations of the method have been designed to test the frequency and nature of cues - and cognitive load - in the elicitation of IAMs. For example, it has been found that verbal cues are much more effective than pictorial cues in triggering IAMs (Mazzoni et al., 2014). Among the possible explanations for this are a mismatch between the details of a given pictorial cue and the individual's own memory representation. It also aligns with the results of Mace's (2004) diary study, which found that abstract and verbal cues were more effective at eliciting IAMs than more concrete sensory or perceptual cues.

Clinically relevant applications of the method have included a study of IAMs in dysphoric mood. Kvavilashvili and Schlagman (2011) asked 25 stable dysphoric (score of 16 or above on the BDI) and 28 non-dysphoric (score of 6 or below on the BDI) participants to complete the same vigilance task, and stop to report any instances of IAMs that came to mind. They found that dysphoric and non-dysphoric participants reported equal frequencies of IAMs, but the dysphoric group reported more memories triggered by internal thoughts, and fewer by cue phrases. Whilst dysphoric participants did not report more objectively negative memories (i.e., memories of negative events such as accidents or failures), they rated their memories as more negative than non-dysphoric participants. Memories rated as negative also had a bigger impact on the mood scores of dysphoric participants.

This vigilance task has also been applied to the study of analogue intrusions. In order to examine the impact of single versus multiple verbal cues on IMs, Oulton and Takarangi (2018) asked participants to view a series of distressing static images and then complete a version of the above-described vigilance task. During the vigilance task, participants in one group were exposed to single cue words which were based on the images seen previously (e.g. knife; crying, etc.); a second group was exposed to triplet cue phrases (e.g. skull-sick-hunger); and a control group was not exposed to any cue phrases. The authors expected that single written cues would prove more effective than the triplet cues at triggering analogue IMs (and that the inverse would be true for involuntary elaborative cognitions). This prediction was based on the premise that "distinct cues isolate relevant nodes in the associative network, but not irrelevant nodes that disrupt retrieval" (Oulton & Takarangi, 2018, p. 271). Results, however, showed that the single and triplet cue conditions did not differ in the mean frequencies of analogue IMs reported. Both conditions, however, resulted in more analogue IM reports than the no-cue (control) condition.

Whilst the vigilance task developed by Schlagman and Kvavilashvili (2008) has been used extensively to investigate IAMs, and on at least one occasion to investigate analogue IMs, there appear to be not instances of it having been used to study naturally-occurring IMs. Given how successful the vigilance task has been in replicating and extending the findings on IAMs, obtained originally from diary studies, there is a compelling case for similarly developing a vigilance task to examine naturally-occurring IMs under controlled laboratory conditions. This will facilitate a more in-depth understanding of the role of cues in triggering IMs, and, in contrast to the analogue method, will involve the recruitment of participants who already experience such memories, rather than inducing intrusions in the laboratory.

4.1.2 The role and nature of triggers in IMs

As discussed in the introduction, prevailing theories of IAMs posit that they are brought to conscious awareness through a process of spreading activation in the network, instigated by a cue (more often external), which sufficiently overlaps with the memory content (Berntsen, 2009; Conway, 2005). Some argue that IMs are triggered by a similar process, but that access to them is enhanced by a number of factors, among them the high level of emotion associated with the event on which the memory is based (Berntsen & Rubin, 2008). There is however an alternative view, based more on theory developed in clinical settings, which argues that IMs represent a disruption to the standard functioning of the autobiographical memory system. This disruption results in a separation of memory traces for perceptual features of the event from the narrative context in which they would normally be situated (Brewin, 2014; Brewin, Dalgleish, & Joseph, 1996; Brewin, Gregory, Lipton, & Burgess, 2010; Ehlers & Clark, 2000). The latter view would suggest that IMs are particularly susceptible to sensory perceptual triggers, to match the primary content of the repetitive, unwanted memory.

However, when taking a broader view of available evidence, the picture is less clear. Some studies have shown that exposure to images that relate to one's own traumatic experience can bring to mind memories of that experience (Michael, Ehlers, Halligan, & Clark, 2005), and a similar relationship was found with analogue IMs (Krans, Pearson, Maier, & Moulds, 2016). A naturalistic diary study of IMs in participants with and without PTSD found that slightly less than half of reported triggers were more sensory-perceptual in nature (including a similar situation or stimulus, or the actual trauma scene itself; Kleim, Graham, Bryant, & Ehlers, 2013). In contrast, a retrospective questionnaire study of IMs in participants with PTSD and depression (with and without trauma) found that all participants identified a large proportion of IMs (as much as 70%) as being triggered internally by their own thoughts (Birrer et al., 2007).

Therefore the balance of evidence to date suggests that divergent results about the cues for IMs may be in part an artefact of the method used. This reinforces the case for studying naturally-occurring IMs under controlled laboratory conditions, to examine the role of cues in eliciting IMs, particularly the role of written, verbal cues and the degree of their relatedness to the memory content.

4.1.3 Aims and Predictions

This chapter will present the results of two laboratory studies (3a and 3b). The aim of both studies was to test the hypothesis that verbal cues can elicit naturally-occurring IMs under controlled conditions, as they have been shown to do with analogue IMs (Oulton & Takarangi, 2018). An additional aim was to test whether the degree of relevance of the verbal cues to the memory content determines whether they successfully result in retrieval. Participants in both studies were selected from the wider group of participants originally recruited to complete an online questionnaire, which asked that they provided a written description of their most frequent IM, and rated it on a number of scales. Participants whose

reported IMs were judged to be genuinely recurrent and distressing were invited to a further lab session, under the pretext of testing their concentration, during which they completed a 600-trial vigilance task based on that developed by Schlagman and Kvavilashvili (2008). In addition, there were 8 stop trials – points at which participants were stopped during the vigilance task and asked to report their thoughts in that moment (Plimpton et al., 2015).

To accomplish the above aims, Study 3a manipulated the presence or absence of verbal cues between participants (experimental versus control condition), and the presence or absence of IM-related cues before the 8 stop probes (in the experimental condition only). In the experimental condition a cue phrase was presented on each of the 600 slides (as in Schlagman & Kvavilashvili, 2008), but on four occasions a personalized cue phrase – based on the content of the IM reported at screening – was inserted into the presentation immediately before the stop trial. For example, if a participant reported an IM about an automobile accident, the cue phrases might be "shattered windscreen," "screeching tires," "oncoming traffic" and "ambulance siren." The remaining four stop probe trials were preceded by incidental cues that were not directly relevant to the reported IM. In the control condition, instead of cue phrases, each slide featured a mathematical formula (e.g. "4 x 5 = 20" or "8 – 5 = 3"). To further explore the role of meaningful verbal cues in triggering IMs, Study 3b manipulated the presence or absence of such cues within and between subjects, by inserting four personalized cue phrases before stop probes in the experimental condition, but exposing participants in the control condition only to cue phrases that were unrelated to their IM nominated at initial screening phase.

Using this method, in Study 3a it was predicted that it would be possible to elicit people's naturally-occurring IMs under controlled laboratory conditions. Based on IAM research, it was expected that participants in the experimental condition (with verbal cues) would report more IMs than participants in the control condition (with maths cues). It was

also predicted that the greater overlap between cue and memory content would result in personalized cue phrases being reported more often as triggers than incidental cue phrases.

A final aim of the study was to see if completing the vigilance task – and writing about IMs in the lab – would improve participants' mood. There was some reason to believe that this might occur based on the results of previously cited research on expressive writing and autobiographical memory questionnaire completion (Boals et al., 2011; James W Pennebaker, 1997; Rubin et al., 2010). Keeping a 2-week diary of IMs (Chapter 3, Study 2) produced no consistent therapeutic effect, though one possible explanation for this is that the length of time was too long. Because of these contradictory results, however, no strong predictions were made that completion of the vigilance task would yield therapeutic benefits (as measured by the BDI, STAI or a Likert scale for rating mood).

4.2 Method - Study 3a

4.2.1 Design

A between-subjects design was used, whereby participants were randomly allocated to either experimental or control conditions. The primary independent variable was whether participants were exposed to verbal cue phrases (experimental condition) or mathematical formulas (control condition) during the vigilance task. The primary dependent variables were the number of IMs reported during the vigilance task, as well as scores on the second administration of the STAI-State and the BDI. Within the experimental condition, there was also an additional within-subjects independent variable of personalized versus non-personalized cue phrases.

4.2.2 Participants

A total of 381 people fully or partially completed an online screening questionnaire regarding their IM (see Chapter 2). On the basis of their responses, 41 participants were

selected for invitation to the laboratory session, and were included in the final sample (22 experimental, 19 control). Of these, 35 were female (85.4%) and 6 were male (14.6%) with no gender differences as a function of experimental condition $\chi^2(1, N = 41) = 1.17$, $p = .208$. The mean age was 21.83 (SD=6.0). There were similarly no group differences in age or baseline BDI and STAI scores (see Table 4-1). Psychology students were granted 1.3 credit hours for their participation.

Table 4-1: *Mean (SD) for age, baseline BDI, STAI and the results of a one-way ANOVA.*

	Experimental	Control	*F*	*df*	*p*
Age	21.23 (6.43)	22.53 (5.56)	.471	1,39	.497
BDI	11.86 (9.22)	16.94 (9.10)	3.04	1,38[a]	.089
STAI-State	41.59 (9.18)	43.78 (12.58)	.403	1,38[a]	.529

[a] A computer error resulted in baseline scores not being collected from one participant.

4.2.3 Materials

Online Screening Questionnaire (see Chapter 2, Appendix I): this questionnaire, completed via the online platform Qualtrics, asked participants to describe briefly the content of their current IM, and rate the memory on a number of characteristics.

Vigilance Task: the vigilance task was adapted from that used by Plimpton et al., (2015) from a task that was originally developed by Schlagman & Kvavilashvili (2008). Six hundred slides were presented in the middle of a computer screen (for 1500 ms each) using the software SuperLab (see Appendix VII). Participants were asked to detect infrequent slides with patterns of vertical lines (n=11) among frequent slides with patterns of horizontal lines (n=589). They were instructed to press the spacebar when they detected a target slide, and their response time was recorded by the computer programme. In the experimental condition, cue phrases appeared in the centre of each slide (e.g. “clear blue sky”, “forgotten appointment”, “tumble dryer”), which were selected from a bank of 1200 phrases previously

coded (independently) for their emotional valence (Schlagman & Kvavilashvili, 2008; see Appendix VIII). In the control condition, these were replaced with simple mathematical calculations (e.g. "16 + 1 = 17", "9 x 11 = 99", "17 – 4 = 13").

In the experimental condition, an equal number of negative, neutral and positive cues were distributed throughout the presentation. At four points in the presentation, however, the stock phrases were removed and replaced with cue phrases that were relevant to the IM reported by the participant. For example, in response to an IM about a friend's suicide the cue phrases "personal loss", "feeling responsible", "tragic event" and "lasting grief" were inserted within the standard sequence of cue phrases.[11] At eight points during the vigilance task, the presentation stopped, and a slide appeared instructing participants to "Please record your thoughts and concentration now." On four occasions, these stop trials with a thought probe came immediately after participants were presented with one of their personalized cues that appeared on a preceding trial for 1500 ms (stop probes 3, 5, 6 and 8). On the four remaining occasions, the stop trials were following the presentation of a non-personalized cue (stop probes 1, 2, 4, and 7). The timing of stops was mirrored in the control (mathematical formula) condition with the exception that stop probes were preceded by trials with non-verbal information (e.g., maths calculations). They were also given a brief questionnaire to record their thoughts and concentration (see below).

Thought Probe Questionnaire (see Appendix X): this was a four-item questionnaire that participants were asked to complete each time they were stopped during the presentation, and a further five questions to be answered after the vigilance test was over. The **first question** asked simply that they recorded their thoughts in the moment they were stopped, and they were given space in order to describe the thoughts in their own words. In the **second**

[11] The IM descriptions provided by participants at screening were read by members of the research team. Keywords that closely reflected the content of the reported IM (including perceptual features and associated emotions) were independently nominated, and four of these were agreed upon through discussion.

question, participants were asked to tick a box to indicate whether they believed their thought was spontaneous (i.e., just popped into mind) or deliberate. If they believed their thought to be spontaneous, they were asked to tick a box to indicate if it was triggered by something in the environment, in their own thoughts or that there was no trigger. If they could identify a trigger, they were asked to describe this in their own words. In **question 3**, participants were asked to rate their concentration level on a 5-point scale (*1=not concentrating at all, 5=fully* concentrating) at the moment when the thought came to mind. The **fourth question** asked that participants rated the vividness of their thought on a 7-point scale (*1=very vague, almost no image at all, 7=very vivid, almost like normal vision).*

The second page of each questionnaire was completed after the vigilance task ended. In **question 5,** participants were asked to indicate whether their thought was a past memory, future event, or related to a current/ongoing situation. If the thought was about the past or future, they were asked in **question 6** to indicate how long ago the event on which the memory was based occurred, or how far into the future they were projecting. In **question 7**, participants were asked to indicate the frequency with which they had had this thought in the past (*1=never, 2=once or twice, 3=a few times, 4=several times, 5=many times).* In **question 8**, they were asked to rate the pleasantness of their thought on a on a 5-point scale (*1=very unpleasant, 3=neutral, 5=very pleasant*). Finally, in **question 9**, participants were asked to tick a box to indicate how specific they believed their thought to be (e.g. "one off event/thing", "general thought about a repetitive event", "general thought about an extended event").

Beck Depression Inventory (BDI; Beck, et al., 1961): See Study 2 (Chapter 3; Appendix V).

Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al., 1970): See Study 2 (Chapter 3; Appendix IV).

Mood Scale: In order to provide another baseline and follow-up measure of mood, participants were asked to complete a simple 9-point Likert scale immediately before and after they completed the vigilance task. Participants were simply asked to circle the number on the scale that best reflected their current mood (*1=extremely negative, 5=neutral, 9=extremely positive).*

4.2.4 Procedure

As described in the method section of Chapter 2, participants were provided a description of IMs and were invited to take part in a study examining the impact of IMs on mood and concentration in daily life, if they currently experienced such memories (an indicative frequency of one IM a day was suggested). Although the aim was to recruit people who reported experiencing their nominated IM at least once a day, the research team also carefully examined the content (i.e., the description of IM provided by the participant) and additional ratings (i.e. duration, distress and avoidance) of nominated IM in reaching a decision about whom to invite to the laboratory session. At the point of invitation, participants were randomly allocated to experimental or control conditions (so that the individually tailored cues could be inserted into the presentation for the former condition).

Participants were given a more comprehensive information sheet upon arrival in the lab and asked to consent to their participation in the remainder of the study. They were then asked to complete online versions of the Beck Depression Inventory (BDI) and the State portion of the State-Trait Anxiety Inventory (STAI) before receiving detailed instructions about the vigilance task and completing a practice trial consisting of 40 slides (with three targets, but no thought probes).

After completed the practice trial, participants were given the following verbal instructions:

> As you can see, this experiment is about people's attention and their concentration during fairly lengthy monotonous tasks. You might be familiar with the situation in

> which your thoughts wander off during an easy monotonous task (for example, driving). However, at critical points, such as when approaching roundabouts, you will need to pay attention to what you are doing again. Our study is interested in these fluctuations in concentration and thoughts during such monotonous tasks. In addition, we are also interested in the effects of verbal and non-verbal information on your concentration levels throughout the task. Hence, some participants will be detecting lines on the screen and other participants need to detect words/mathematical formulas. You have been allocated to the group that detects lines. Therefore, you can just ignore the words/mathematical formulas and concentrate on the lines.
>
> The main vigilance task is similar to the practice one but longer. In addition, the presentation will occasionally stop, and you will be prompted to record your concentration level and thoughts at the moment you were stopped.
>
> As you can see, although this task is quite simple, it can be difficult to maintain concentration. As with the driving example, your thoughts may drift to matters unrelated to the task. These thoughts can be about anything: the past, present or the future. They may be thoughts that pop into your mind spontaneously, or they may be something you have deliberately chosen to think about. It doesn't matter if your concentration and thoughts fluctuate in this way throughout the presentation, but please ensure that you write down the content of your thoughts at the exact moment you are stopped. Each time you are stopped by the presentation, you will be provided with a questionnaire to record your thoughts and assess your level of concentration.

Just before beginning the vigilance task, participants were asked to rate their mood in that moment on the 9-point scale. During the vigilance task, participants were exposed to a total of 11 target slides in both the experimental and control conditions. In addition, the presentation stopped 8 times and they were asked to complete thought probe questionnaires. In the experimental condition, on four of those occasions the stop probe came immediately after the participant was exposed to a personalized cue that had been developed based on the IM they reported in the screening questionnaire (stop probes 3, 5, 6 and 8). On the remaining four occasions (stop probes 1, 2, 4 and 7) the cue immediately preceding the stop probe was incidental (i.e., drawn from the pre-existing bank of cue phrases and not tailored to the content of the reported IM). In the control condition, the mathematical calculations that appeared instead of the cue phrases were presented in a fixed sequence, with no variation from participant to participant. When the presentation stopped, participants were immediately given the first side of the thought probe questionnaire, and asked to record the

contents of their mind as quickly as possible. On the first stop probe trial, they were guided through the remaining questions about the trigger for the thought, the concentration rating at the time it came to mind, and how vivid the thought was. Once this was completed, they were asked to return the questionnaire to the experimenter, who numbered them in the top right-hand corner to maintain the order in which they were completed.

Once the vigilance task was completed, participants were asked to complete the second side of the thought probe questionnaire (regarding the temporal location, repetitiveness, pleasantness and specificity of the thought). The researcher handed each questionnaire to participants one-by-one, so that they could refer to their reported thought before completing the second side. Once the second side of all the questionnaires had been completed, participants were asked to rate their mood again on the 9-point scale. Finally, they were asked if at any point, during the presentation, they experienced an IM, other than during one of the stop trials. If they indicated yes, they were also asked how many times this occurred, what the trigger was, and if the IM was identical to the one reported on the screening questionnaire or different. The researcher recorded this information on a piece of A4 paper designated for this purpose.

Before leaving the lab, participants were partially debriefed that one of the purposes of the study was to see if their IM came to mind during the vigilance task, and if so, whether it was more likely to be triggered by a personalized or irrelevant cue. Participants were then advised that they would receive an email in three days with a link to a final set of questionnaires (BDI and STAI – State). Once these were completed, they received a full and final debrief.

4.3 Results - Study 3a

All participants completed the online screening questionnaire and the laboratory-based vigilance task. The IMs reported at screening were coded according to content, and the

mean ratings for associated measures of frequency, duration, distress and vividness were analysed for group differences. The experimental and control groups were compared for the frequency of thought-type reported (e.g. task related versus unrelated, spontaneous versus deliberate) as well as the frequency of IMs reported. The role of personalised versus non-personalised cues in triggering IMs was analysed within subjects in the experimental condition, comparing the frequency of IMs reported for stop probes 3,5,6,8 (personalised cues) with IMs reported for stop probes 1,2,4,7 (non-personalised cues). In cases where Mauchley's Test was found to violate the assumption of sphericity, degrees of freedom were corrected using Greenhouse-Geisser (ε <.75) or Huyhn Feldt (ε >.75) estimates of sphericity (Field, 2013). Finally, BDI and STAI scores were analyzed for group differences as well as to assess possible therapeutic benefits of reporting IMs during the vigilance task. Unless otherwise indicated, the alpha level adopted for determining significant results was 0.05.

4.3.1 Content and phenomenology of IMs Reported at screening

The content of IMs reported by participants in the initial online questionnaire varied considerably. This content was coded according to the scheme developed by Reynolds and Brewin (1999), into the categories of 'death/illness of another person,' 'illness/injury to oneself,' 'assault or abuse to oneself,' 'interpersonal problems' and 'other.' Examples of the types of memories that fell into the 'other' category were a criminal conviction, failing first-year university exams, and a near automobile accident. The results of the coding are presented in Table 4-2. Because of the small number of IMs that fell into the category "assault or abuse to oneself" (none in experimental condition, and one in the control) these were combined with IMs that fell into the category "illness/injury to oneself." Whilst there are some notable differences in the distribution of reported IMs between the two groups – namely the frequency of 'interpersonal problem' reports - these were not statistically significant $\chi^2(3, N = 41) = 1.86$, $p = .60$.

Table 4-2: *Percentages (frequency) of IMs as a function of experimental condition and content category.*

Condition	*Death/illness of another person*	*Illness/injury or assault/abuse to oneself*	*Interpersonal problems*	*Other*	*Total*
Experimental	27% (6)	19% (4)	27% (6)	27% (6)	100% (22)
Control	21% (4)	5% (2)	48% (9)	21% (4)	100% (19)
Total	24% (10)	15% (6)	37% (15)	24% (10)	100% (41)

The IMs reported at screening were also rated by participants on a number of scales, the means for which are presented in Table 4-3. The frequency of the memories was on average, '3-4 times per week'. In addition, the ratings given for distress, vividness and avoidance were high (well above mid-point on the scale). There were no group differences between the experimental and control conditions for the mean ratings given on any of the associated measures. In addition, 73% of participants in the experimental condition reported their IM to be accompanied by bodily sensations, whilst this was the case for 63% of participants in the control condition. There were no group differences $\chi^2(1, N = 41) = 0.43$, $p = 0.51$. Similarly, 32% of participants in the experimental condition reported their IM to be like "reliving the event as occurring here and now" rather than "looking back at the past," whilst this was the case for 26% of participants in the control condition. Again there were no group differences $\chi^2(1, N = 41) = 0.15$, $p = 0.70$.

Table 4-3: *Mean (standard deviation) ratings for experimental and control conditions, and results of one-way ANOVA.*

Characteristics	Condition		Variable Description	*p*
	Experimental	Control		
Frequency [a]	2.54 (1.30)	3.05 (1.35)	3-4 times per week	0.23
Vividness [b]	5.64 (1.18)	5.33 (1.33)	Highly vivid (1-7 scale)	0.45
Distress [b]	5.64 (1.43)	4.95 (1.51)	Highly distressing (1-7 scale)	0.14
Disruption [b]	3.36 (1.43)	3.74 (2.08)	Moderate disruption (1-7 scale)	0.50
Avoid thinking [b]	5.05 (1.89)	5.26 (1.88)	High avoidance (1-7 scale)	0.71
Avoid reminders [b]	4.73 (2.10)	4.84 (2.17)	High avoidance (1-7 scale)	0.86
Duration [c]	1.82 (0.59)	1.84 (0.60)	minutes	0.89
Age of memory [d]	5.82 (1.09)	5.32 (1.76)	less than one year	0.27

[a] Frequency ratings were made on a 7-point scale: 1=*none*, 2=*once or twice a week*, 3=*three or four times a week*, 4=*once a day*, 5=*two to three times a day*, 6=*three to five times a day*, 7=*more than five times a day*

[b] Ratings were made on a 7-point scale: 1=*not at all*, 7=*extremely*

[c] Duration ratings were scored on a 5-point scale: 1=*seconds*, 2=*minutes*, 3=*up to an hour*, 4=*several hours*, 5=*constantly*.

[d] Timeframe ratings for the memory were made on an 8-point scale: 1=*twenty-four hours*, 2=*one week*, 3=*one month*, 4=*within six months*, 5=*less than one year*, 6=*between one and five years*, 7=*between five and ten years*, 8=*more than 11 years.*

4.3.2 Vigilance Task Performance

During the vigilance task, participants were exposed to 11 targets slides (featuring vertical lines). The mean number of successfully detected targets by pressing the space bar was 9.75 (*SD*=1.04) for the experimental condition and 9.11 (*SD*=2.52) for the control condition, whereas the corresponding mean response times were 776 milliseconds (*SD*=71.64) and 801 milliseconds (*SD*=238.32), respectively. However, due to a software error, responses were only collected for 8 participants in the experimental condition and 9 in the control condition. The results of two, one-way ANOVAs on the number of successful targets and the mean response times show no group differences (both $F<1$).

4.3.3 Types of Thoughts Reported

Each of the 41 participants were stopped 8 times during the course of the vigilance task, resulting in a total of 328 thought probes. On 15 of these occasions, participants reported that their mind was blank, leaving 313 probes. Participants were asked to rate each reported thought as either deliberate (i.e. something they had chosen to think about) or spontaneous (i.e. something that had just popped into their mind; see Plimpton et al., 2015). A total of 88 thoughts (28%) were coded as deliberate and 225 (72%) were coded as spontaneous thoughts. Two researchers also coded all of the 313 thoughts as either task-related (e.g. referencing some aspect of the vigilance task, including participants' assessment of their performance) or task-unrelated (Plimpton et al., 2015; Stawarczyk, Majerus, Maj, Van der Linden, & D'Argembeau, 2011). For example, if participants reported waiting for the vertical lines to come up or thinking that the task was boring these thoughts were classed as task-related, and if they were thinking about matters not relevant to the vigilance task (e.g., their upcoming exam or winning a prize in a high school), thoughts were classed as task-unrelated. Inter-rater reliability was very good (Cohen's Kappa=.82). Of 313 valid thought probes, only 40 (13%) were classed as task-related, and 273 (87%) were classed as task-unrelated.

Spontaneous, task-unrelated thoughts were the unit of interest for analysis. Therefore, the 19 thoughts (6%) that were coded as both deliberate and task-related were removed from further analysis. An additional 21 thoughts (7%) were coded as spontaneous and task-related and were also removed. Finally, an additional 69 thoughts (22%) that were coded as deliberate and task-unrelated were removed. This yielded a total of 204 spontaneous, task-unrelated thoughts (65% of all valid thought probes). Of these, 30 thoughts referred to IMs nominated by participants at screening (see section 4.3.7 below).

The reported frequencies of different types of thought by experimental condition are presented in Table 4-4. These frequencies suggest that the different types of incidental stimuli encountered by participants on each trial (verbal vs. numeric information) had a substantial impact on the type of thought that participants were reporting. Group differences in the reported frequency of deliberate vs. spontaneous thoughts and task-related vs. task-unrelated thoughts suggest that the control group was able to more successfully concentrate on the task than the experimental group. Although the total numbers of deliberate, task-related thoughts were fairly low, control group participants had a significantly higher number of such thoughts than experimental group participants. By contrast, participants in the experimental group reported a significantly higher number of spontaneous, task-unrelated thoughts.

Table 4-4: *Mean (SD) frequencies of each category of thought (including IMs) as a function of experimental condition, and the results of a 1-way ANOVAs comparing group differences.*

	Condition		
	Experimental	Control	*p*
Deliberate	1.55 (1.54)	2.84 (2.01)	.024
Spontaneous	6.14 (1.46)	4.74 (2.05)	.015
Task-related	0.41 (0.59)	1.63 (1.77)	.004
Task-unrelated	7.27 (0.94)	5.95 (1.84)	.005
Deliberate, Task-related	0.09 (0.29)	0.89 (1.24)	.005
Spontaneous, Task-unrelated	5.83 (1.44)	4.00 (2.06)	.002

4.3.4 Characteristics of spontaneous, task-unrelated thoughts and their triggers

The mean ratings of on-task concentration and thought characteristics for spontaneous, task-unrelated thoughts (excluding the 30 IMs) are presented in Table 4-5.

Results of one-way ANOVAs on these ratings showed no significant differences between experimental and control conditions.

Table 4-5: *Mean (SD) ratings for each variable (excluding IMs) as a function of group, and the results of a one-way ANOVA.*

	Condition		
	Experimental (*n*=22)	Control (*n*=19)	*p*
Concentration [a]	3.27 (0.97)	3.12 (1.10)	0.63
Vividness [b]	4.61 (0.99)	4.64 (0.96)	0.89
Rehearsal [c]	3.06 (0.65)	2.83 (0.69)	0.28
Pleasantness [d]	2.99 (0.58)	2.94 (0.66)	0.81

[a] Concentration ratings were made on a 5-point scale: 1=*not at all*, 5=*fully concentrating.*

[b] Vividness ratings were made on a 7-point scale: 1=*very vague, almost no image at all*, 7=*very vivid, almost like normal vision*

[c] Rehearsal ratings were made on a 5-point scale: 1=*never*, 2=*once or twice*, 3=*a few times*, 4=*several times*, 5=many times

[d] Pleasantness ratings were made on a 5-point scale: 1=*very unpleasant*, 3=*neutral*, 5=*very pleasant.*

By contrast, there were marked differences between the conditions in terms of number of different types of triggers (environmental trigger, own thoughts, no trigger) reported by participants for spontaneous task-unrelated thoughts (excluding IMs). While participants in the experimental condition (verbal cues) reported a very high proportion of environmental triggers for their thoughts, participants in the control condition (mathematical formulas) reported a high proportion of 'own thoughts' as triggers (see Table 4-6). Reports of 'no trigger' was relatively infrequent in both groups. It is also worth pointing out that, in line with previous studies using the vigilance task, the majority of environmental triggers (91%) reported in the experimental condition referred to incidental cue-words presented on the screen. In contrast, the majority of environmental triggers (96%) reported by control participants involved some other aspects of the vigilance task (e.g., patterns of lines on the

screen) or external distracters ("vibration of phone", "footsteps" and "my stomach making funny noises").

Table 4-6: *Percentage (total) of reported triggers as a function of experimental group.*

	Environment	Own Thoughts	None	Total
Experimental	62% (64)	24% (25)	14% (14)	100% (103) [a]
Control	27% (19)	70% (49)	3% (3)	100% (70)

[a] One participant failed to record a trigger for one of their reported thoughts.

The frequencies for each trigger-type (environment, own thought, no trigger) were calculated by participant, and entered into a 2 (experimental condition) x 3 (trigger-type) mixed ANOVA with repeated measures on the last factor. Results showed a significant main effect of trigger type $F(1.69, 63.15) = 15.84$, $p < .001$, $\eta^2 = .289$, and a marginally significant effect of experimental condition $F(1, 39) = 3.17$, $p = .083$, $\eta^2 = .075$. However, these effects were qualified by a significant interaction $F(1.69, 63.15) = 14.26$, $p < .001$, $\eta^2 = .268$ (see Figure 4-1). Tests of simple main effects revealed that participants in the experimental condition reported more environmental triggers ($M = 2.91$, $SD = 1.65$) than the control group ($M = 1.00$, $SD = 0.94$) ($p < .001$), whilst the control group reported more own thought triggers ($M = 2.58$, $SD = 2.14$) than the experimental group ($M = 1.14$, $SD = 0.94$) ($p = .007$). In addition, the experimental group reported more instances of thoughts with no trigger ($M = 0.64$, SD = 1.05) than the control group ($M = 0.11$, $SD = 0.32$) ($p = 0.04$).

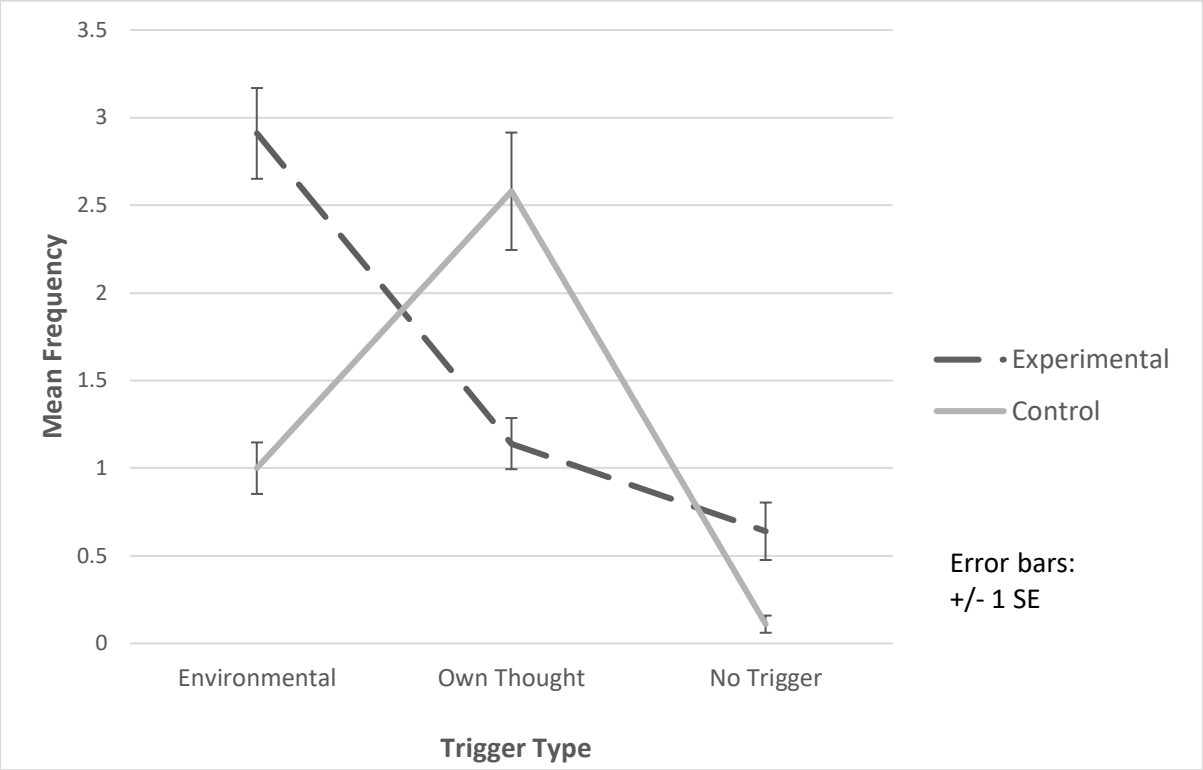


Figure 4-1: *Mean frequency with which each type of trigger was reported, as a function of experimental group.*

4.3.5 IM Frequency

A key objective of the study was to determine whether it was possible to capture people's naturally occurring IMs under controlled laboratory conditions, using a method that was previously shown to be successful for capturing IAMs. Results from the present study show that it is possible to capture IMs under such conditions. A total of 30 IMs were recorded across both conditions (24 in the experimental condition and 6 in the control condition). These IMs represented 15% of all 204 spontaneous, task-unrelated thoughts (19% in the experimental condition, and 8% in the control condition).

Because of the relatively high number of participants who did not report any IMs during the course of the vigilance task, the non-parametric Mann-Whitney U test was used to compare groups. In line with predictions, the experimental group reported significantly more

IMs (M = 1.09, SD = 0.97) than the control group (M = 0.32, SD = 0.95), U = 100, z = -3.17, p = .002, r = -0.49. The high standard deviations, particularly in the control condition, show that there was considerable variation in the reporting frequency per participant. Indeed, three participants reported the six IMs collected in the control condition, but four of these IMs were reported by one participant. In the experimental condition, the 24 IMs were reported by 15 participants (two participants each reported six IMs, five participants reported two IMs, and eight participants reported one IM).

4.3.6 Types of triggers reported for IMs

Participants in the control condition appeared more likely to report their own thoughts as triggers for their IMs, whereas participants in the experimental condition appeared more likely to report environmental triggers for their IMs. Indeed, the only instance where a participant in the control condition reported an environmental trigger for their IM was when "the ambiance of the room, bright with the fan, matching room conditions of the memory" (for an IM regarding the breakup of a relationship). The results of a chi square analysis showed these group differences to be significant $\chi 2(2, N=30) = 10.17$, $p = .006$ (see Table 4-7).

Table 4-7: *Percentage (frequency) of IMs as a function of group and reported trigger.*

	Environment	Own Thoughts	None	Total
Experimental	79% (19)	17% (4)	4% (1)	100% (24)
Control	17% (1)	83% (5)	0% (0)	100% (6)

One of the main aims of the present study was to examine whether people's naturally-occurring IMs were more susceptible to being triggered by personalized cues, or if the memories could be triggered by seemingly irrelevant cues. This was accomplished by

inserting personalized cues within the vigilance task completed by participants in the experimental condition. Of the 19 IMs reported in the experimental condition in response to environmental triggers, 17 of these (89%) were in response to cue phrases that appeared on the screen during the vigilance task.

Of the 15 participants in the experimental condition who reported an IM, 13 reported verbal cue phrases appearing on the screen as triggers. These IMs accounted for 17 of the 24 total IMs reported in the experimental condition. For nine of the reported IMs the identified verbal cues were personalized (M = 0.63, SD=0.50). For the remaining eight IMs the identified verbal cues were non-personalized (M = 0.56, SD = 0.63). The results of a Wilcoxon signed-rank tests showed no difference in the frequency with which each type of cue was reported by participants in the experimental condition, z = -0.28, p = 0.78, r = -0.07.

4.3.7 Phenomenology of Reported IMs

The mean ratings given to IMs for concentration, vividness, rehearsal and pleasantness (as a function of experimental group) are presented in Table 4-8. Participants in the experimental condition gave significantly higher concentration ratings when recording their IMs than participants in the control condition. There were no group differences in the IM ratings given for vividness, rehearsal, and pleasantness. However, it should be pointed out that these comparisons could be made on very small numbers of participants who actually reported at least one IM during the vigilance task.

Table 4-8: *Mean ratings for each variable as a function of experimental condition, and the results of a Mann-Whitney U Test for group differences.*

	Condition		*p*
	Experimental (*N*=15)	Control (*N*=3)	
Concentration [a]	3.44 (1.14)	1.08 (0.14)	.002
Vividness [b]	5.17 (1.28)	6.58 (0.72)	0.10
Rehearsal [c]	4.17 (0.75)	4.67 (0.58)	0.36
Pleasantness [d]	1.56 (1.10)	1.33 (0.58)	.912

[a] Concentration ratings were made on a 5-point scale: 1=*not at all,* 5=*fully concentrating.*
[b] Vividness ratings were made on a 7-point scale: 1=*very vague, almost no image at all,* 7=*very vivid, almost like normal vision*
[c] Rehearsal ratings were made on a 5-point scale: 1=*never,* 2=*once or twice,* 3=*a few times,* 4=*several times,* 5=many times
[d] Pleasantness ratings were made on a 5-point scale: 1=*very unpleasant,* 3=*neutral,* 5=*very pleasant.*

Finally, it was interesting to compare the ratings given by participants to IMs and to spontaneous task-unrelated thoughts referring to the past, which could be conceived of as ordinary IAMs that are usually captured by the vigilance task with incidental cue words (see Plimpton et al., 2015). The mean ratings are presented in Table 4-9 as a function of memory type (IM vs. IAM) , along with the results of a Wilcoxon signed-rank test. As can be noted, there were no differences with regard to reported concentration levels. There were, however, highly significant differences in the reported vividness, rehearsal and pleasantness of IMs in comparison to non-IM past memories.

Table 4-9: *Mean ratings of each variable for IMs and past memories (non-IM), and the results of a Wilcoxon signed-rank test.*

	IMs [a]	Past Memories (Non-IM) [a]	*p*
Concentration	2.97 (1.44)	3.37 (1.21)	.273
Vividness	5.48 (1.45)	4.68 (1.35)	.002
Rehearsal	4.39 (0.74)	2.92 (1.36)	.002
Pleasantness	1.61 (1.15)	2.57 (0.98)	.007

[a] Only 14 participants (11 in the experimental condition and three in the control condition) reported both an IM and an IAM. Therefore the means and analyses presented are based on these participants.

4.3.8 Therapeutic Effects of Recording IMs

To test for possible therapeutic benefits of reporting their IM during the vigilance task, participants were divided into two groups according to whether they had reported an IM (n = 18) or not (n = 23), regardless of experimental condition (see Table 4-10). Participants' scores on the BDI, STAI, and 9-point mood scale were then entered into a 2 (IM reported or not) x 2 (time of administration) mixed ANOVA with repeated measures on the last factor. The analyses for the BDI and STAI scores did not result in any significant main effects or interactions. Results for the mood scale showed a significant main effect of time of administration $F(1, 39) = 8.74$, $p = .005$, $\eta^2 = 0.18$, a main effect of condition $F(1, 39) = 5.94$, $p = .019$, $\eta^2 = 0.13$, but no interaction $F(1, 39) = 1.50$, $p = 0.23$, $\eta^2 = 0.04$. Participants who reported an IM seemed to rate their mood lower overall than participants who did not, and self-assessed mood appeared to grow more negative after the vigilance task was completed.

Table 4-10: *Mean scores at the first and second administrations of the BDI, STAI and 9-point mood scale, as a function of whether participants reported and IM during the vigilance task.*

	IM reported		IM not reported	
	Time 1	*Time 2*	*Time 1*	*Time 2*
BDI	15.94 (10.30)	15.63 (10.95)	12.68 (8.57)	14.14 (11.38)
STAI	42.56 (10.59)	43.81 (7.30)	42.59 (11.13)	44.50 (8.83)
Mood	5.44 (1.50)	4.5 (1.50)	6.22 (1.38)	5.83 (1.75)

Note: Two participants did not complete the BDI and STAI at Time 2

4.4 Discussion - Study 3a

The present study resulted in several novel findings. The most important finding was that it is possible to elicit naturally occurring IMs in the lab using the modified version of a paradigm originally developed by Schlagman and Kvavilashvili (2008) for studying IAMs. In addition, most of these IMs arose in response to environmental triggers, the majority of which were the phrases presented on the screen during the vigilance task. Thus, results strongly suggest that IMs are as dependent on meaningful environmental cues as other types of involuntary cognition, as evidenced by the paucity of IMs reported in the control (mathematical formulas) condition. However, the effort to examine the 'reactivity' of IMs by manipulating the relevance of some cues to the IM reported at screening, did not produce any effect. Participants in the experimental group were equally likely to report their IM in response to a personalized cue as to a non-personalized cue.

It seems likely that the high number of cues overall lessened the impact of the personalized cues. This could have occurred for a number of reasons. Because cues were presented on each trial, and there were hundreds of trials, this made it difficult to remove all non-personalized cues from the presentation sequence that might have had some relevance to the IM reported at screening. Therefore, some participants reported their IM as being

triggered by a non-personalised cue phrase that was nonetheless meaningfully related to the content of their reported IM (see Table 4-11; Berntsen, 2009).

In addition, the number of cues also presented many competing opportunities to trigger a retrieval process for other autobiographical content. For example, if a participant already had an autobiographical memory triggered by a non-personalized cue that was presented 10 slides before the stop trail, the personalized cue that appeared immediately before the stop trial would have had to disrupt this already-occurring retrieval process (Conway & Pleydell-Pearce, 2000). It is also possible that having a personalized cue just before the stop trial provided too little time to initiate a successful retrieval process. Indeed, when Schlagman and Kvavilashvili (2008) first developed this lab method, participants were asked to stop the presentation themselves to report that an IAM had come to mind. For those IAMs which were reported by participants to have been triggered by a particular cue phrase on the screen it was possible to calculate the retrieval time, i.e., the time it took the participant to report an IAM after seeing this cue phrase. Schlagman and Kvavilashvili (2008) found that the mean retrieval time for such IAMs was between 4.61 (*SD*=3.81; Study 2) and 5.06 (*SD*=3.86; Study 1) seconds.

Table 4-11: *Sample of IMs reported in response to personalized and non-personalized cues.*

Reported IM	***Reported Trigger***	***Relatedness***
Thoughts of friend's suicide	"senseless tragedy"	Non-personalised
Bad memories of my parents last year late feb arguing violence scares me overthinking one particular event.	the words displayed e.g. divorce, argument, wedding anniversary	Non-personalised
Thinking about my weight and ex-boyfriend	Reading the words "feeling unwanted" and recently seeing him (yesterday morning)	Non-Personalised
I was thinking about my most recent relationship and that I maybe rushed into it and then ended up putting up with a lot of unpleasant behaviour that I shouldn't have because he was my first love and I thought it seemed like the best thing to do. In retrospect I regret that.	Words on slides ("hurtful deception"?)	Personalised
Seeing my mum in a hospital bed with no hair for the first time	The phrase "hospital visit"	Personalised
Parking ticket & memory from before about car accident	some of the words e.g. reckless driving	Personalised

Finally, it is also possible that personalized cues were drowned out by the attentional resources needed to monitor all of the cues. Related studies have found that both increasing attentional load and increasing the number of verbal cues in the presentation sequence

resulted in a lower number of IAMs reported (Vannucci, Pelagatti, Hanczakowski, & Chiorri, 2019; Vannucci, Pelagatti, et al., 2014).

Given the surprising finding that participants in the experimental condition of Study 3a were equally likely to report their IM in response to personalised and random cue words, a follow-up (Study 3b) was designed, which aimed to isolate the impact of personalized cueing more effectively than in Study 3a. This was achieved by reducing the number of incidental cues to 150 (as opposed to the 600 verbal cues used in Study 3a) and personalizing a selection of 4 cues in the experimental condition, and not personalising any of the cues in the control condition. In other words, the effectiveness of personalised versus random cues was examined primarily between subjects (although the design also allowed to make comparisons between personalised and random cues within subjects in the experimental condition). As in Study 3a, the vigilance task contained eight stop trials. In the experimental condition, at stop trials three, four, five and six, an incidental cue phrase was replaced by a personalized cue which was inserted three slides before the stop trial (producing a 4.5 second-long window for IM retrieval), and were not immediately preceded or followed by any other cues. The aim was therefore to maximize attentional resources for detecting personalized cues, and to allow sufficient time for the IM to be retrieved. By contrast, stop trials one, two, seven and eight, were preceded by non-personalised (incidental) cue words which were the same for all participants. In the control condition, participants encountered the same 150 cues distributed in semi-random fixed positions across 600 slides, as was the case in the experimental condition, with the exception that stop trials three, four, five and six were preceded by standard incidental (non-personalised) cues. It was predicted that these changes would mean that the number of reported IMs at stop trials three, four, five and six would be higher in the experimental than control condition due to personalised cues in the former, while there would be no differences between the conditions in the number of reported

IMs after stop trials one, two, seven and eight, which were preceded by the same (non-personalised) incidental cues in both conditions.

In addition, to examine whether recording IMs during the vigilance task resulted in mood improvements participants were asked to complete the same 9-point scale at the beginning and end of the laboratory session. They were also asked to complete the Hospital Anxiety and Depression Scale (HADS) at the beginning of and after completing the laboratory session.

4.5 Method - Study 3b

4.5.1 Design

The study used an experimental, between-subjects design, whereby screened participants were randomly allocated to either the experimental or control conditions. The primary independent variable was the relatedness of the cues to participants' reported IMs (incidental in the control condition, and a combination of incidental and personalized in the experimental condition). The primary dependent variables were the frequency with which participants reported their nominated IM during the vigilance task, and the change in their Hospital Anxiety and Depression Scale (HADS) score from baseline.

4.5.2 Participants

Based on their responses to the online screening questionnaire (see Chapter 2), 74 people were invited to a follow-up lab session. A total of 39 participants accepted and completed all aspects of the study (19 experimental, 20 control). Of these, 32 were female (82%) and seven were male (18%) with no gender differences as a function of experimental condition $\chi^2(1, N=39)=.24$, $p=.62$. Similarly, there were no group differences in participants' age or baseline HADS scores (see Table 4-12).

Table 4-12: *Mean (SD) for age, baseline HADS and the results of a one-way ANOVA.*

	Experimental	Control	*F*	*df*	*p*
Age	20.89 (4.74)	21.25 (6.59)	.037	1,38	.85
HADS	10.21 (4.77)	13.25 (6.79)	2.59	1,38	.12

4.5.3 Materials

Online Screening Questionnaire: This was identical to the questionnaire used in Study 3a.

Vigilance Task: The vigilance task contained the same 600 slides, each presented for 1500 milliseconds, using SuperLab software. As in Study 3a, participants were asked to detect infrequent arrangements of vertical lines (*n*=11) among frequent arrangements of horizontal lines (*n*=589), and were instructed to press the spacebar when they detected a target slide. In the present study, in both conditions cue phrases appeared in the centre of only 150 slides (e.g. “clear blue sky”, “forgotten appointment”, “tumble dryer”). These were balanced for emotional valence (50 positive, 50 neutral, 50 negative). The experimental and control conditions mirrored each other in terms of the placement of the 150 cue phrases and eight stop trials. In contrast to Study 3a, however, cue phrases appeared three slides (4500 milliseconds) before stop probe trials, and the two slides immediately preceding the stop trial had no cue phrases on them (see Appendix IX). The selection of this time interval was based on the mean IAM retrieval time of four to five seconds found by Schlagman and Kvavilashvili (2008). For all of the stop trials in the control condition - and stop probes 1, 2, 7 and 8 in the experimental condition - these cue phrases were fixed and did not differ between participants. For stop probes 3, 4, 5 and 6 in the experimental condition, participants were presented with a cue phrase that was based on the IM they reported at screening. As in Study 3a, the sets of four personalised cue words were derived individually for each

participant by the research team who independently nominated suitable cue phrases for each IM description and the best possible cue words were agreed upon after discussion.

Thought Probe Questionnaire: This was identical to the questionnaire used in Study 3a (see Appendix X).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983; see Appendix XI): The HADS is a short, 14-item measure developed to gauge levels of depression and anxiety in a general medical population. It has 2 sub-scales for depression and anxiety, the questions for which are interspersed throughout the measure, and which are scored separately. Responses to each question incur a score of 0 to 4, some of which are reverse scored. Questions focus on particular symptoms for anxiety (e.g. "I feel tense or 'wound up'" 3=*most of the time,* 2=*a lot of the time,* 1=*time to time, occasionally,* 0=*not at all*; "I can sit at ease and feel relaxed" – 0=*definitely,* 1=*usually,* 2=*not often,* 3=*not at all*) and depression (e.g. "I look forward with enjoyment to things" - 0=*as much as I ever did,* 1=*rather less than I used to,* 2=*definitely less than I used to,* 3=*hardly at all*; "I feel as if I am slowed down" – 3=*nearly all of the time,* 2=*very often,* 1=*sometimes,* 1=*not at all*). Overall scores of 8 to 10 are typically considered to reflect mild symptoms, 11-14 moderate, and 15 to 21 severe (Stern, 2014).

The HADS has been shown to be a valid measure of anxiety and depression symptoms, with subscale scores for each correlating highly with clinician determined ratings for each condition (both $p<.001$). Results also suggest the measure successfully distinguishes the symptoms for each. This is reflected in significant correlations between the same clinician determined ratings and subscale scores for a smaller group of participants (17) who showed high symptoms of depression or anxiety, but not both. Finally, the HADS has been shown to be a reliable measure, with a high rate of alignment between cases determined to be clinically significant following researcher interview and those determined to be clinically significant by

the scale. This is reflected in a rate of only 1% false positives and 1% false negatives in the case of the depression subscale, and 5% false positive and 1% false negatives in the case of the anxiety subscale (Zigmond & Snaith, 1983).

Mood Scale: This was identical to the scale used in Study 3a.

4.5.4 Procedure

Upon their arrival in the lab, participants were given a more comprehensive information sheet than that presented with the online questionnaire, and asked to give written consent for their participation in the remainder of the study. Then they completed the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) via the Qualtrics online system before receiving detailed instructions (identical to Study 3a) about the vigilance task. Participants completed a practice trial before the main vigilance task. Before leaving the lab they were given an interim debrief sheet, and advised that they would receive an email in 3 days with a link to a final questionnaire (HADS). Once this was completed they received a full and final debrief via email.

4.6 Results – Study 3b

4.6.1 Content and phenomenology of IMs reported at screening

All IM descriptions collected at screening were coded according to the scheme developed by Reynolds and Brewin (1999) into the categories "death/illness of another person," "illness/injury to oneself," "assault or abuse to oneself," "interpersonal problems" and "other." The proportions of memories falling into each category are represented in Table 4-13. There were no group differences between the experimental and control conditions $\chi^2(4, N=39)=2.90$, $p=.58$.

Table 4-13: *Percentages (frequency) of IMs reported at screening for content categories for nominated IMs in experimental and control conditions.*

	Death/illness of another person	*Illness/ injury to oneself*	*Assault or abuse to oneself*	*Interpersonal problems*	*Other*
Experimental *n*=19	32% (6)	10% (2)	21% (4)	16% (3)	21% (4)
Control *n*=20	25% (5)	25% (5)	15% (3)	5% (1)	30% (6)
Total *n*=39	28% (11)	18% (7)	18% (7)	10% (4)	26% (10)

In addition, participants rated their nominated IM on a number of scales, including frequency, duration, vividness distress and avoidance. The mean ratings for each variable as a function of experimental condition are presented in Table 4-14. The frequency with which participants experienced their nominated IM was closer to three to four times per week. Participants in both conditions rated their memories, on average, as highly vivid and highly distressing, with more moderate levels of disruption and avoidance. Some group differences did emerge regarding the avoidance ratings given. Participants in the experimental group indicated that they avoided thinking about the event marginally more than participants in the control group. There was a clear difference regarding avoidance of reminders, with the experimental condition participants reporting that they engaged in this more than control participants. It is difficult to account for these findings given the random allocation of participants to the experimental and control conditions.

In addition, 68% of participants in the experimental condition reported their IM to be accompanied by bodily sensations, whilst this was the case for 65% of participants in the control condition. There were no group differences $\chi^2(1, N = 39) = 0.05$, $p = 0.82$. In the experimental condition, 58% of participants also reported their IM to be like "reliving the event as occurring here and now" rather than "looking back at the past." In the control

condition, 35% of participants indicated their IM was accompanied by this sense of reliving, but again there were no group differences $\chi^2(1, N = 39) = 2.06$, $p = 0.15$.

Table 4-14: *Mean (standard deviation) ratings for experimental and control conditions, and results of one-way ANOVA for each.*

Characteristics	Condition		Variable Description	*p*
	Experimental	Control		
Frequency [a]	3.0 (1.15)	3.50 (1.54)	Three or four times a week	0.26
Vividness [b]	5.58 (1.17)	5.65 (1.53)	Highly vivid (1-7 scale)	0.87
Distress [b]	5.11 (1.33)	4.90 (1.77)	Highly distressing (1-7 scale)	0.69
Disruption [b]	3.32 (1.45)	2.90 (1.57)	Moderate disruption (1-7 scale)	0.40
Avoid thinking [b]	5.37 (1.71)	4.25 (2.10)	Moderate avoidance (1-7 scale)	0.08
Avoid reminders [b]	5.16 (1.68)	3.70 (2.25)	Moderate/High avoidance	0.03
Duration [c]	2.11 (1.15)	1.75 (0.55)	Minutes	0.22
Age of memory [d]	6.00 (1.37)	5.60 (1.54)	Between 1 and 5 years	0.40

[a] Frequency ratings were made on a 7-point scale: 1=*none*, 2=*once or twice a week*, 3=*three or four times a week*, 4=*once a day*, 5=*two to three times a day*, 6=*three to five times a day*, 7=*more than five times a day*

[b] Ratings were made on a 7-point scale: 1=*not at all*, 7=*extremely*

[c] Duration ratings were scored on a 5-point scale: 1=*seconds*, 2=*minutes*, 3=*up to an hour*, 4=*several hours*, 5=*constantly*.

[d] Timeframe ratings for the memory were made on an 8-point scale: 1=*twenty-four hours*, 2=*one week*, 3=*one month*, 4=*within six months*, 5=*less than one year*, 6=*between one and five years*, 7=*between five and ten years*, 8=*more than 11 years.*

4.6.2 Vigilance Task Performance

Participants' performance on the vigilance task as a function of experimental group is presented in Table 4-15. The results of two separate one way ANOVAs showed group differences in the rate of target detection $F(1, 33)=5.33$, $p=0.027$, but no differences in response time ($F<1$).

Table 4-15: *Mean (SD) rate of successful target detection and response time (milliseconds) as a function of group.*

	Target Detection	Response Time
Experimental	9.70 (0.96)	841.90 (278.20)
Control	10.41 (0.80)	817.40 (249.00)

4.6.3 Types of Thoughts Reported

All 39 participants were stopped 8 times during the presentation and asked to record their thoughts at that moment. This yielded a total of 312 thought descriptions. There were 12 instances where participants indicated that their mind was blank when they were stopped, so these were removed from further analysis, leaving a total of 300 thoughts. Out of these, 53 thoughts (18 %) were classed by participants as deliberate and 247 (82%) were classed as spontaneous.

Two researchers also coded all thoughts as either task-related (e.g., "the task I have to complete and staying focused" or "I was thinking about when the next vertical line would appear") or task-related interference, which involved an appraisal of one's performance on the task, or an assessment of some other aspect of the task not directly related to what the participant has been asked to do (e.g. "task is getting boring, making me agitated" or "I am thinking there is only one more trial to do"). By contrast, thoughts were classed as task-unrelated if they were completely unrelated to any aspects of the vigilance task (e.g., "Thinking about my sister" or "Thinking about driving lessons and my road rage"). Inter-rater reliability was moderate (kappa=.546). A total of 14 thoughts (5%) were classed as task-related, 52 thoughts (17%) were classed as task-related interference, and 234 thoughts (78%) were classed as task-unrelated.

Spontaneous, task-unrelated thoughts were the primary unit of analysis. Therefore, the 53 thoughts (18%) classed by participants as deliberate were excluded from further analysis,

leaving 247 spontaneous thoughts (82%). Out of these 247 thoughts, 7 (3%) were coded by researchers as task-related, and an additional 39 (16%) were coded as task-related interference. These 46 thoughts (19%) were also removed from further analysis, yielding a final sample of 201 spontaneous, task-unrelated thoughts (67% of all valid thought probes). Of these, 21 thoughts referred to IMs nominated by participants at screening (see section 4.6.6 below).

The reported frequencies of different types of thought by experimental condition are presented in Table 4-16. In contrast to Study 3a, the only variable for which group differences emerged was task related thoughts (but these only represented only a very small proportion of the total thoughts reported). It appears that the inclusion of verbal cue phrases in both conditions resulted in groups being equally likely to report spontaneous and task unrelated thoughts. This was the case even with the inclusion of Task Related Interference as a variable (which was not included in Study 3a).

Table 4-16: *Mean (SD) frequencies of each category of thought (including IMs) as a function of experimental condition, and the results of a 1-way ANOVA comparing group differences.*

	Condition		
	Experimental	Control	*p*
Deliberate	1.84 (1.50)	2.0 (1.77)	0.77
Spontaneous	5.89 (1.41)	5.75 (1.77)	0.78
Task-related	0.58 (1.41)	0.15 (0.37)	0.02
Task-related Interference (TRI)	1.32 (1.60)	1.35 (1.95)	0.95
Task-unrelated	5.84 (2.12)	6.15 (1.89)	0.64
Deliberate, Task-related (incl. TRI)	0.68 (1.20)	0.35 (0.75)	0.30
Spontaneous, Task-unrelated	5.21 (2.01)	5.0 (1.92)	0.74

4.6.4 Characteristics of spontaneous, task-unrelated thoughts and their triggers

Participants rated each of their thoughts on a number of scales (assessing levels of vividness of the thought, concentration levels, etc) and the mean ratings given to all non-IM spontaneous task-unrelated thoughts are presented in Table 4-17, overall and as a function of experimental group. These were entered into a series of one-way ANOVAS, which showed no group differences.

Table 4-17*: Mean (SD) ratings for each variable as a function of group, and the results of a one-way ANOVA.*

		Condition		
	Overall	Experimental	Control	*p*
Concentration [a]	3.03 (0.92)	2.87 (0.91)	3.19 (0.93)	0.29
Vividness [b]	4.58 (1.19)	4.65 (1.26)	4.50 (1.15)	0.71
Rehearsal [c]	3.01 (0.74)	2.88 (0.73)	3.13 (0.75)	0.31
Pleasantness [d]	3.18 (0.68)	3.09 (0.49)	3.26 (0.82)	0.44

[a] Concentration ratings were made on a 5-point scale: 1=*not at all*, 5=*fully concentrating.*

[b] Vividness ratings were made on a 7-point scale: 1=*very vague, almost no image at all*, 7=*very vivid, almost like normal vision*

[c] Rehearsal ratings were made on a 5-point scale: 1=*never*, 2=*once or twice*, 3=*a few times*, 4=*several times*, 5=many times

[d] Pleasantness ratings were made on a 5-point scale: 1=*very unpleasant*, 3=*neutral*, 5=*very pleasant.*

4.6.5 Reported triggers for non-IMs

Across both conditions, participants reported that 63% (114) of their non-IM thoughts were triggered by environmental cues, 26% (46) by their own thoughts, and 11% (20) had no trigger. In line with previous studies using the vigilance task, the vast majority (83%) (n = 90) of these 114 environmental cues, described by participants, referred to word cues presented on screen. The remaining 4% (n = 4) referred to some other aspect of the vigilance task (e.g., pattern of lines on the screen) and 13% (n = 14) to stimuli in the environment (e.g.,

noise outside the room).[12] The frequencies with which participants reported each trigger category were entered into a 2 condition (experimental vs. control) x 3 trigger (environment, own thought, no trigger) mixed ANOVA. Results showed a very strong effect of trigger category $F(2, 70)=22.34$, $p<.001$, $\eta^2=0.39$, but not of group ($F<1$), or an interaction $F(2, 70) = 2.04$, $p = 0.14$, $\eta^2 = .055$. Pairwise comparisons (LSD) showed that environmental triggers were reported much more often than 'own thoughts' ($p<.001$) or 'no trigger' ($p<.001$). Similarly, participants reported their 'own thoughts' as a trigger more often than instances of 'no trigger' ($p = .029$).

4.6.6 IM Frequency

A total of 21 IMs were reported across both conditions[13], with 16 (76%) IMs being reported in the experimental condition and 5 (24%) in the control condition. These IMs represented 15% of all spontaneous, task-unrelated thoughts reported in the experimental condition, 5% of all such thoughts reported in the control condition, and 10% of all spontaneous task-unrelated thoughts reported across both conditions.

There was some variability in the reported frequency per participant in both conditions. In the control condition, five participants reported one IM, and the remaining 15 participants (75%) did not report any IMs. In the experimental condition, nine of 19 participants (47%) did not report any IMs. One participant reported four IMs, one reported three IMs, one reported two IMs, and seven (37%) reported one IM. Because of the high number of participants who did not report any IMs during the course of the vigilance task, the non-parametric Mann-Whitney U Test was used to compare groups.

[12] On six occasions participants did not provide a description of their environmental trigger.

[13] This number excluded four memories reported in the control condition and two in the experimental condition that were deemed to be "IM-related" (see Chapter 3 data coding). An additional three memories excluded from the final total were determined to be IMs, but different from the ones reported at screening via the online form. Finally, one participant reported one of their IMs as a 'deliberate' thought.

It was expected that exposing participants to personalized cues would result in a greater frequency of IMs reported than exposing them to standardized, incidental cues, which were not related to the content of nominated IMs. Overall, across all the stop probes, the experimental group (M = 0.84, SD =1.12) did record more IMs than the control group (M = 0.25, SD = 0.44), and this difference was significant U=130, z= -1.96, p=.032, r= -.314 (one-tailed).

If comparing the two groups across stop probes 3, 4, 5 and 6 (during which participants in the experimental condition were presented with personalized cues but participants in the control condition were not – see Table 4-18) we again find a significant difference U = 132, z = -1.96, p = .031, r = -.31 (one-tailed). This difference was not present, however, when comparing the two groups across the remaining four trials (1, 2, 7 and 8) where neither condition was exposed to personalized cues U = 179.50, z = -.64, p = .48, r = -.10 (one-tailed).

To compare within subjects, we used a Wilcoxon signed rank test to compare the frequency of IMs reported during stop probes 1, 2, 7 and 8 with the frequency of IMs reported during stop probes 3, 4, 5, and 5 in both the experimental and control conditions. Results show a significant difference in the experimental condition z = -2.49, p = 0.02, r = -0.64, but not the control condition z = -1.34, p = 0.18, r = -0.59.

Table 4-18: *Mean (SD) frequency of IM reports as a function of experimental condition and stop probes.*

	Stop probes 3, 4, 5, 6 [a]	Stop probes 1, 2, 7, 8 [b]
Experimental	0.74 (0.99)	0.11 (0.32)
Control	0.20 (0.41)	0.05 (0.22)

[a] Personalised cues in the experimental condition, non-personalised cues in the control condition
[b] Non-personalised cues in the experimental and control conditions

4.6.7 IM Triggers

The percentage (and frequency) with which participants reported each type of trigger (environmental, internal thought and no trigger) are presented in Table 4-19. In nearly all cases (95%), participants reported that their IM was triggered by an environmental cue. In all 20 cases where an environmental trigger was reported, participants described the trigger as one of the cue phrases on the screen. A sample of IMs reported in response to personalized and non-personalized cues are presented in Table 4-20.

Table 4-19: *Percentage (frequency) of IMs as a function of group and identified trigger.*

	Environment	Own Thoughts	None	Total
Experimental	94% (15)	0% (0)	6% (1)	100% (16)
Control	100% (5)	0% (0)	0% (0)	100% (5)
Overall	95% (20)	0% (0)	5% (1)	100% (21)

To directly assess the role of personalized cues in eliciting IMs in comparison to non-personalised cues in the experimental group, we examined participants' reports of external triggers when they reported an IM during the stop probe. Of the 16 IMs reported in the experimental condition, 12 of these identified personalized cue phrases as triggers (75%).[14] The mean frequency with which personalized cues were reported in the experimental condition was 1.33 (SD=0.87) whilst the mean frequency with which non-personalised cues were reported was 0.33 (SD=0.50). The results of a Wilcoxon signed rank test showed these differences to be significant $z = -2.31$, $p = .02$, $r = -.60$.

[14] Of the remaining four IMs, two were reported during stop probes 1, 2, 7 and 8 and had non-personalised cues as triggers, one was reported during stop probes 3, 4, 5 and 6 and but indicated 'to trigger' for their IM, and one was reported during the same sequence (stop probes 3, 4, 5 and 6, which were preceded by personalised cues) but reported a non-personalised cue as a trigger.

Table 4-20: *Reported IMs and triggers.*

Reported IM	Condition	Trigger description	Relatedness
"Mistaken identity' brought up a distressed memory which I was chased due to misidentification, and my life was at risk as the individuals were armed	Experimental	mistaken identity	Personalized
Taking pets to the vet	Experimental	veterinary appointment	Personalized
A break up I went through a few months ago	Experimental	"relationship breakdown" on the screen	Personalized
Reminded me of my brother`s seizure	Experimental	terrible nightmare	Non-personalized
I was thinking of someone having an asthma attack, my grandma	Control	asthma attack	Non-personalized
Last year my grandad passed away after knowing for less than 3 months that he had cancer. My dad`s side of the family aren't close as well which is sad to see	Control	good health	Non-personalized

4.6.8 Phenomenology of Reported IMs

The mean ratings given to IMs for concentration, vividness, rehearsal and pleasantness are presented in Table 4-21. These means are based on 17 participants (12 from the experimental condition and five participants from the control condition) who reported both an IM and an IAM. When compared to the ratings given for non-IM past memories, some expected and unexpected results emerged. Concentration ratings given for both types of thought were virtually equal, suggesting that the 'cognitive conditions' (e.g. engagement in

an undemanding task) that precipitate an IAM are similar to those that precipitate an IM. Surprisingly, however, there were no differences in reported vividness between the IMs and non-IM past memories. Ratings for rehearsal and pleasantness were more aligned with what would be expected, with IMs receiving a significantly higher rehearsal rating than past memories, and IMs receiving a lower pleasantness rating (marginally significant difference).

Table 4-21: *Mean ratings (SD) for each variable as a function of thought type, and the results of a one-way ANOVA.*

	IMs [e]	Past Memories (Non-IM) [e]	*F*	*p*
Concentration [a]	3.14 (1.15)	3.14 (0.97)	.002	0.97
Vividness [b]	5.0 (1.27)	4.89 (1.09)	.140	0.71
Rehearsal [c]	3.78 (0.80)	3.22 (0.82)	8.88	.009
Pleasantness [d]	1.81 (0.94)	2.41 (0.86)	4.04	0.06

[a] Concentration ratings were made on a 5-point scale: 1=*not at all,* 5=*fully concentrating.*
[b] Vividness ratings were made on a 7-point scale: 1=*very vague, almost no image at all,* 7=*very vivid, almost like normal vision*
[c] Rehearsal ratings were made on a 5-point scale: 1=*never,* 2=*once or twice,* 3=*a few times,* 4=*several times,* 5=many times
[d] Pleasantness ratings were made on a 5-point scale: 1=*very unpleasant,* 3=*neutral,* 5=*very pleasant.*
[e] *N*=17

4.6.9 Therapeutic effects of recording IMs

To explore possible therapeutic benefits of writing about their IMs, participants were divided into two groups according to whether they reported at least one IM during the vigilance task. A total of 17 participants (44%) reported at least one IM, whilst 22 (56%) did not. The mean HADS depression and anxiety scores for each group are presented in Table 4-22, along with the mean scores on the mood scale that was administered at the beginning and end of the lab session. These were entered into a 2 (group) x 2 (time of administration) mixed ANOVA. With regard to the depression and anxiety scores, there were no significant main or

interaction effects (all $F < 1$). For ratings of mood, there was a main effect of time of administration $F(1, 36) = 16.32$, $p < .001$, $\eta^2 = .312$, with mood ratings decreasing at the end of the session, but the main effect of group and group by time interaction were not significant (both $F < 1$).

Table 4-22: *Mean (SD) HADS depression and anxiety scores as a function of experimental group and time of administration.*

	IM reported		IM not reported	
	Time 1	*Time 2*	*Time 1*	*Time 2*
HADS Depression	3.82 (2.70)	3.82 (3.30)	4.09 (2.76)	4.68 (2.95)
HADS Anxiety	8.12 (3.94)	8.35 (3.81)	7.55 (4.23)	8.0 (4.95)
Mood [a]	6.0 (1.46)	4.94 (1.69)	6.18 (1.62)	5.09 (2.09)

[a] Due to an error, a pre-task mood rating was not collected from one participant.

4.7 Discussion – Study 3b

The present study replicates and extends some important findings from Study 3a. Namely, the findings showed that it is possible to elicit participants' own, naturally occurring IMs in the laboratory under controlled conditions. In addition, the effect of personalized cues on the frequency of IM reports was clearer. This was made possible by a reduction in the overall number of cues in both conditions, which placed participants under less cognitive load, which had previously been shown to increase reports of IAMs (Vannucci, Pelagatti, et al., 2014). In both conditions, 4500 ms was allowed to elapse between cue presentation and stop trial, to allow sufficient time for IM retrieval (based on previous findings regarding IAM retrieval time: Schlagman & Kvavilashvili, 2008). As a result, between subjects comparisons showed that the experimental condition (personalised cues) retrieved significantly more IMs that the control condition (non-personalised cues). But even within-subjects comparison in the experimental condition alone showed the personalised cues (inserted before stop probes 3,

4, 5, and 6) to be more effective at eliciting IMs than the non-personalised cues (before stop probes 1, 2, 7 and 8).

4.8 Overall Discussion

Studies 3a and 3b, described in this chapter, represent the first attempt at eliciting naturally-occurring IMs in a non-clinical population under controlled laboratory conditions. In addition to demonstrating that this is indeed possible, several additional and important findings emerged. Study 3a showed that IMs were susceptible to meaningful (verbal) cuing, as reflected by a strong main effect of cueing comparing meaningful verbal cues to mathematical calculations in the control condition. Whilst the within-subject comparison of personalized versus non-personalized cues did not reach the threshold for significance in Study 3a, it was possible to discern the greater impact of personalized versus non-personalised cue phrases in Study 3b. In the latter study, participants in the personalized cue condition reported significantly more IMs than participants in the non-personalised cue condition. In addition, reduction in the total number of incidental cues from 600 to only 150, presented during the vigilance task, in Study 3b appears to have contributed to the success of this manipulation. Finally, phenomenological ratings suggest that these were genuinely IMs in both studies, but the result did not show a relationship between IM reporting and improvement on measures of mood, depression or anxiety.

4.8.1 IM Frequency

A growing number of studies have demonstrated the suitability of the vigilance task in eliciting and measuring task-unrelated thoughts in the lab in general (Plimpton et al., 2015; Vannucci et al., 2017) and IAMs in particular (Kvavilashvili & Schlagman, 2011; Mazzoni et al., 2014; Schlagman & Kvavilashvili, 2008; Vannucci, Pelagatti, et al., 2014; Vannucci et al., 2017). The present results not only replicate but significantly extend these findings by showing that this method is also suitable for eliciting IMs that non-clinical participants reported as

experiencing in their daily life at the time that the study was conducted. The success of this method in eliciting involuntary cognitions in general may lie in its ability to recreate the conditions of low cognitive load under which off-task thoughts are generally experienced in day to day life.

Given the demonstrated impact of relevant verbal cues for triggering our personal past, it is perhaps unsurprising that in Study 3a participants in the control condition (mathematical calculations) reported many more deliberate and task-related thoughts than in the experimental condition. By contrast, participants in the experimental condition reported more spontaneous, task-unrelated thoughts, and it was within this condition that a greater number of IMs were reported. That being said, the reduced cognitive load under which participants were placed in Study 3b (through the reduction in written verbal cues) did not appear to yield a greater mean frequency of IAMs or IMs than in Study 3a. Greater frequency of such memories was expected in Study 3b compared to Study 3a, based on previous findings by Vannucci, Pelagatti, et al., (2014), who showed that fewer verbal cues during the task resulted in a greater number of task unrelated thoughts. The discrepant patterns across the Studies 3a and 3b could be a result of using a probe-caught method, whereas a self-caught method was used by Vannucci, Pelagatti et al. (2014). This manipulation of reducing the number of cue phrases in the vigilance task did, however, make it possible to obtain a main effect of personalized versus non-personalized cues in Study 3b.

4.8.2 Triggers of IMs and Phenomenology

The results of Study 3a showed a very strong main effect cue type, with verbal phrases trigger many more off task thought generally – and IMs specifically – than mathematical formulas. As noted above, this is perhaps to be expected, given that verbal cues have been shown to be effective triggers for IAMs. There has been little exploration, however, of the capacity of verbal cues to trigger IMs. Naturalistic and retrospective studies

have focused more on environmental triggers, the perceptual details of which match key aspect of the IM (Kleim et al., 2013; Michael et al., 2005). The susceptibility of these memories in particular to visuo-spatial cues aligns with prevailing clinical theories about the sensory/perceptual nature of IMs being a reflection of peri-traumatic encoding divorced from its autobiographical context. And whilst the present studies do not provide a direct comparison of verbal versus other types of environmental cue, it does demonstrate that at least a proportion of IM triggers are likely to be verbal.

There were some differences across the two studies in terms of the reported phenomenology of IMs, and the comparisons with IAMs. Most of the IMs reported in the present studies, however, do appear to be genuinely intrusive when compared to IAMs along a number of phenomenological characteristics. In Study 3a, IMs were rated as more vivid, more rehearsed and less pleasant than IAMs reported during the same task. These are expected phenomenological differences in these two types of memories. It was not, however, possible to replicate all of these results, and in Study 3b, IMs were rated as much more rehearsed than IAMs, but only marginally less pleasant, and comparable in terms of the vividness ratings given.

4.8.3 Therapeutic effects

A number of different strands of research, including expressive writing (James W Pennebaker, 1997), autobiographical memory questionnaires (Boals et al., 2011; Rubin et al., 2010), prolonged exposure (Brewin, 2003), and cognitive therapy (Foa & Rothbaum, 1998), suggest that interaction with the contents of IM might yield therapeutic benefits. The suggestion is that incorporation of the memory into the autobiographical memory narrative, and alteration of the appraisals associated with the memory, has the potential to reduce the repetitive and distressing nature of the memory.

In the present study, however, this effect was not evident in Time 1 and Time 2 scores

on the BDI, STAI, HADS or mood ratings obtained before and after completing the vigilance task. This could be for a number of reasons, not least of which is the relatively short period of time that participants wrote about and answered questions regarding the content of their IMs (often just two to three minutes). The minimum time used in expressive writing tasks is 15 minutes, with longer and more frequent engagement found to show stronger effects (see Pennebaker, 1997). To give a sense of completion time, the Autobiographical Memory Questionnaire used by Boals and colleagues contained 26 items, each rated on a seven-point scale whilst the Impact of Events Scale had 22 items. The thought probe questionnaire used in the present studies contained only 9 items, though one of them requested a description of thought (in this case IM) content. Even with multiple IM reports (reaching a maximum of six in the case of two participants in Study 3a), the shorter length (plus not having a significant focus on reappraisal of the memory) reduced the scope for a therapeutic effect. If therapeutic benefit from such activities is partly derived from monitoring thoughts over a period of time (in addition to engaging with them), then the relative brevity of the laboratory session in the present study (one hour) could also account for the lack of effect.

4.8.4 Limitations and Future Directions

Review of the SuperLab files for both studies suggests that due to computer error, some of the cues did not follow their intended order of presentation. Whilst all participants in the experimental conditions of both studies were exposed to personalised cues (based on the IM reported at screening), this resulted in some participants being presented with the same personalised cue more than once. This was the case with four of the participants in Study 3a who reported an IM, and six of the participants in Study 3b who reported an IM. But on no occasion in either study did participants report an IM in response to a second instance of a personalised cue being presented. An additional two participants in Study 3a, along with

some of the abovementioned participants in both studies, appear to have been exposed to a personalised cue at a point in the presentation when it had been intended that they be exposed to a non-personalised cue (as well as the inverse). Interestingly, Study 3b in particular still showed a main effect of personalised versus non-personalised cues (within and between conditions), suggesting that this effect might have been even stronger had this handful of cue-sequence changes not occurred.

In addition, whilst the aim of the present study was to examine the impact of incidental verbal cues, personalised verbal cues and cognitive load on the triggering of IMs, this did not leave scope for a comparison between verbal cues and sensory perceptual cues. Given that it has been demonstrated that this method can be used to elicit IMs under laboratory conditions, even with verbal cues alone, a next logical next step would be a more direct comparison between verbal and pictorial cues. It has been shown that verbal cues are more effective than pictorial ones in triggering IAMs (Mazzoni et al., 2014). Some IM research in the clinic and in the lab has shown that pictures can be effective triggers (Krans et al., 2016; Michael et al., 2005). This merits comparison with verbal cues under controlled conditions.

4.8.5 Conclusion

The present studies represent the first time that a laboratory-based vigilance task, originally designed for the study of IAMs, has been applied to the study of IMs. Results show that it is possible to capture IMs under controlled laboratory conditions, and to do so using verbal cue phrases. The reduction in cue frequency in Study 3b made clear that personalised verbal cues are more effective at eliciting IMs than incidental cues, which chimes with current thinking in IAM research. The possibility of manipulating variables – particularly cues – using the present methods offers exciting avenues for future research.

Chapter 5: The role of triggers and ongoing activities in eliciting analogue intrusive memories: A diary study (Studies 4a and 4b)

5.1 Introduction

The elusive nature of naturally occurring IMs, as well as the difficulty and ethical implications of using experimental manipulations in studying them, has resulted in many researchers using analogue methods. Often referred to as the 'trauma film paradigm', these methods have yielded interesting and replicable findings about such film-induced IMs. In brief, participants are asked to view a short film clip or static images that include distressing content, and then record any images from the film that pop to mind during the subsequent days (Holmes & Bourne, 2008; James et al., 2016). It is widely acknowledged that these film-induced IMs cannot be directly compared to naturally occurring IMs, but investigation of the former are thought to offer some insight into the formation of the latter (Marks et al., 2018). There are some unaddressed research questions, however, response to which could go some way toward clarifying the extent to which these two phenomena can be usefully compared to each other. The first of these is around the nature of triggers in film-induced IMs, the exploration of which requires modification of the diary that has typically been used in trauma-film research, to align more closely in format to the diary used in IAM research.

As noted in Chapter 1, the primary aim of this area of research has been to clarify the underling mechanisms of IMs, through assessing which experimental manipulations appear to increase or reduce the frequency of film-related IMs. This has been accomplished through setting participants certain types of tasks before, during and after viewing of the film. This is done to determine if these tasks appear to have any impact on the subsequent frequency with which people report film-related IMs in the diary. It has been found that performing visuo-spatial tasks (such as the completion of a tapping pattern, or playing the game Tetris) during and after the viewing of distressing film content, seems to interrupt the consolidation of analogue IMs, resulting in fewer reports of such thoughts during the subsequent days of diary keeping. In contrast, completion of verbal task during the viewing of the film resulted

in an increase in the number of reported IMs (see Holmes, Brewin, & Hennessy, 2004; James et al., 2016).

This pattern of findings has been interpreted as supportive of the dual representation theory of PTSD (Holmes et al., 2004). The theory claims that trauma related IMs, as a symptom of PTSD, occur because peritraumatic dissociation at the time of the event results in enhanced sensory encoding, combined with impoverished encoding of contextual and verbally accessible memory. These two memory traces, joined together under normal circumstances, become decoupled from one another. This sensory data, devoid of any verbally accessible contextual memory for the situation in which the traumatic event occurred, results in the repetitive, unwanted IMs that so many experience after the traumatic event. Therefore, interrupting this encoding with a visual spatial task, it is argued, will result in fewer subsequent IMs. And similarly, interrupting the verbal, contextual coding with a concurrent task, will contribute to an enhanced sensory perceptual encoding, resulting in a higher frequency of IMs (Brewin, Gregory, Lipton, & Burgess, 2010; Brewin, 2015).

Because the primary focus has been on frequency and the mediating influence of prior, concurrent or post-film tasks, the structure of the diary given to participants has been quite simple, without including many of the items that would normally be found in an IAM diary. Indeed, the majority of studies have used diaries which only sought to measure the frequency of IMs, and in a smaller number of cases – distress (see Marks, Franklin, & Zoellner, 2018). Very few studies have sought to measure a broader range of variables, and none (to our knowledge) have assessed triggers for IMs, concurrent tasks, or concentration levels at the time that IMs were experienced in everyday life.

How soon after viewing the film (i.e., the analogue trauma) do these memories begin to intrude upon consciousness? The pattern of recording film-related IMs in the diary shows quite consistently that the majority of such IMs are reported in the first few hours after

viewing the film, and taper off thereafter (James, Lau-Zhu, Clark, et al., 2016). In addition, available data from laboratory based studies of film-related IMs suggests that self-reports of such thoughts are highest during the period immediately following the viewing of the film (Green, Strange, Lindsay, & Takarangi, 2016b). Relatedly, it would be interesting to know if higher initial reports of IMs immediately following the film are predictive of higher reports in the days following (in the diary). There is some reason to believe that this would be the case. In a study of involuntary and intrusive musical imagery, Hyman et al. (2015) asked a group of psychology student participants to listen to a series of songs over the course of several weeks (one during each classroom session), and rate them along a number of scales (for familiarity, likability etc). At the following classroom session they were asked to report how often they had noticed the song playing in their mind over the intervening days. They found that participants who reported having the song in their mind as they left the initial lab session, later reported experiencing it much more frequently in the days following.

Questions have also been raised about the validity of self-reports of analogue IMs. Initial speculation was based on evidence from mind-wandering research that human can lack meta-awareness of the contents of our thoughts (Schooler, Reichle, & Halpern, 2004; Smallwood & Schooler, 2006). Given the distressing nature of IMs, however, it is by no means a foregone conclusion that people would similarly lack meta-awareness of the occurrence of this type of cognition. Two such studies sought to test this by asking participants to monitor their thoughts whilst performing a reading task after viewing a distressing film, and report any instances of an image from the film coming to mind. In one condition, however, participants were also intermittently stopped during the reading task (probed) and asked to report the contents of their mind. In this condition, between 25% and 29% of participants reported that they were thinking about the film when randomly probed in this fashion, leading researchers to conclude that participants may have lacked meta-

awareness for the occurrence of at least some analogue IMs (Takarangi et al., 2017, 2014). From this it might be inferred that such induced IMs occur more frequently after viewing the film than previously suggested by diary reports alone, though some subsequent findings have suggested this might be overestimated if researchers assume that all probe caught IMs are new cognitions as opposed to continuations of thoughts that were previously self-reported (Green et al., 2016b).

Questions also remain about the cues or triggers for such film-induced IMs. Oulton and Takarangi (2018) asked participants to view a series of distressing images and then complete a computer-based vigilance task. During the task, participants were randomly allocated to one of three conditions in which they were exposed to single cue phrases related to the images (e.g. knife), cue phrases in triplets (e.g. skull, sick, hunger) or no cue phrases at all. Participants were instructed to press a key to indicate that they had experienced an involuntary cognition related to the images (either intrusive memories or involuntary elaborative cognitions) and then asked to record the contents of this on a subsequent screen. When the content of these involuntary cognitions was analysed, it was found that participants in the no-cue condition reported fewer IMs than participants either in the single or triplet cue conditions. The latter two conditions, however, did not differ from each other in the number of IMs elicited (despite predictions that single cues would be more likely to elicit IMs). This resonates with findings from Vannucci et al. (2017) which showed that exposure to verbal cues was more likely to trigger periods of mind-wandering when compared to the absence of verbal cues. In addition, they also found that verbal cues prompted more instances of mind-wandering about the past when compared to participants who were not exposed to any cues.

Whilst there has been some exploration of cuing for analogue IMs under controlled laboratory conditions, there has been little investigation of this in a naturalistic environment. This would seem a fruitful line of enquiry, given how it might facilitate comparison between

the triggers for such cognitions, and the triggers for naturally occurring IMs as well as IAMs. Whilst it has been shown that the majority of triggers for IAMs are environmental in nature and are often based on abstract and verbal information (Mace, 2004), the picture is less clear for IMs generally, and analogue IMs in particular. Whilst there is some evidence that cues for naturally occurring IMs are sensory perceptual in nature (Ehlers et al., 2004), there has been little investigation of this with regard to analogue IMs. Therefore, a key aim of the present study was to examine the nature of these triggers as well as concurrent activities reported by participants. An additional aim was to determine if the reported triggers were primarily sensory-perceptual in nature, or if they aligned with the pattern identified with IAMs where slightly larger (or comparable) proportions of triggers have been reported as being more verbal and abstract than sensory-perceptual (Mace, 2004; Schlagman, Schulz, & Kvavilashvili, 2006).

Intrusive memories are often based on highly vivid mental images of the original traumatic event (Brewin et al., 2010). Certain naturalistic (e.g. peritraumatic dissociation) and experimental (e.g. concurrent verbal tasks during the viewing of distressing imagery) conditions seem to facilitate the formation of these highly vivid, image-based IMs. But in terms of individual differences, some questions remain about whether people who have a trait tendency toward the use of visual imagery are more likely to experience IMs. With regard to standard autobiographical memories, a relationship has been found between high levels of vividness and object imagery, and greater frequency of involuntary and voluntary autobiographical memory retrieval. In individuals with high levels of object imagery, IAMs were also more detailed and vivid (Vannucci, Pelagatti, Chiorri, & Mazzoni, 2015). On this basis, it might be anticipated that people who are found to score higher on scales of imagery would also report more frequent and vivid IMs relative to people to who score low on such scales. And there have been some resonant findings with regard to flashbacks and nightmares

in people diagnosed with PTSD, where the frequency of these correlated positively with visual imagery ability (Bryant & Harvey, 1996).

Finally, content and length of the films has also varied considerably in these experiments. Some studies have used thematically consistent content, but a majority are using a compilation of clips of varying content including road traffic accidents and other dangerous incidents (e.g., elephant stampede). One study, however, found that exposure to thematically consistent content (in this case, an assault) yields more film-related IMs than varied content (Weidmann, Conradi, Gröger, Fehm, & Fydrich, 2009). The length of many trauma films has been 9 to 10 minutes or more, though more recently some studies have used shorter formats (James et al., 2016).

Given the above mentioned, under-explored areas in research using the trauma-film paradigm, there are a number of questions driving the present studies. Firstly, what are the reported triggers for analogue IMs, and do they follow a similar pattern of reported triggers for naturally occurring IMs as well as IAMs? Specifically, are the majority of triggers for analogue IMs environmental as is the case with IAMs, or are they reported as arising internally in response to participants' own thoughts? Alternatively, maybe it is difficult to identify the triggers for such thoughts, as is the case with a small proportion of IAMs (Berntsen, 1996; Schlagman & Kvavilashvili, 2008). Finally, IAMs have comparable proportions of triggers that are abstract/verbal and sensory/perceptual (Mace, 2004; Schlagman et al., 2006), but it is unclear whether this pattern will map onto analogue IMs.

Additional unaddressed questions relate to the tasks in which people report being engaged when their film-related IMs come to mind, and the level of concentration these tasks demand. In addition, what impact will a shorter, fragmented but thematically consistent film have on the frequency and content of IMs reported in both the lab and the diary in the days following? Will a relationship be evident between higher initial experience of IMs (in the lab

shortly after viewing the film) and higher reports of IMs in the diary in the days following? Finally, will a relationship be found between measures of mental imagery use and vividness and the frequency of IMs reported in the lab and diary?

These questions were addressed in two separate trauma-film studies. The first pilot study (Study 4a) was exploratory in nature, recruiting 30 undergraduate participants and asking that they watch a 5-minute compilation of road safety advertisements and report any IMs they experienced in the lab shortly thereafter, and in a diary during the 72 hours immediately following the lab session. At the request of the ethics committee, participants were carefully screened for current symptoms of depression or PTSD. Given that the majority of trauma-film studies have used longer films with varied content, and limited recording of IM occurrence in the lab and IM phenomenology via the diary, the primary goals of this pilot study were: 1) to examine whether a 5-minute thematically consistent clip would elicit a reliable number of film based IMs in the lab and during the 72 hour period following the lab session similar to other studies that have used longer and more thematically varied clips; 2) to examine whether initial IM reports in the lab correlate with later reports in the diary; 3) to examine whether measures of mental imagery use and vividness correlate with frequency of IM reports in the lab and the diary; 4) to determine the triggers for IMs reported in the diary; 5) to examine the phenomenology of IMs reported in the diary, namely the vividness of reported thoughts, concurrent ongoing tasks and participants' concentration levels.

With regard to Study 4a, a number of predictions were made. Firstly, it was predicted that participants would report environmental triggers for their film-related IMs with much greater frequency than their own thoughts or 'no trigger', but that unlike findings on ordinary IAMs, these triggers would be primarily sensory-perceptual in nature. In line with findings in IAM research, it was predicted that concurrent activities when IMs came to mind would be cognitively undemanding, and require little concentration for successful completion. Finally,

it was predicted that higher scores on measures of mental imagery use and vividness (in this case the Vividness of Visual Imagery Questionnaire (VVIQ) and Spontaneous Use of Imagery Scale (SUIS)) would correlate with the frequency of IM reports in the lab and the diary.

5.2 Method - Study 4a

5.2.1 Design

The study followed an exploratory, observational design whereby all participants followed the same procedure and completed the same tasks.

5.2.2 Participants

Participants were recruited opportunistically from the University of Hertfordshire Campus. Pre-screening questionnaires were completed by 60 participants of which 30 (12 males and 18 females) were invited to a laboratory session based on their fulfilment of the selection criteria (score of 2 or below on the Primary Care PTSD Screen (PC-PTSD; Prins, Ouimette, Kimerling, Camerond, et al., 2003) and 8 or below on the depression sub-scale of the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). This was done to ensure that only participants who were well (e.g., not in a state of heightened distress or experiencing poor mental health) were invited to the laboratory.

Three participants did not return their diary booklets, and one did not complete any full diary entries. These were excluded from further analyses, resulting in a final sample of 26. The mean score on the PC-PTSD was 0.73 (*SD*=0.92, *range* 0-3)[15], whilst mean scores on the anxiety and depression subscales of the HADS were 7.0 (*SD*=3.58, *range* 0-13) and 3.73 (*SD*=2.15, *range* 0-8) respectively. Participants also completed the Spontaneous Use of

[15] One participant, out of 26, scored 3 on the PC-PTSD. When this was examined against their scores on the HADS it was deemed unlikely that they were experiencing symptoms of PTSD, and in fact more likely that they did not read the instructions properly for how to complete the PC-PTSD. For this reason, they were allowed to proceed with their participation.

Imagery Scale (SUIS; *M*=37.73, *SD*=8.39, *range* 23-53) and the Vividness of Visual Imagery Questionnaire (VVIQ; *M*=36.0, *SD*=7.91, *range* 21-56). Participant ages ranged from 18 – 24 years (*M*=20.27, *SD*=1.34), with 15 females and 11 males.

5.2.3 Materials

Primary Care PTSD Screen (PC-PTSD; Prins et al., 2003; see Appendix XII): This is a 4-item measure developed for use in primary care settings to offer a quick and un-intrusive means of determining whether patients may have some symptoms of PTSD. As the name suggests, this is not a diagnostic tool in its own right, but can help clinicians determine whether further testing is warranted. Respondents give 'yes' or 'no' answers to 4 questions about whether they have experienced symptoms such as nightmares, avoidance, heightened vigilance or detachment over the past month in response to a traumatic event. Typically, indicating yes to three or more of the questions is sufficient to trigger follow-up evaluation for PTSD. The PC-PTSD showed good retest reliability at development, with a high correlation (Pearson's coefficient of 0.83, $p<.001$) between initial scores and one month follow-up (pre-treatment). The validity of the measure was reflected in the similarly high Spearman correlation (0.83, $p<.001$) between the results of the PC-PTSD and the Clinician Administered PTSD Scale (CAPS).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983): See Study 3b (Chapter 4; Appendix XI).

Spontaneous Use of Imagery Scale (SUIS; Reisberg, Pearson, & Kosslyn, 2003; see Appendix XIII): This is a 12-item questionnaire used to measure the extent to which people spontaneously use imagery in daily life. Respondents rate each item as 1 to 5 depending on how much they feel it applies to them (1 = *never appropriate*, 3 = *appropriate about half the time*, 5 = *always completely appropriate*). Sample items are "I prefer to read novels that lead me easily to visualize where the characters are and what they are doing instead of novels that

are difficult to visualize," or "When I first hear a friend's voice, a visual image of him or her almost always springs to mind". The overall scores are derived from adding up responses on the 5-point scale for each question. The minimum score is therefore 12 and the maximum is 60, with higher scores indicating higher use of mental imagery in daily life.

The SUIS demonstrated a high level of internal consistency at development, with all items on the scale correlating highly with each other (coefficient of 0.98 or greater; Reisberg et al., 2003). Subsequent analysis with a Dutch translation of the scale largely replicated these reliability results across 3 different samples (α=0.76, α=0.72, α=0.72 respectively). In terms of scale validity, that study furthermore found a significant inverse correlation between the SUIS and the Vividness of Visual Imagery Questionnaire (VVIQ: the inverse relationship being a function of the way the latter measure is scored – see below; Nelis, Holmes, Griffith, & Raes, 2014).

Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973; see Appendix XIV): This is a 16-item scale used to measure the vividness of mental imagery. Respondents are presented with a mental image prompt - such as the face of a friend or relative who they often see, a rising sun, a shop they often visit, and a country scene – and asked to respond to a series of questions regarding the resultant image that comes to mind. For example, after being asked to "visualize a rising sun" and "consider carefully the picture that comes before your mind's eye", respondents are asked to rate the vividness of their mental imagery following statements such as "The sun is rising above the horizon into a hazy sky" or "The sky clears and surrounds the sun with blueness." Responses to each item are on a scale of 1 to 5 (1 = *perfectly clear and as vivid as normal vision*; 2 = *clear and reasonably vivid*; 3 = *moderately clear and vivid*; 4 = *vague and dim*; 5 = *no image at all, you only "know" that you are thinking of the object*), and are added together to determine final score. Overall scores range from 16 to 80, with lower scores indicating higher levels of vividness in the mental imagery.

The reported retest reliability of the VVIQ was good (coefficient of 0.74), as was the split-half reliability (coefficient of 0.85; Marks, 1973). Subsequent analysis has found the measure to show high internal consistency (α=0.91) and good construct validity, reflected in significant Pearson correlations (p<0.01) with both Gordon Test of Visual Imagery Control and the Bett's Questionnaire Upon Mental Imagery (Campos & Pérez-Fabello, 2009; Marks, 1989).

Film Clips: The film was a shortened version of that used by Holmes, James, Coode-Bate, and Deeprose (2009). Instead of varied subject matter (cutting a face, elephant stampede, etc), only the clips relating to road safety were retained, resulting in a 5-min film consisting of 5, thematically consistent clips.

- *'It's 30 for a reason' (2005):* A young girl is leaning against a tree on the side of a suburban street, with blood dripping out of her ear. Her voice explains that if she is hit at 40 miles per hour there is an 80% chance she will die. The clip continues in reverse sequence, as the blood disappears from her face, her bones crack back into place, and her body slides back into the centre of the street. The clip ends with the girl sitting up and taking a sharp breath, presumably the moment just before she was hit by the car.
- 2) '*Pay Attention or Pay the Price' (2002):* A teenage boy and girl flirt with each other via text message as they leave school separately, accompanied by friends. They eventually spot each other across the road. She sends a final text to him, and as he is reading it, he steps into the road and is hit by a van. The girl screams. The windscreen of the van shatters upon impact with the boy's body. He is thrown in front of the van and lands heavily on the pavement, blood escaping from his mouth. The clip cuts away to a casket being carried at the boy's funeral, and ends by focusing the girl's face as she is crying.

- 3) *Anti-Drink/Drive [Shame] (2000):* This television advertisement features two parallel narratives that intersect at the end. In one, a father is playing with his young son and daughter in their back garden. In another, a young man is playing football with friends, and then is shown drinking at the pub after the game. As the young man is driving home from the pub his wheel catches on a verge. The car rolls over and crashes through the fence of the garden in which the father and children were playing. The young boy is run over by the car, and the clip ends with the father holding the young boy's lifeless body and crying, with the driver looking on.
- 4) *'No Seatbelt, No Excuse':* A teenage couple (boy and girl) are picked up in a car by some friends. A narrator's voice advises that today the boy (Michael) is going to hit the girl so hard that she will end up with brain damage. Shortly after this the car is involved in a collision. All passengers except the Michael are wearing seatbelts. In slow motion, his body is jerked violently forward and backward. His head makes contact with that of his girlfriend, and then shatters the car door window. The clip cuts away to an emergency medical technician communicating over a radio. He says that three people in the vehicle have died, and one is in critical condition, and that this is the result of one passenger not wearing a seatbelt. The clip ends with 3 body bags in view, and a member of emergency services shutting the van door.
- 5) '*The Faster the Speed, The Bigger the Mess':* A young couple are embracing as she is sat on a stone wall, and he stands in front of her. A car careens around the corner, flips over, and slides across the road, pinning the couple to the wall. The young woman screams while her boyfriend is motionless. The clip cuts away her being treated in hospital, and the young

man's parents identifying his body in the morgue. The penultimate scene features the young woman in court as the driver of the vehicle is sentenced. We learn from a final scene that he was speeding but swerved to avoid a border collie in the road. The clip ends showing her in a wheelchair, visiting her boyfriend's grave.

Emotion and Involvement Scales: Immediately before and after watching the film, and at the end of the session, participants rated the degree to which they were feeling certain emotions on a series of 7-point Likert scales (1=*not at all*, 4=*moderately*, 7=*very much*) by indicating how angry, happy, anxious, sad, and disgusted they were feeling (adapted from Weidmann et al., 2009). In addition, immediately after watching the film, on similar 7-point scales (1=*not at all*, 4=*moderately*, 7= *very much*) participants indicated how distressing they found the entire film clip, and how involved they felt in the events depicted.

Diary of film-related IM (see Appendix XV): All participants received A5 booklets in which to record any memories or images from the film that popped to mind over a 3-day period following the first meeting. The diaries consisted of 32 pages, though participants were advised that if they ran out of pages, they would be provided with another booklet.

Each page consisted of 11 questions that participants had to answer either in their own words or choosing an option from a rating scale. In **question one**, participants had to record the time and date that the IM was experienced, and in **question two** the time and date it was recorded in the diary. In **question three** they provided a brief written description of the film-related image or memory that popped to mind, and in **question four** indicated whether there was any trigger (*in your thoughts, in the environment, no trigger*). If there was a trigger, they were asked to describe what it was **question five**. Participants also described the activity they were involved in (**question six**) and rated their levels of concentration (1=*not at all*, 5=*fully concentrating;* **question seven**). Vividness was rated on a 7-point scale (1=*very vague*,

almost no image, 7=*extremely vivid, almost like normal vision;* **question eight**). In **question nine**, participants indicated their mood prior to experiencing the memory (1=*extremely negative*, 4=*neutral*, 7=*extremely positive*), and in **question ten** how distressing they found the memory (1=*not distressing at all*, 4=*moderately distressing*, 7=*extremely distressing*). Finally, participants were asked what effect the memory from the film had on their mood (1=*no effect*, 4=*neutral*, 7=*it made me feel a lot worse;* **question eleven**).

A grid was printed in the inside front cover of the diary, divided according to the number of days of diary-keeping (in this case 4 days of the week, spanning a 72-hour period). Participants were advised that if enough time elapsed between experiencing a film-related IM and having an opportunity to record it such that they felt un able to recall details such as what they were doing at the time, how vivid the memory was etc, they had the choice of placing a tick in this gird next to the corresponding day. It was emphasised that full entries were always preferable, but that they could place as many ticks in this grid as they needed to in order to best reflect the true frequency of their film-related IM.

Debriefing questionnaire: After returning the diary, all participants answered several questions designed to measured compliance with the diary method. For example, participants had to indicate how many days (out of 3) they forgot to keep a diary with them. If there was a reason they did not keep the diary with them every day, participants were asked to indicate this. They were then asked how difficult they found keeping a diary of their film related IMs (*very easy, somewhat easy, somewhat difficult, very difficult),* and what percentage of all film-related IMs they experienced were recorded in the diary. If they deliberately did not record some of their film related IMs in the diary, they were asked the reason for this. Finally, participants were asked whether they found the process of diary keeping at all useful and if so why, and given space to record any additional comments.

5.2.4 Procedure

Initial participant screening using the PC-PTSD and the HADS was conducted online through Qualtrics. Along with online screening questionnaires, participants also completed the SUIS and the VVIQ, though scores on these did not form part of the inclusion/exclusion criteria. Eligible participants were invited to take part in the study, and those that accepted were tested individually in a psychology laboratory.

On the day of testing, participants were advised several times that the content of the film was potentially distressing in nature, and that they could withdraw at any point without consequence. Those who had personal experience of an automobile accident – as something they or someone close to them had experienced – were strongly advised not to participate in the study.

Before watching the film, participants were given particular verbal instructions about how to view it:

> *These films clips you are about to watch include scenes of road traffic accidents, which may contain some graphic details, and which may be unpleasant to watch. If at any point you would like to stop the film please tell me straight away.*
>
> *For the next 5 minutes, we will show you a film. It is important that you keep concentrating on what is happening in each scene. Please try to watch each scene completely. If possible, try not to get distracted from the film, do not turn your head or look away. While watching the film, please imagine yourself being a close witness at the scene. For the purpose of our study, it is important that you let go of whatever reactions you may have and that you do not suppress them.*

The researcher confirmed one final time with the participant that they were ready, started the film, and then left the room. However, immediately before starting the film, the researcher asked participants to complete the 7-point scales (1=*not at all*, 7=*very much*) to measure the degree to which they were feeling angry, happy, anxious, sad and disgusted. When the researcher re-entered the room after the film screening, participants were asked to complete these again, along with two additional 7 points scales to measure feelings of distress, and the extent to which participants felt involved in the events depicted in the film clip. The researcher

then left the room for an additional 2 minutes, under the guise of filing away the scales. Upon returning, however, participants were asked if they experienced any memories or images from the film while they had been on their own. If they had done, they were asked which specific portions of the film came to mind, and how many times over the 2-minute period.

The entire lab session lasted approximately half an hour. At the end, participants were given the diary to record their film-related IMs over the 72 hours immediately following the end of the lab session, along with detailed instructions about how to do so. The date of the lab session and the time they were to begin recording were written on the front of the diary, as well as the date and time that they were to finish (e.g., if the lab session ended at 1:30 pm participants would begin recording immediately when they left, and finish exactly 72 hours later). The 32-page structured diary had 11 questions to which participants were asked to respond each time they experienced a film-related IM. To clarify, film-related IMs were defined as *"spontaneous images, sounds or thoughts that you may have about specific scenes from the film, which pop into your mind without you trying to recall anything."*

Thorough precautions were taken to ensure the wellbeing of participants. Before leaving the lab, they were given details of support services (on and off-campus) in the event that they found the film unduly distressing. To ensure that their emotional state had returned closer to baseline, they were given one final set of 7-point scales on which to rate how angry, happy, anxious, sad and disgusted they were feeling. In the event that a participant did become highly distressed, provision was made for them to speak to a clinical psychologist affiliated with the research team. At no point, however, was this necessary.

Before participants left the lab session, a date and time for the second meeting was set, as close as possible to the time that participants stopped recording their film-related IMs. At the second meeting, participants returned their diary and completed a final set of mood scales. They then completed a short debriefing (compliance) questionnaire about their adherence to

the diary keeping and what, if anything, they felt they gained from the experience. Before leaving they were given a final debrief sheet, and the opportunity to ask any questions they may have had.

5.3 Results - Study 4a

All participants viewed the compilation of road traffic accidents and kept the diary of their film-related IMs for 72 hours. For all inferential analysis, the alpha level was set to 0.05. In cases where Mauchley's Test was found to violate the assumption of sphericity, degrees of freedom were corrected using Greenhouse-Geisser (ε <.75) or Huyhn Feldt (ε >.75) estimates of sphericity (Field, 2013).

5.3.1 Manipulation Checks and Diary Compliance

In order to examine the emotional impact of the film, the three collection points (Time 1 - just before the film, Time 2 - just after the film and Time 3 - the end of the lab session) for the five emotions (anger, happiness, anxiousness, sadness and disgust) that participants rated during the lab session (on a 7-point scale) were entered into a series of one-way repeated measures ANOVAs. The results are presented in Table 5-1. Participants registered a significant change overall in each of the five emotions. Bonferroni corrected pairwise comparisons show a significant change between scores recorded at Time 1 and Time 2 (with ratings for anger, anxiousness, sadness, and disgust going up after viewing the film, and ratings for happiness going down; all p<0.03). There was also a significant difference between Time 1 and Time 3 in the ratings given to happiness, disgust (both p=.001) and sadness (p=.049) suggesting that people remained significantly less happy and significantly more disgusted and sad when they left the lab than when they arrived. The mean disgust rating, however, dropped from Time 2 to Time 3 (p=.001), suggesting people improved appreciably since the moment just after watching the film. This was also true for the Time 2 and 3 collection points for sadness (p=.008) and anxiousness (p=.001). Even though the film

had a measurable impact on these mood scales, the mean ratings remained relatively low throughout (always below the mid-point for negative emotion). Overall this suggests a relatively minor impact of the film on mood.

Table 5-1: *Mean (SD) ratings for each emotion as a function of collection time, along with the results of a one-way, repeated measures ANOVA.*[c]

	Time 1	Time 2	Time 3	*F*	*p*	η^2
Angry	1.35 (0.71) [a]	2.00 (1.28) [b]	1.57 (0.84)	6.34	.004	0.22
Happy	4.70 (1.11) [a, b]	3.30 (1.49) [b]	3.78 (1.59)	19.69	.001	0.47
Anxious	2.17 (1.07) [a]	2.91 (1.24) [b]	2.00 (0.74)	8.15	.001	0.27
Sad	1.61 (0.99) [a, b]	2.87 (1.52) [b]	2.13 (1.52)	12.36	.002	0.36
Disgusted	1.17 (0.39) [a, b]	2.91 (1.12) [b]	1.91 (0.95)	32.63	.001	0.60

[a] Reliably different from Time 2
[b] Reliably different from Time 3
[c] Because not all participants completed all PANAS scales, the means are based on the data from 23 participants.

Compliance with the diary task was good overall, with only three participants reporting that they failed to keep the diary on one of the three days of diary keeping, resulting in a low mean number of days that the diary was not kept (*M*=0.19, *SD*=0.49). Participants estimated that, out of a total number of intrusions experienced over the 72-hour period, they managed to record an average of about 79% of film related IMs (*SD*=25.11; *range*=2.00 to 100.00).

5.3.2 Number of Film Related Intrusions Reported in the Lab and in the Diary

One aim of Study 4a was to examine the frequency with which participants reported IMs shortly after viewing the film, whilst still in the lab, and how this compared to IM reports in the diary during the 72 hours following the lab session. To this end, during the lab session participants were left on their own for two minutes after watching the film, and subsequently asked if any images from the film came to their mind during that period of time. Out of 26 participants, 22 (85%) indicated that this was the case. The mean frequency of film related

IMs reported during this 2-minute period was 2.73 (*SD* = 2.14, *range* 0 - 9, *median* = 2.5). By comparison, all 26 participants returned their diary to a member of the research team, resulting in 90 full diary entries (*M* = 3.46, *SD* = 1.92, *range* 1 - 9, *median = 3.0*) and 69 ticked entries (*M* = 2.65, *SD* = 3.37, *range* 0 - 11, *median* = 1.5), totalling 159 IMs (*M* = 6.04, *SD* = 4.26, *range* 1-15, *median* = 5.0).

5.3.3 Number of IMs recorded in the diary each day

In addition to overall recording frequency in the diary, the number of IMs reported per day was examined, to determine whether frequency declined over time. Because participants recorded their film-related IM in a diary for 72 hours, the recording per day is divided into 4 to reflect the day they were given the diary, the two intervening (24 hr) days, and the day they returned it. The results of two, separate one-way, repeated measures ANOVAs showed the significant main effect of day for fully recorded entries $F(3, 54) = 6.62$, $p = .001$, $\eta^2 = 0.27$, but not for ticked entries $F(2.11, 38.01) = 2.01$, $p = 0.15$, $\eta^2 = 0.10$. Planned comparisons revealed a significant drop in the frequency of full diary entries between the first and second days of diary keeping ($p = 0.03$), but not between the second and third days ($p = 0.35$), or the third and fourth days ($p = 0.41$). In other words, the number of IMs reported on day one was higher than day two, three, and four, all of which did not differ from each other (see Figure 5-1).

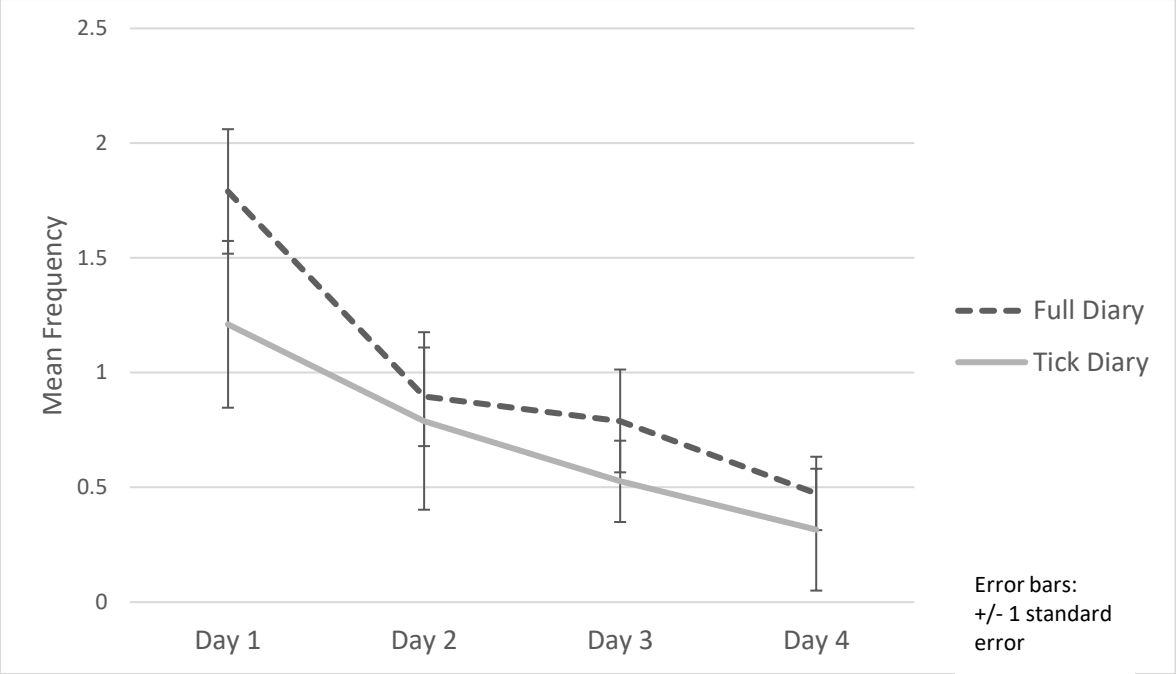


Figure 5-1: *Mean frequency of full and tick diary entries, as a function of day.*

5.3.4 Reported Triggers for IMs

For each of the film-related IMs reported in the diary, participants indicated whether they believed this to be triggered by something in their environment, by their own thoughts, or as having no trigger. The proportion of triggers within each of these categories, out of total number of IMs recorded, was entered into a one-way ANOVA with trigger category (environment, own thought, no trigger) as a within subject variable. Results show a main effect of trigger type $F(1.71, 42.83) = 6.73$, $p = .004$, $\eta^2 = .21$ (see Figure 5-2). Pairwise comparisons (LSD) revealed that the proportion of environmental triggers was higher than the proportion of own thought triggers ($p<.001$), but not reports of 'no trigger' category ($p =$. 26). The proportion of 'no trigger' reports, however, was significantly higher than own thought triggers ($p = .014$).

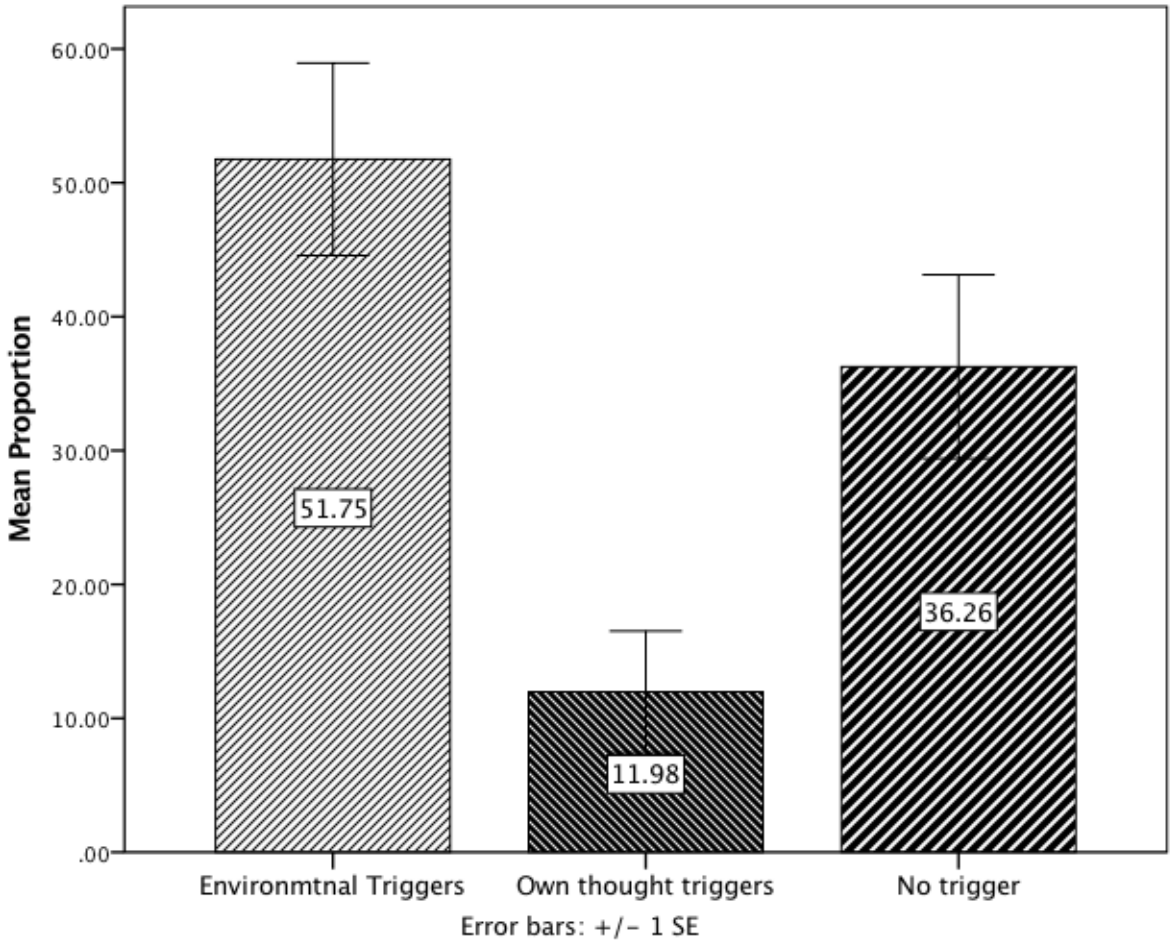


Figure 5-2: *Means of proportions of trigger type reported in the analogue IM diary.*

In those cases where participants reported a trigger as either environmental or their own thoughts, they were asked to describe the trigger in their own words. These were coded according to the scheme developed by Mace (2004) into abstract/verbal, sensory/perceptual, physiological/emotional state, and unclassifiable/undecided. The abstract/verbal category refers to instances where a memory is triggered by one's own thoughts, or by a written word or words detected in the immediate environment (e.g. "article about a car accident" or "conversation about driving"). Conversely, the sensory/perceptual category pertains to objects, smells and sounds in the environment (e.g. "walking past a car next to a fence" or "in a car and driver was texting whilst driving"). Physiological/emotional state triggers arise from one's own experience of one's physical body (e.g. hunger, pain) or emotions (e.g.

anger, sadness). Those triggers that could not be categorised into one of the above were coded as unclassifiable/undecided.

The mean proportion of each type of trigger (out of the total number of triggers reported) was calculated by participant and entered into independent samples t-test. The mean value of these proportions across 22 participants is represented in Figure 5-3 (four of the participants reported all of their thoughts as having no trigger and were therefore excluded from the analysis). None of the cases were coded as arising from a physiological/emotional state, nor were any deemed unclassifiable. The results of the independent samples t-test showed the difference in proportion to be significant $t(21) = -3.27$, $p = .004$ (see Figure 5-3).

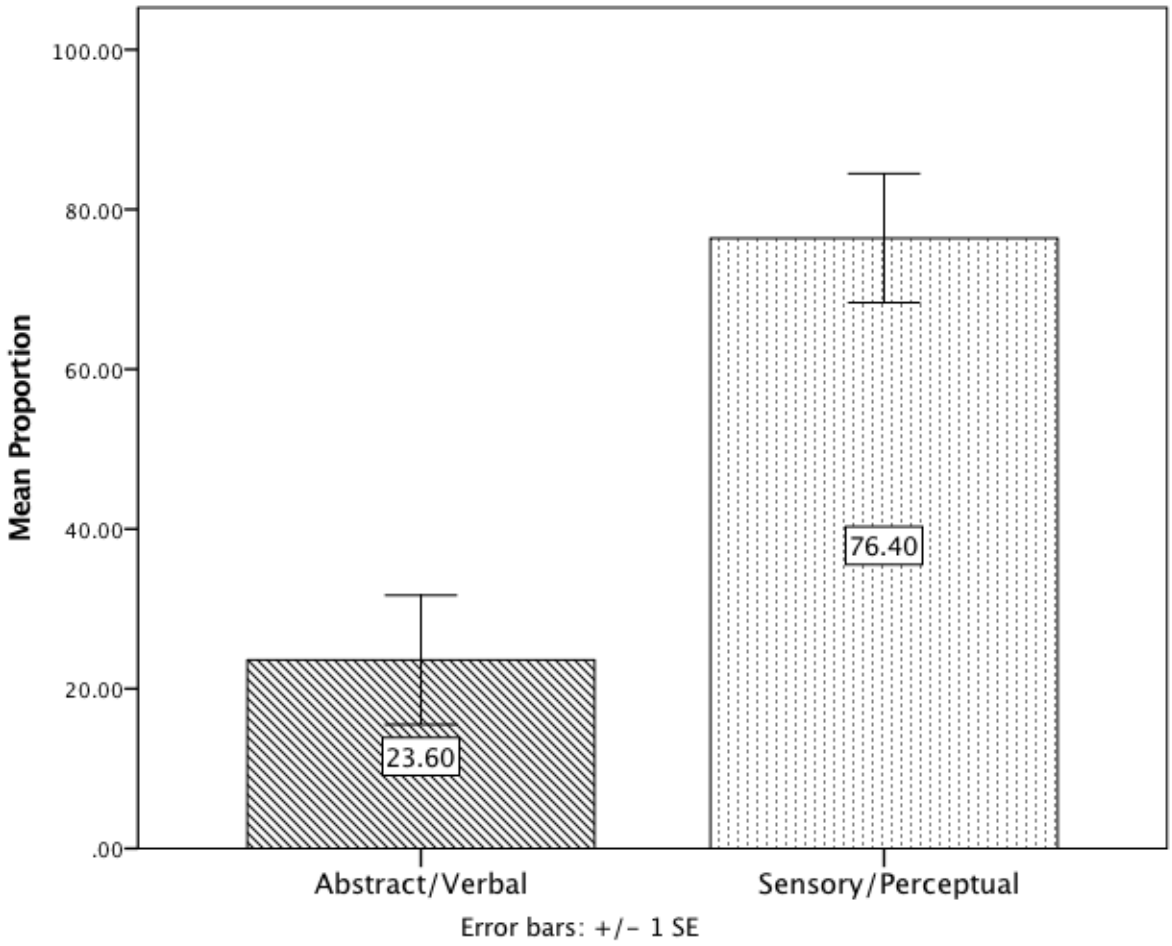


Figure 5-3: *Mean proportions of trigger reports as a function of modality.*

5.3.5 Conditions in which IMs were reported to occur

In each diary entry, participants were asked to describe the activity in which they were engaged when the IM came to mind. These were coded as either habitual tasks that did not require a high level of concentration (e.g., walking, eating lunch, washing dishes) or controlled activities requiring a higher level of focus (e.g., doing revision, editing a film, talking to a friend; see Kvavilashvili & Mandler, 2004). For each participant, the proportion of IMs recorded during habitual tasks and the proportion of IMs recorded during controlled activities were calculated. A mean proportion of 48.74 (*SD* = 35.61) of these activities were coded as habitual, while a mean proportion of 51.26 (*SD* = 35.61) were coded as controlled. The results of a paired samples t-test on these mean proportions showed this difference to not be significant $t(24) = -0.18$, $p = 0.86$.

In addition, the mean concentration rating reported was 2.85 (*SD* = 1.23). Examining the distribution of concentration ratings that participants gave across the 5-point scale (1=*not concentrating at all*, 5=*fully concentrating*) showed that the mean proportion of IMs that participants reported while being in a state of low concentration (points 1 and 2 on the scale), medium concentration (point 3 on the scale) and high concentration (points 4 and 5 on the scale) were 37.78 (*SD* = 35.56), 25.55 (*SD* = 33.29) and 34.72 (*SD* = 36.23), respectively. These were entered into a one-way, repeated measures ANOVA, but no significant differences were found ($F<1$). Effectively, these means indicate that the majority of IMs memories were reported to occur when participants experienced low to medium levels of concentration on the tasks at hand which is reflected in the overall mean concentration rating reported above.

5.3.6 Correlations Between Imagery Scores and Frequency of Reported IMs

It was predicted that higher reported levels of vividness of mental imagery would correlate with more frequent reports of film-related IMs in the lab and in the diary, as well as

higher levels of reported distress and involvement after viewing the film. Spearman's correlations (one-tailed) were conducted on SUIS and VVIQ scores and IM frequency as reported in the lab and diary (see Table 5-2). In terms of reported frequency of IMs, the only significant relationships found were between the number of full diary entries and VVIQ scores (p=.014), as well as between the total number of entries (full entries plus tick entries) and VVIQ scores (p=.027).

Table 5-2: *Correlations between imagery scales and frequency of IM reporting.*

	Spontaneous Use of Imagery Scale (SUIS)	Vividness of Visual Imagery Questionnaire (VVIQ)
Post-film IM	-.164	-.231
Full diary entries	.068	-.431*[1]
Tick diary entries	.025	-.168
Full + Tick diary entries	.106	-.382*[1]

* Correlation is significant at the 0.05 level.
[1] The response scale on the VVIQ means that lower scores equal higher levels of vividness (e.g. 1 = *perfectly clear and as vivid as normal vision*; 5 = *no image at all, you only "know" that you are thinking of the object*).

5.3.7 Additional Findings

5.3.7.1 Correlations of Frequency, Distress and Involvement Ratings

There was not a significant correlation between the frequency of fully recorded and ticked diary entries of IMs $r_s(25) = -.254$, $p = 0.105$. The number of fully recorded IMs and ticks also did not correlate with the number of IMs reported immediately after watching the film in a 2-minute waiting period in the laboratory $r_s(25) = .099$, $p = 0.32$, and $r_s(25) = -0.25$, $p = 0.11$, respectively (both tests were one-tailed).

Overall mean ratings of distress taken just after viewing the film were 5.08 (SD = 1.20) a seven-point scale. Overall mean ratings of involvement were 3.88 (SD = 1.75) on an identical scale. Spearman's correlations (one-tailed) between these post-film distress and involvement rating and IM frequency showed no significant relationships (see Table 5-3).

Table 5-3: *Spearman's correlation's between IM frequency as reported in the lab and diary, and participants' ratings of involvement and distress in the laboratory.*

	Post-Film Distress	Post-Film Involvement
Lab reports	-0.17	-0.16
Full diary entries	0.09	-0.09
Tick diary entries	.220	.171
Full + Tick diary entries	.049	.131

5.3.7.2 Characteristics of IMs reported in the diary

Film related IMs reported in the diary were rated on a number of scales, including vividness of reported IMs, distress, self-assessed mood prior to experiencing the IMs, and the impact that IMs had on their mood. Mean ratings on each scale were calculated for each participant by averaging the ratings on a scale for a total number of film-related IMs reported by the participant. The mean ratings across all participants are presented in Table 5-4. Each measure was on a 7-point scale, as outlined in the method section, with higher numbers indicating greater vividness, positivity (in the case of participants' assessed mood prior to experiencing the memory), distress, and how much worse experiencing the memory made them feel.

Table 5-4: *Mean ratings, (SD, range) for IMs reported in the diary over the 72 hours of diary keeping.*

	Mean	***SD***	***Minimum***	***Maximum***
Vividness	*4.14*	*1.50*	*1.00*	*7.00*
Distress	*3.35*	*1.61*	*1.00*	*7.00*
Mood before IM	*4.32*	*0.94*	*2.00*	*7.00*
Impact on Mood	*2.68*	*1.65*	*1.00*	*6.67*

Ratings for vividness are somewhat lower than might be expected in the case of IMs (Kvavilashvili & Schlagman, 2011). And distress ratings are below the median, highlighting possible experiential differences between these and naturally occurring IMs.

5.3.7.3 Film Clips Reported

We also examined potential differences in the frequency with which participants reported particular film clips as the basis for their IMs. The mean frequency with which each of the five clips in the film was reported in the lab, in the diary, and overall, is represented in Table 5-5. These were entered into a 2 (context: Lab vs Diary) x 5 (Clip number) mixed ANOVA with repeated measures on both factors. There was no significant main effect of context ($F<1$), showing no difference in the frequency of clip reports in the lab versus the diary. There was, however, a main effect of clips $F(2.26, 56.37)=9.69$, $p<.001$, $\eta^2=.279$, but no interaction between context and clips $F(2.94, 73.55)=1.28$, $p=.288$, $\eta^2=.049$. Bonferroni adjusted pairwise comparisons showed that Clip 5 was reported more frequently than Clip 1 ($p=.004$), Clip 2 ($p<.001$) and Clip 4 ($p=.021$), but not Clip 3 ($p=.340$). There were no differences in the frequency of reporting between the other clips.

Table 5-5: *Mean frequency (SD) with which each of the film clips was reported in the lab and the diary.*

	Clip 1	Clip 2	Clip 3	Clip 4	Clip 5
Lab	0.12 (0.43)	0.12 (0.33)	0.73 (1.22)	0.23 (0.51)	1.23 (1.18)
Diary	0.35 (0.63)	0.42 (0.76)	0.50 (0.58)	0.46 (0.81)	1.12 (1.48)

It is difficult to say with certainty whether this result arises because of recency effects or the emotional impact of the film clips. The mean distress ratings per clip derived from

participants' diary entries suggests that clip 5 was least distressing overall (*M*=3.18, *SD*= 1.48, *n*=13). Clip 3 was given the highest mean distress rating (*M*=4.08, *SD*= 1.68, *n*=12), whilst ratings for clip 1 (*M*=3.43, *SD*= 1.10, *n*=7), clip 2 (*M*=3.60, *SD*= 1.94, *n*=8) and clip 4 (*M*=3.96, *SD*= 2.10, *n*=8) fell somewhere in between.

5.4 Discussion - Study 4a

Several important findings emerged from this study. Firstly, it was found that a brief, 5-minute compilation of thematically consistent clips resulted in participants reporting a reliable number of IMs in the diary, comparable to previous studies with longer or thematically more varied film clips (James, Lau-Zhu, Clark, et al., 2016). It was also found that the majority of triggers for film-related IMs were environmental as opposed to internal (own thought) or having no identifiable trigger. Of these triggers, the majority were sensory-perceptual as opposed to abstract/verbal or reflective of a physiological/emotional state. This pattern is what might be expected of naturally occurring IMs (Kleim et al., 2013), but differs substantially from the pattern previously found for IAMs (Mace, 2004; Schlagman, Kvavilashvili & Schulz, 2007). The enhanced number of reported IMs which had no apparent triggers compared to internal triggers is also different from a pattern that has typically been reported in the literature on ordinary non-intrusive IAMs(Berntsen, 1996; Schlagman & Kvavilashvili, 2008). In relation to the nature of ongoing activities, there was no difference in the frequency with which participants reported being engaged in habitual versus controlled activities when their film-related IM came to mind. Finally, there was no relationship between IM frequency and distress/involvement ratings, or IM frequency and scores on the SUIS. There was, however, a relationship between VVIQ scores and full diary entries, with higher vividness ratings correlating significantly with IM frequency (Vannucci et al., 2015).

Taken together, these findings have important implications for research on IMs using a trauma-film paradigm. They suggest that an IAM diary format can be easily adopted and

used in research on analogue IMs, and that this can facilitate examination of a number of theoretically and practically important research questions. This was the first study of this kind, however, with relatively small participant numbers. The aim of Study 4b was therefore to replicate these initial results on a larger sample of 64 participants. The procedure and materials used in Study 4b were almost identical to those used in Study 4a except that after watching the film all participants completed a brief 5-minute version of the vigilance task (see Studies 3a and 3b, Chapter 4). The presence or absence of film-related cue phrases was manipulated, as well as the inclusion or exclusion of instructions to stop the vigilance task and report the experience of film-related IMs.

However, a surprisingly low number of task-unrelated thoughts were reported during the vigilance task (whether film-related or film-unrelated) and the manipulation did not seem to have significant impact on diary reports of IMs when compared to the results obtained in Study 4a (with some minor exceptions, see below). Therefore, analyses reported in the results section will not consider this manipulation, and only the number of IMs reported in the diary will be reported and analysed. It was predicted that the diary results would replicate those found in Study 4a, particularly with regard to IM frequency, trigger reports and trigger modality, as well as the nature of ongoing tasks.

5.5 Method - Study 4b

5.5.1 Design

All participants completed identical tasks, including viewing the same 5-minute road safety advertisement compilation as in Study 4a, and recording any film related-IMs in a structured diary for 72 hours.

5.5.2 Participants

Participants were recruited from the University of Hertfordshire using an advertisement posted to the University intranet (StudyNet), and from outside the University

through personal contacts. Of 64 participants, 45 were female (19 male). The average age was 25.29 (*M* = 5.99, *range* 18 - 44). Participants represented a range of occupations, including student, shop assistant, registered nurse, mechanic, teaching assistant, chef, and local government officer.

5.5.3 Materials and procedure

The materials used in Study 4b were identical to study 4a, except for the use of the short vigilance task which participants completed immediately watching the film. When participants first arrived in the laboratory they were asked to complete the PC-PTSD, to determine whether they were experiencing sufficient post traumatic symptoms to warrant clinical follow-up. Whilst no participants were excluded on this basis, if any had answered yes to three or more questions on the 4-item scale, they would have been advised that they were not eligible to participate, and signposted accordingly.

All eligible participants were reminded from the outset that the study was examining the effects of attention and concentration on the frequency of intrusive memories in everyday life. They were given an information sheet, asked to provide informed consent, and were advised several times that the content of the film was potentially distressing in nature, and that they could withdraw at any point without consequence. Those who had personal experience of an automobile accident – as something they or someone close to them had experienced – were strongly advised not to participate in the study.

After completing the vigilance task, all participants were given the diary to record their film-related IMs over the 72 hours immediately following the end of the lab session, along with detailed instructions about how to do so. The date of the lab session and the time they were to begin recording were written on the front of the diary, as well as the date and time that they were to finish (e.g. if the lab session ended at 1:30 pm participants would begin recording immediately when they left, and finish exactly 72 hours later). As in Study 4a,

film-related IMs were defined as “spontaneous images, sounds or thoughts that you may have about specific scenes from the film, which pop into your mind without you trying to recall anything.”

At the second meeting, participants returned their diary, completed a short debriefing (compliance) questionnaire about their adherence to the diary keeping and what, if anything, they felt they gained from the experience. Before leaving they were given a final debrief sheet, and the opportunity to ask any questions they may have had.

5.6 Results - Study 4b

All participants viewed the film, and kept the diary of film-related IM for 72 hours. The alpha level for determining statistical significance was set at 0.05. In cases where Mauchley’s Test was found to violate the assumption of sphericity, degrees of freedom were corrected using Greenhouse-Geisser (ε <.75) or Huyhn Feldt (ε >.75) estimates of sphericity (Field, 2009).

5.6.1 Manipulation Checks and Diary Compliance

During the lab session, participants rated five emotions (anger, happiness, anxiousness, sadness and disgust) on a 7-point scale (1=*not at all*, 4=*moderately*, 7=*very much*) at the three different time points (time 1=just before the film, time 2=just after the film and time 3=the end of the lab session). The ratings for these emotions were entered into a series of one-way repeated measures ANOVAs. The results are presented in Table 5-6. Participants reported a significant change overall in each of the five emotions. Pairwise comparisons (LSD) showed a significant change between scores recorded at Time 1 and Time 2 (with ratings for anger, anxiousness, sadness, and disgust going up after viewing the film, and ratings for happiness going down; all p<.001). There was also a significant difference between Time 1 and Time 3 in the ratings of anger (p=.001), happiness (p=.009), sadness and disgust (both p<.001) suggesting that people remained significantly less happy

and significantly more angry, disgusted and sad when they left the lab than when they arrived. From Time 2 to Time 3, however, there was a significant drop in anger, anxiousness, sadness and disgust ratings, and a significant rise in happiness ratings (all $p<.001$) suggesting that people improved appreciably since the moment just after watching the film. Even though the film had a measurable impact on these mood scales, the mean ratings remained relatively low throughout (except for sadness ratings, always below the mid-point for negative emotion). Overall, this suggests an immediately significant, but overall relatively minor impact of the film on participants' mood.

Table 5-6: *Mean (SD) ratings for each emotion as a function of collection time, along with the results of a one-way, repeated measures ANOVA.*

	Time 1	Time 2	Time 3	*F*	*p*	η^2
Angry	1.28 (0.65)[a,b]	2.70 (1.81)[b]	1.67 (1.11)	32.74	.001	0.34
Happy	4.53 (1.59)[a,b]	2.79 (1.28)[b]	3.97 (1.31)	35.51	001	0.36
Anxious	2.34 (1.44)[a]	3.22 (1.69)[b]	2.34 (1.37)	14.16	.001	0.18
Sad	1.45 (0.79)[a,b]	4.11 (1.69)[b]	2.03 (1.27)	101.2	.001	0.62
Disgusted	1.11 (0.31)[a,b]	3.47 (1.97)[b]	1.83 (1.15)	65.71	.001	0.51

[a] Reliably different from Time 2
[b] Reliably different from Time 3

There was a reasonable rate of diary compliance, with 52% of participants reporting that they kept the diary with them all of the three days. An additional 7% said they had the diary with them 2.5 out of three days, and 26% said they had it two out of three days. When asked what percentage of experienced IMs participants managed to record in the diary, participants reported a mean of 85.43% (*SD*=20.78) (for similar findings in diary studies of IAMs, see Laughland & Kvavilashvili, 2018).

5.6.2 Film-related IMs reported in the diary

All 64 participants returned their diary, reporting a total of 221 entries. However, unlike Study 4a, 7 participants (11%) returned blank diaries, indicating that they had not

experienced any film related IMs. An additional two participants made only one entry each that were excluded from analysis – in one case because it was recorded several days after the 72-hour diary-keeping period had ended, and in another case because the participant reported a dream rather than a film-related IM. Five additional diary entries were excluded from further analysis, four because they also fell outside of the 72 hour diary keeping window, and one because it was an autobiographical memory triggered by the film content rather than an analogue IM. This resulted in a total of 214 film related IMs in the full diary (*M*= 3.34, *SD*= 3.31, *range* 0-16). In addition, 30 participants (47%) reported a total of 134 tick entries in the diary (*M* = 2.09, *SD* = 4.58, *range* 0 - 34). The combined total of full and tick diary entries was 348 IMs (*M* = 5.44, *SD* = 6.99, *range* 0 - 50).[16]

In addition to overall recording frequency, the mean number of IMs reported per day was examined (see Figure 5 - 4). The results of a one-way, repeated measures ANOVA showed the main effects of day for both fully recorded IM entries $F(2.46, 152.3) = 16.87$, $p < .001$, $\eta^2 = .21$, and for ticked entries $F(2.77, 174.2) = 9.79$, $p < .001$, $\eta^2 = .14$.

With regard to full entries, pairwise comparisons (LSD) revealed a significant increase in the frequency of entries between the first and second days of diary keeping ($p = .026$), and a significant drop from the second to the third days ($p < .001$). The frequency of entries on the third and fourth days were not significantly different ($p = .11$). The frequency of entries on the first day was greater than the third ($p = .009$) and fourth days ($p < .001$).

With regard to ticked entries, pairwise comparisons showed no difference between days one and two ($p = .71$). The frequency of tick entries dropped from Day 2 to Day 3 ($p = .02$) and from Day 3 to Day 4 ($p = .003$).

[16] Means are based on the full sample of 64 participants.

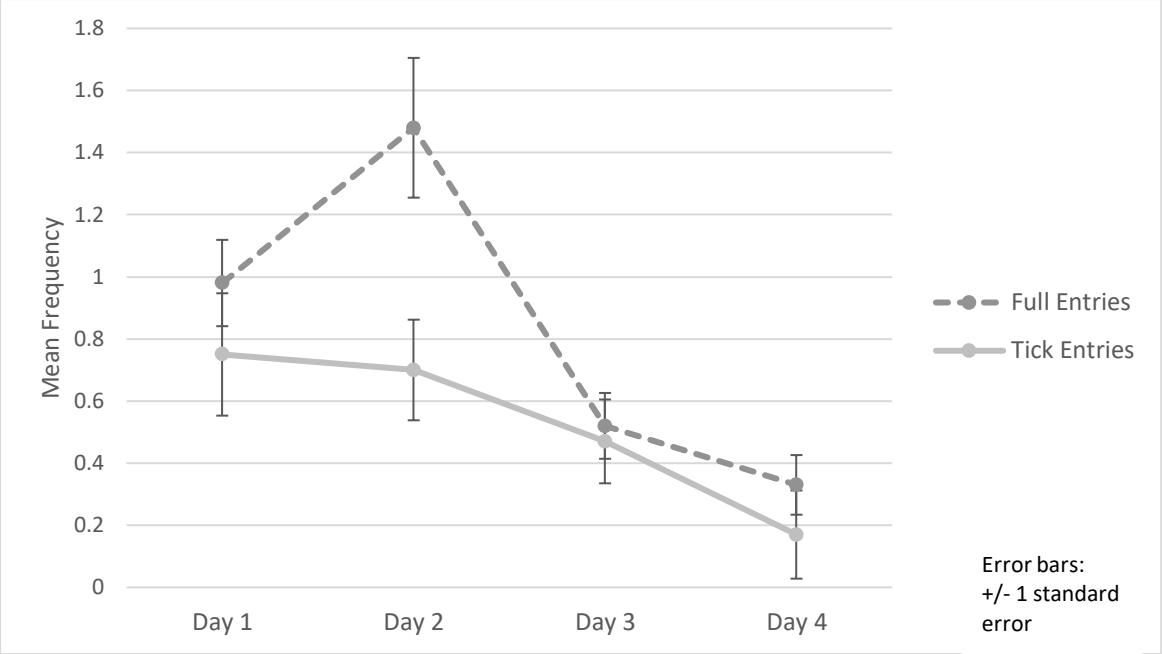


Figure 5-4: *Mean frequencies of full and ticked entries as a function diary keeping day.*

5.6.3 The role of triggers in eliciting IMs

For each of the film-related IM reported in the diary, participants indicated whether they believed this thought to be triggered by something in their environment, by their own thoughts, or as having no trigger. The proportion represented by each category of trigger (environment, own thought, no trigger) for each participant was entered into a one-way repeated measures ANOVA. There was a main effect of trigger type $F(2, 108) = 10.85$, $p < .001$, $\eta^2 = .167$ (see Figure 5.5).[17] Pairwise comparisons (LSD) revealed that the proportion of environmental triggers was higher than the proportion of own thought triggers ($p < .001$), and reports of 'no trigger' ($p = .006$). Unlike the results of Study 4a, however, the proportion of 'no trigger' reports, was not significantly higher than own thought triggers ($p = .14$).

[17] Because seven participants did not report any film related IMs in the diary, and two participants had their single entries excluded (see above), this analysis is based on 55 participants.

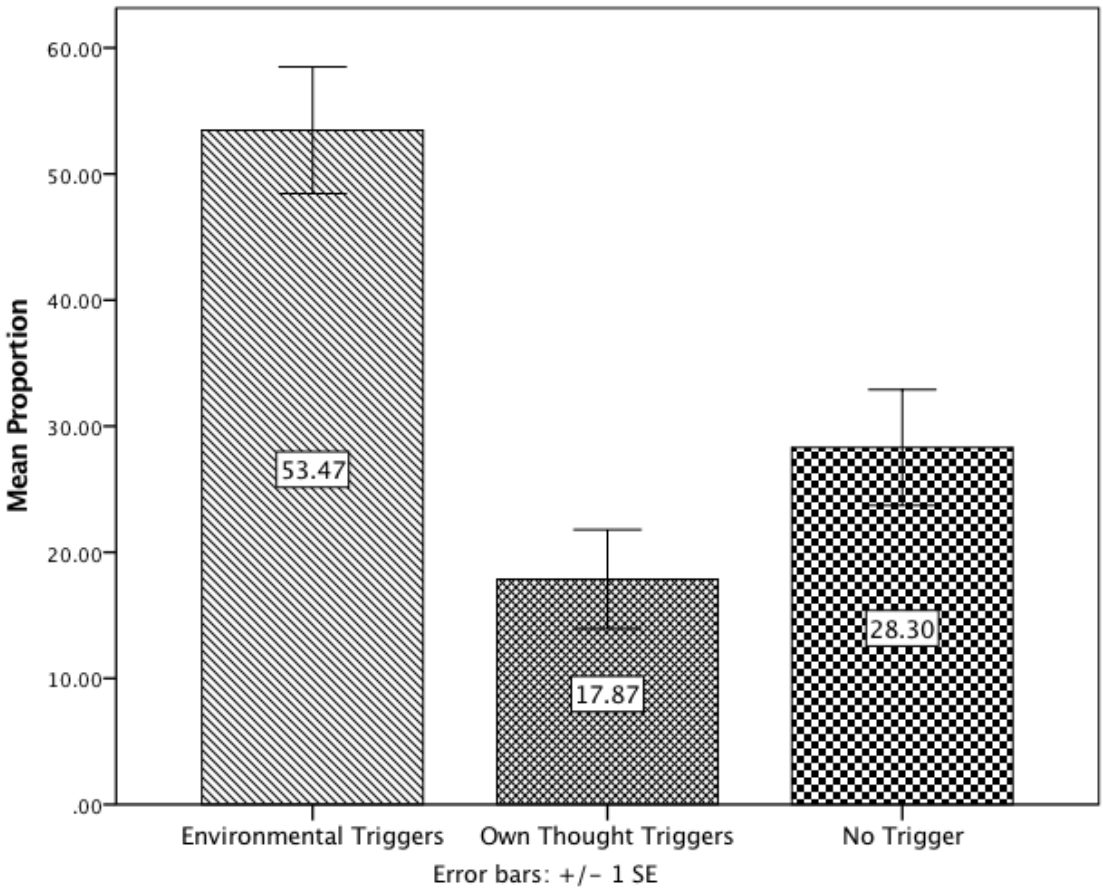


Figure 5.5: *Means of proportions of trigger type reported for IMs in the diary.*

As in Study 4a, reported triggers were also coded according to the scheme developed by Mace (2004) into abstract/verbal, sensory/perceptual, physiological/emotional state, and unclassifiable/undecided. None of the reported triggers were coded as referring to physiological/emotional states, so this category was excluded from analysis. The mean proportion of the remaining three types of trigger was then calculated by participant and entered into a one-way repeated measures ANOVA. The mean proportions of these trigger categories across 49 participants is represented in Figure 5.6.[18] This analysis resulted in a significant main effect of trigger type $F(1.69, 81.37) = 15.73$, $p < .001$, $\eta^2 = .25$. Pairwise comparisons (LSD) revealed that sensory/perceptual triggers were reported much more frequently than abstract/verbal triggers (p=.004) or triggers that were deemed unclassifiable

[18] Six additional participant who did not report any triggers for their film related IMs were excluded from this analysis, leaving a total of 49 participants.

($p < .001$). There were also many more reports of abstract/verbal than unclassifiable triggers ($p = .03$).

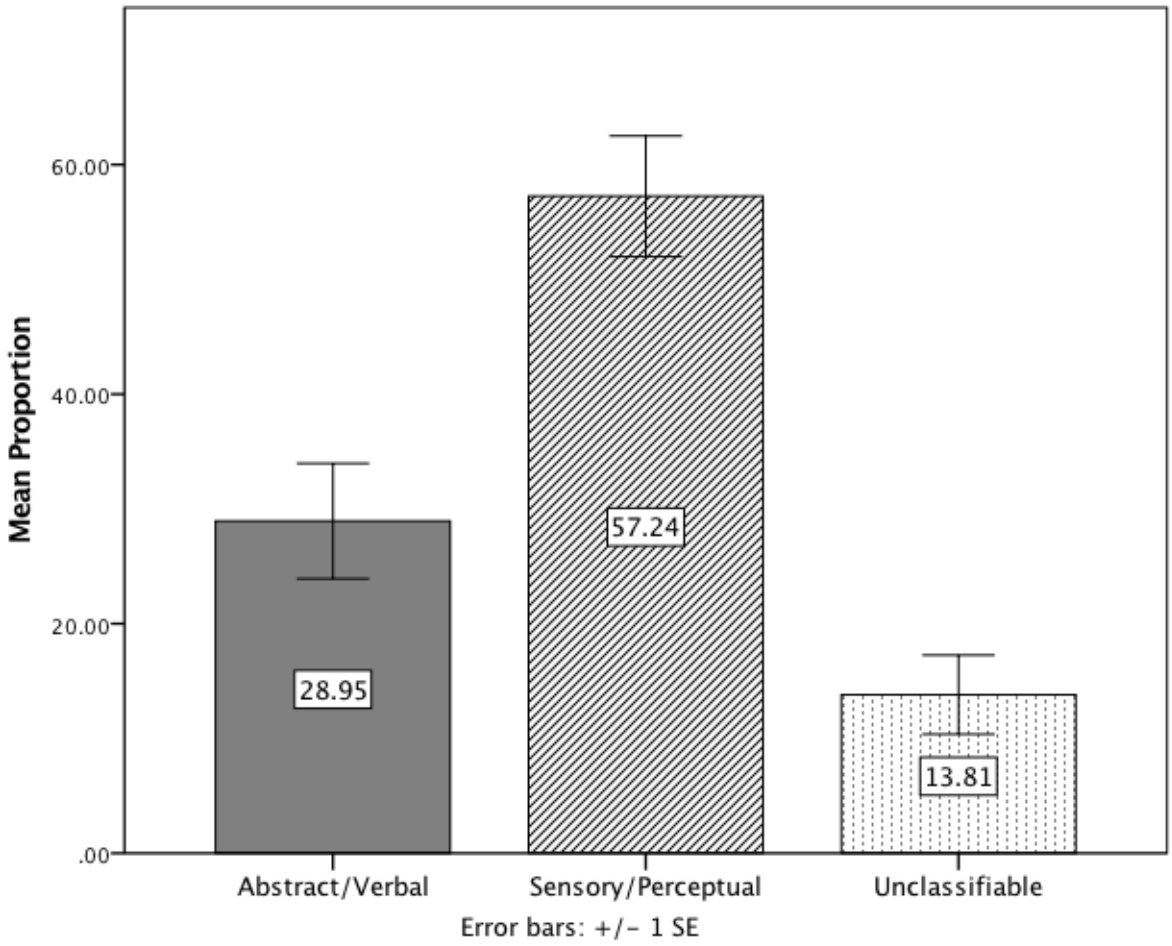


Figure 5-6: *Mean proportions of different types of triggers, coded according to trigger modality.*

5.6.4 Conditions in which IMs were reported to occur

For each participant, the proportion of IMs recorded during habitual tasks and during controlled activities were calculated. A mean proportion of activities coded as automatic or habitual was 61.6 (SD = 33.78) and the mean proportion of controlled activities was 38.40 (SD = 33.79). The results of a one-way ANOVA on these mean proportions showed this difference to be significant $F(1, 54) = 6.49$, $p = .014$ $\eta^2 = .11$.

In addition, the mean concentration rating reported was 3.11 (*SD* = 0.96). Examining the distribution of concentration ratings that participants gave across the 5-point scale (1=*not concentrating at all*, 5=*fully concentrating*) showed that the mean proportion of IMs that participants reported while being in a state of low concentration (points 1 and 2 on the scale), medium concentration (point 3 on the scale) and high concentration (points 4 and 5 on the scale) were 32.33 (*SD* = 34.99), 27.71 (*SD* = 30.74) and 42.08 (*SD* = 39.97), respectively. These were entered into a one-way, repeated measures ANOVA, but no significant differences were found $F(2, 108) = 1.24$, $p = 0.29$, $\eta^2 = .02$.

5.6.5 Additional Findings

5.6.5.1 Correlations of Frequency, Distress and Involvement Ratings

With regard to IM frequency, there was a significant positive correlation between the frequency of fully recorded and ticked diary entries $r(55)_s = .27$, $p = .046$.[19] This contrasts with the lack correlation between these two variables in study 4a, suggestion that the initial study perhaps lacked sufficient power.

Overall mean ratings of distress and involvement taken just after viewing the film were 5.26 (*SD* = 1.39) and 4.80 (*SD* = 1.40), respectively, using identical 7-point rating scales. Spearman's correlations between these post-film distress and involvement ratings and IM frequency are presented in Table 5-7. Statistically significant correlations emerged only for ticked entries and involvement ratings, as well as distress ratings and combined full and tick entries.

[19] Participants who did not report any IMs were excluded from this analysis. The correlation in the full sample was also positive but only marginally significant $r(64)_s = .24$, $p = .058$.

Table 5-7: *Spearman's correlation's between IM frequency as reported in the diary, and involvement and distress ratings given in the lab. For all results n=64.*

	Post-Film Distress	Post-Film Involvement
Full diary entries	.20	-.12
Tick diary entries	.22	.33**
Full + Tick diary entries	.28*	.07

*Alpha level .05
**Alpha level .001

5.6.5.2 Characteristics of IMs reported in the diary

Film related IMs reported in the diary were rated on a number of scales, including vividness of reported IMs, distress, self-assessed mood prior to experiencing the IMs, and the impact that IMs had on their mood. Mean ratings on each scale (across the total number of reported IMs) were calculated for each participant. The mean ratings across all participants are presented in Table 5-8. Each measure was on a 7-point scale, with higher numbers indicating greater vividness, distress, positivity (in the case of participants' mood prior to experiencing the memory), and how much worse experiencing the memory made them feel.

Table 5-8: *Mean ratings, (SD, range) for IMs reported in the diary over the 72 hours of diary keeping.*

	Mean	***SD***	***Minimum***	***Maximum***
Vividness	4.32	1.23	1.40	6.68
Distress	3.66	1.27	1.0	6.0
Mood before IM	4.26	0.68	3.0	6.0
Impact on Mood	3.40	1.35	1.0	5.88

5.6.5.3 Film Clips Reported

The mean frequency with which each of the clips was reported in IMs recorded in diaries (as well as unclassifiable cases) is presented in Figure 5-7. These were entered into a one-way repeated measures ANOVA. The results showed a main effect of film clip $F(4.10, 221.6) = 5.25$, $p < .001$, $\eta^2 = .09$. Pairwise comparisons (LSD) showed that Clip 5 was reported more frequently than Clip 1 ($p = .04$), Clip 2 ($p < .001$) and marginally more than Clip 4 ($p = .06$), but not Clip 3 ($p = .10$). There were also many more instances of people reporting IMs based on Clip 5 than IMs that were unclassifiable in terms of the clip to which they were related ($p < .001$). In addition, Clip 3 was reported more frequently than Clip 2 ($p < .001$) as well as unclassifiable clips ($p = .001$).

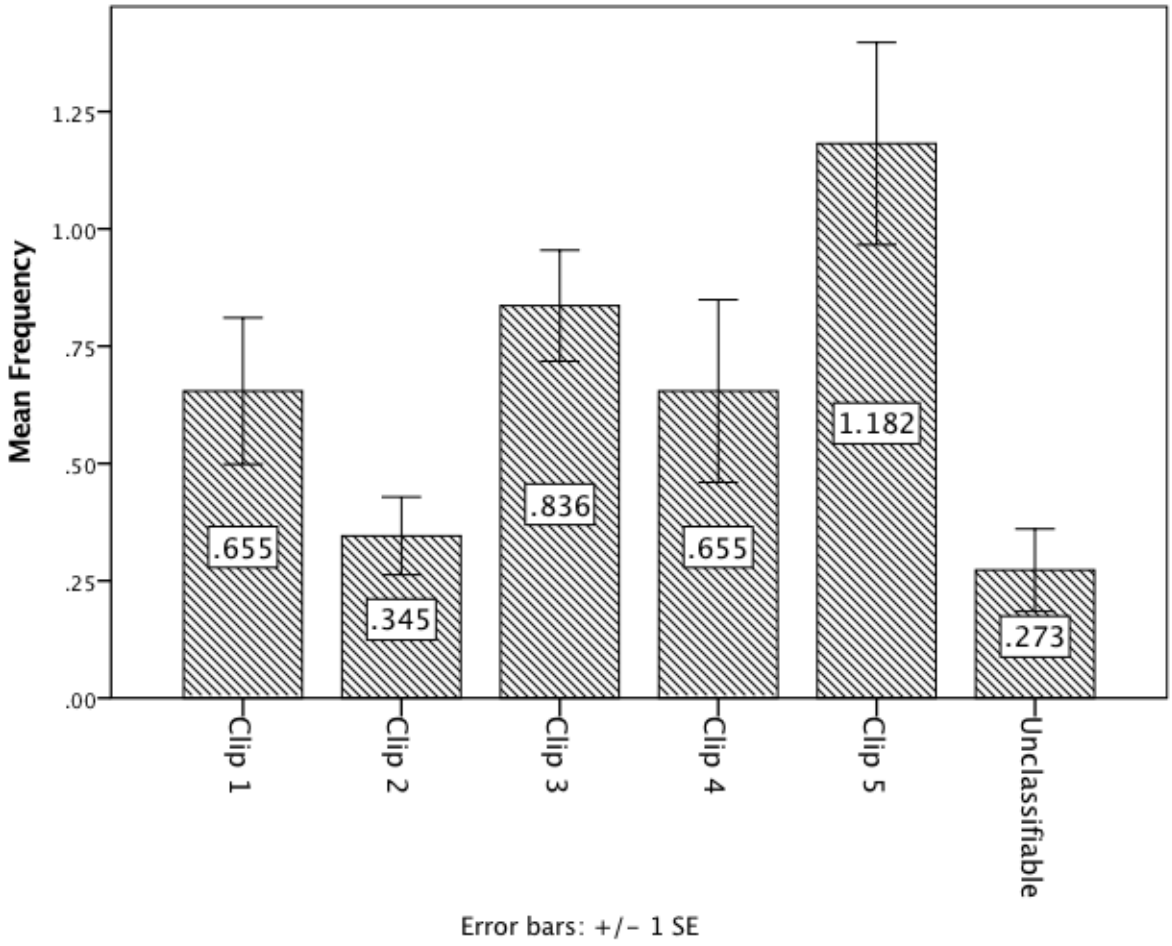


Figure 5-7: *Mean frequency with which each of the clips was the basis for the reported IM, as well as the frequency of unclassifiable reports.*

5.7 Overall Discussion

Several important findings emerged from Studies 4a and 4b. First, it is possible to reliably induce IMs with a brief (5 minute) thematically consistent film, with content that is mild enough to have been shown on television. Second, a full structured diary such as that used in IAM research does offer replicable data on the triggers for analogue IMs, as well as ongoing activities, concentration levels, and other phenomenology. With regard to triggers in particular, novel insight has been gained into the comparability of these IMs with naturally occurring IMs, as well as IAMs.

5.7.1 IM frequency and reporting pattern

In both studies, participants reported comparable mean frequencies of IMs in the 72 hours following the lab session. Examination of PANAS scores collected in the lab showed that the film had exerted the expected emotional impact, which nonetheless seemed to dissipate quickly – usually by the end of the lab session. Though exposure to distressing content is a requirement of the paradigm – and participants consent to viewing this material – it was worth exploring lowering the threshold in terms of both the film length and strength of content.

Study 4a showed the expected, gradual reduction in the frequency of IM reports over the four calendar days of diary keeping. Perhaps most notably, the majority of these were reported during the remainder of the day on which the film was viewed (Day 1) and tapered off significantly thereafter. This aligns with what has been found in a majority of trauma film studies (see James et al., 2016; see also Laughland & Kvavilashvili, 2018). By contrast, in Study 4b participants reported significantly more full entries on Day 2 than any other day of diary keeping. However, the same pattern was not evident with regard to tick entries. One possible and interesting explanation of this reduction of IMs in the first day of the study is

that it was due to participants completing a brief 5-minute vigilance task immediately after watching the film, which is akin to using an interference paradigm to test the predictions of dual-representation theory of IMs in PTSD. The majority of studies using this paradigm have measured IM frequency following the completion of a visual-spatial or verbal task, but rarely one that combines the two. The vigilance task that participants completed in the present studies incorporated both elements. Whilst visual spatial tasks have typically been thought to impede the frequency of IMs, and verbal task increase the frequency (though not as consistently), it might be the case that in concert they delay the point in time after which these memories begin to intrude. It could reasonably be expected, however, that if this were the case, the reporting pattern would be replicated with the tick diary entries.

5.7.2 Triggers and concurrent activities

In both Studies 4a and 4b, participants reported being engaged in relatively automatic activities when their film-related IM came to mind, though the first study reported a slightly lower proportion of such activities, as well as a lower mean concentration level. Nonetheless, it would appear to be the case that IMs – at least analogue IMs – come to mind under conditions similar to naturally occurring IAMs (e.g., Kvavilashvili & Mandler, 2004; Schlagman & Kvavilashvili, 2008).

Similarly, the triggers reported for analogue IMs in both studies follow a similar pattern to IAMs in terms of high proportions of triggers that were environmental in nature. In comparison, relatively few IMs were reported as triggered by participants' own thoughts. In both studies, however, there was a slightly higher proportion of 'no trigger' reports than is typically found in IAM research (Berntsen, 1996, 1998; Schlagman & Kvavilashvili, 2008). It may be the case that participants struggle more to identify cues for analogue IMs, as has been claimed to be the case with naturally occurring IMs in clinical populations. Because of peri-traumatic dissociation, and insufficient narrative contextualisation of sensory detail

associated with the memory, it is thought that some triggers for IMs match peripheral details from the environment at the time of the event (Ehlers et al., 2004, 2002). This in turn can make it more difficult for people experiencing trauma related IMs to identify what precisely triggered their memory. It could be the case that similar cognitive mechanisms are at work in the case of analogue IMs.

Finally, the coding of the reported triggers using the scheme developed by Mace (2004) produced novel results showing that in both studies a significant majority of triggers were coded as sensory/perceptual rather than abstract/verbal. Whilst this might be expected given the highly visual nature of IMs, it is nonetheless an interesting finding in terms of the comparability of these analogue IMs to naturally occurring IMs. The finding in the present study also stands in contrast to findings in IAM research, in which the majority of triggers are abstract and verbal (Mace, 2004; Schlagman et al., 2007).

5.7.3 Correlations

The pattern of correlations was inconsistent between the two studies. For example, in Study 4a, the number of full diary entries did not correlate with the number of tick diary entries. In Study 4b these two variables did correlate suggesting that the finding from Study 4a may be the result of low power. This could potentially also explain the lack of correlation with scores on the SUIS and VVIQ, which have been shown to previously correlate with the frequency of nightmares and flashbacks in people with PTSD (Bryant & Harvey, 1996). The results of other correlational analyses (between reporting frequency and distress/involvement ratings) were non-significant in Study 4a, and in Study 4b significant results emerged with regard to the frequency of tick entries in the diary (or combined full and tick entries). It is difficult to account for these results, and adequate explanation will require further research in future.

5.7.4 Reporting of different clips

In both studies, clip 5 of the young couple, sitting on a wall during the moments before an automobile accident, was the most frequently reported. It seems safest to assume that this was a recency effect, as it was the last out of all clips shown. It is interesting, however, that the second most frequently reported clip in both studies was the third, of the young boy who is playing football in his garden when a car comes crashing through the fence. Whilst this was not the only clip involving a child, it suggest (perhaps unsurprisingly) that there is something particularly distressing about this content which led to it more often forming the basis of IMs.

5.7.5 Limitations

There are limitations to both studies. In Study 4a numbers were relatively low which may have resulted in insufficient power for some of the analyses. In Study 4b, as noted above, the initial experimental manipulation did not yield any results and was therefore excluded from further analysis. The inclusion of the vigilance task in the experimental procedure may have impacted the diary results in unanticipated ways – namely with regard to the distribution of IM reports over the 72 hours of diary keeping.

5.7.6 Conclusion

The present studies offer useful initial insight into the comparability of analogue IMs to naturally occurring IMs and IAMs. This is particularly the case with regard to triggers, ongoing tasks and concentration levels, but also other aspect of phenomenology such as ratings of vividness and distress. This comparison was made possible by the incorporation of an IAM style diary into the trauma film paradigm in a way that – to our knowledge – has not been previously done. These findings obviously require further investigation and replication before more robust conclusions can be drawn. One way that this might be pursued is through

a within subjects study of analogue IMs and IAMs, which will facilitate even more direct comparison along some of these variables. The results of such a study will be reported in Chapter 6.

Chapter 6: Comparing Involuntary Autobiographical Memories and Trauma Film Induced Intrusive Memories: A Diary Study (Study 5)

6.1 Introduction

The studies described in previous chapters have demonstrated the prevalence of IMs in non-clinical samples, and that methods traditionally associated with IAM research can inform us about the frequency and phenomenology of IMs (whether naturally occurring and trauma film induced). However, these studies did not directly address the key questions in research on IMs about their underlying mechanisms and their relationship with IAMs. The final study presented in this thesis will examine this question by reporting results of a study that aimed to directly compare IAMs with analogue IMs.

There is an ongoing debate in the literature about how best to account for the occurrence of IMs. Do they rely on the same cognitive architecture as autobiographical memory generally, or are they the output of a separate system? This has sometimes been posited as a debate between advocates of a single system model, versus proponents of a special mechanisms view (e.g., the dual representation theory) (e.g. Berntsen & Rubin, 2008; Brewin, 2014, 2016; Rubin, Berntsen, Ogle, Deffler, & Beckham, 2016). Some recent findings have been argued to lend support to the special mechanisms view, by finding that a period of wakeful rest versus an undemanding (0-back) vigilance task, following exposure to an analogue trauma, showed different impact on the frequency of reported IMs, but not the quality of voluntarily retrieved memories. Specifically, wakeful rest resulted in fewer IMs relative to completion of the vigilance task, but yielded no difference in the frequency of voluntarily retrieved (deliberate) memories (Hørlyck, Bisby, King, & Burgess, 2019).

It has been well evidenced that IAMs are a feature of a typical autobiographical memory system. In diary studies they have been found to occur on average between 2 and 6 times per day (Berntsen, 1996; Schlagman & Kvavilashvili, 2008), though one study that asked participants to record their IAMs using a mechanical clicker found that people reported a mean frequency of 22.13 IAMs over a 1-day period (Rasmussen & Berntsen, 2011).

Theoretically, it has been argued that IAMs access the same episodic memory base as deliberately retrieved memories, but instead of an intentional, top-down search, they are triggered by exposure to internal or external cues and brought to mind through an associative, bottom up spreading activation processes (Berntsen, 2010; Conway, 2005; Conway & Pleydell-Pearce, 2000; Schlagman & Kvavilashvili, 2008). IAMs were not a subject of study until relatively recently, with research focusing predominantly on voluntarily recalled autobiographical memories (see Berntsen, 1996, 1998, 2010). Accumulating evidence has shown that IAMs are more specific than voluntarily retrieved AMs, in addition to eliciting stronger emotional and physical response, and having greater impact on mood (Berntsen, 1998; Hall & Berntsen, 2008; Schlagman & Kvavilashvili, 2008).

The differences between IAMs and IMs is a subject of debate. It has been also suggested that they might be represented on a continuum with IAMs occupying one end of a spectrum of low intrusiveness and disruption, IMs the middle, and intrusive flashbacks, characteristic of PTSD, the other extreme end of this continuum (Kvavilashvili, 2014). Whilst it could be argued that IMs – for the most part - have not been studied with the same methodological rigor as IAMs, there would appear to be some important differences between the two. Firstly, IAMs can consist of positive, negative, or neutral content, whereas IMs have mostly negative content, although sometimes they can also be positive (see Bywaters et al., 2004). In addition, IAMs are not repetitive and disruptive as is the case with IMs, and they vary more in vividness (from low to high), whereas IMs tend to be high in vividness.

Triggers for IAMs have been widely investigated, with replicable results across different studies using both diary and laboratory methods. For example, findings show that the majority of triggers are fairly easy to identify and often refer to external cues in one's environment, although internal thoughts and feelings can also trigger such memories, and in a limited number of cases no triggers are reported (Berntsen, 1996; Schlagman et al., 2007). In

the case of laboratory-based methods, verbal cue phrases reported as triggers for IAMs are more often negative than neutral or positive, though when examining memory content and cue valence there are also strong congruency effects (Schlagman & Kvavilashvili, 2008). Specifically, IAMs retrieved in response to positive cues were rated as more pleasant than IAMs retrieved in response to neutral cues, which similarly were rated more pleasant than IAMs retrieved in response to negative cues. In addition, despite the popular view of IAM triggers being more sensory-perceptual in nature (as exemplified by Marcel Proust's story about the Madeleine cookie and the cup of tea eliciting strong childhood memories), it has been found that the majority of IAM triggers are in fact verbal in nature rather than sensory perceptual or related to a physiological or emotional state (Mace, 2004).

Less is known about triggers for IMs, due mainly to the methods used to study them, which have been largely retrospective and based on interviews and questionnaires (Michael et al., 2005; Reynolds & Brewin, 1999; Reynolds & Brewin, 1998; Speckens et al., 2007). It has been suggested that triggers for naturally occurring IMs in PTSD share important characteristics with peripheral features of the environment in which the traumatic event occurred (particularly features present just before the main traumatic event), with triggers therefore acting as 'warning signals' of impending danger (Ehlers et al., 2004, 2002). Another retrospective study found that the most frequently reported trigger for IMs - across a sample that included participants with PTSD, depressed with trauma, and depressed without trauma - were one's internal ruminative thoughts and there were no group differences in this respect (Birrer, Michael, & Munsch, 2007). In contrast, a more recent diary study of IMs in traumatised participants with and without PTSD found that over half of the cues across both groups were environmental, but only 18% could be classified as abstract/verbal (Kleim et al., 2013).

As for analogue IMs, induced in participants through the trauma film paradigm, there has been very little investigation of triggers. Indeed, most studies using this paradigm have asked participants to record the frequency with which they experienced film-related IMs (and sometimes associated characteristics such as vividness and distress), but have failed to ask participants to report triggers (see James et al., 2016). That being said, a recent study using this paradigm did ask for such reports in the diary that participants kept for 7 days after viewing the distressing film content. In the first of 3 experiments, it was found that 90% of reported cues across the sample were external, though no distinction appears to have been made with regard to whether they were sensory-perceptual or abstract/verbal (Lau-Zhu et al., 2019).

Divergence between IAMs and analogue IMs in the pattern of reported triggers might lend support to a special mechanism view, whilst similarity in trigger patterns may lend support to the unitary system perspective. This extends to other features of the context in which IMs come to mind, including ongoing activities and reported concentration levels. It seems plausible that the oft reported disruptiveness of IMs could mean that they can arise when people are engaged in attentionally demanding and undemanding activities (in contrast to IAMs, which are more likely to arise under the latter conditions (Brewin et al., 2010; Ehlers & Clark, 2000; Schlagman et al., 2006). Furthermore, a comparison of IAMs and analogue IMs could provide some insight into the degree to which naturally occurring and analogue IMs are comparable.

At the same time, little is known about whether the baseline frequency with which people experience IAMs may be a predictor for the frequency of IMs, and by extension, PTSD. In terms of the inverse relationship, available evidence suggests that PTSD may impact the frequency of IAMs experienced. One study recruited participants with and without PTSD who had nonetheless experienced a traumatic event that met Stressor Criterion A from

the DSM-IV (Schönfeld & Ehlers, 2017). They were asked to record their IAMs in a diary for one week. The memories were then subjected to a content analysis to determine which were trauma related and which were not. The PTSD group recorded fewer involuntary memories overall than the non-PTSD group, but also fewer non-trauma memories and more trauma memories than the non-PTSD group.

The present study, therefore, compared the frequency and phenomenology of IAMs and analogue IMs within one sample of participants using a within subjects design. Participants first completed a 3-day structured diary of their IAMs, and upon returning the diary were asked to watch a brief compilation of road safety advertisements and keep a structured diary of film-related IMs for 3 days. This part of the study was almost identical to the method and materials used in Study 4a. The adoption of this design facilitated examination of the relationship between the frequency of IAMs and analogue IMs, in addition to within-subjects comparison of reported triggers for both IAM and IMs, as well as ongoing tasks, concentration levels and phenomenology.

A number of predictions were made. First of all, it was hypothesised that there would be a positive correlation between the number of recorded IAMs and IMs. This prediction was based on findings from questionnaire studies showing that self-reported frequency of IAMs correlated positively with several measures of emotional distress including symptoms of PTSD, anxiety, depression, and rumination (Berntsen, Rubin, & Salgado, 2015; del Palacio-Gonzalez & Berntsen, 2019). Similarly, in line with previous findings from IAM research (Vannucci et al., 2015) as well as results presented in Study 4a, it was hypothesised that the frequency of reported IAMs and IMs would correlate positively with vividness of visual imagery scales. Furthermore, it was anticipated that the majority of triggers for both IAMs and IMs would be reported as environmental, but in line with findings of Studies 4a and 4b, a greater proportion of IM triggers would be reported as sensory/perceptual than abstract/verbal

(the latter were predicted to make up the majority of IAM triggers). Finally, it was expected that both types of memory would occur under similar conditions of relatively low concentration and engagement in cognitively undemanding activities.

6.2 Method

6.2.1 Design

A within-subjects design was used whereby all participants completed all components of the study. The independent variable was the type of memory recorded in the diary (IAMs versus analogue IMs).

6.2.2. Participants

Participants were students at the University of Hertfordshire recruited from the Online Psychology Research Participation (SONA) system. The final sample consisted of 40 participants (9 male, 31 female) with a mean age of 22.98 year (*SD* = 4.93, range = 19 - 39). All participants included in the final sample scored 2 or below on the Primary Care PTSD Screen (PC-PTSD) and 11 or below on depression and anxiety sub-scales of the Hospital Anxiety and Depression Scale (HADS). The mean score on the PC-PTSD was 0.88 (*SD* = 0.88, *range* 0-2), whilst mean scores on the anxiety and depression subscales of the HADS were 5.95 (*SD*=2.60, *range* 1-11) and 3.08 (*SD*=1.77, *range* 0-8) respectively. Participants also completed the Vividness of Visual Imagery Questionnaire (VVIQ), the mean score for which was 33.5 (*SD* = 7.11, *range* 16 - 48).

6.2.3 Materials

Primary Care PTSD Screen (PC-PTSD; Prins et al., 2003): See Studies 4a and 4b (Chapter 5; Appendix XII).

Hospital Anxiety and Depression Scale (HADS: Zigmond & Snaith, 1983): See Studies 3b, 4a and 4b (Chapters 4 and 5; Appendix XI).

Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973): See Studies 4a and 4b (Chapter 5; Appendix XIV).

Diary of Involuntary Autobiographical Memories (see Appendix XVI): All participants received diaries in the form of A5 booklets to record any IAMs that came to mind during the first phase of diary keeping. Diaries had 24 identical pages, each of which contained eleven questions about the content and phenomenology of the IAM reported. **Question 1** asked participants to record the date and time that they experienced their IAM, as well as the date and time that they recorded it, whilst **question 2** asked that they provide a written description of their memory in the space provided. **Question 3** asked participants to rate the vividness of their IAM on a scale from 1 to 7 (*1=very vague, almost no image; 7=extremely vivid, almost like normal vision*), whilst **question 4** asked participants to indicate whether the memory that came to mind was triggered by (a) their own thoughts, (b) something in the environment, or (c) there was no trigger. In cases where participants circled (a) or (b), they were asked to provide a written description of the trigger for **question 5**. In **question 6,** they were asked to indicate where they were and what they were doing when the IAM came to mind, and in **question 7** – to rate how much they were concentrating on this activity (*1=not at all; 7=fully concentrating*). **Question 8** asked participants to rate their mood prior to experiencing this memory (*1=extremely negative; 4=neutral; 7=extremely positive*), and in **question 9**, participants indicated how pleasant or unpleasant they found the memory (*1=very unpleasant; 4=neutral; 7=very pleasant*). **Question 10** asked what effect, if any the IAM had on participant's mood (*1=made me feel a lot worse; 4=had no effect; 7=made me feel a lot better*). **Question 11** asked that they indicated whether the memory was of (a) a general event or (b) a specific event. **Question 12** asked that participants indicated when the original event (on which the memory was based) occurred, and **question 13** asked

participants to indicate if they had ever had a memory of this event before by circling one of five options (*never; once or twice; a few times; several times; many times*).

Diary of Film-Related IMs: See Studies 4a and 4b (Chapter 5; Appendix XV).

Film Clips: The film clip was a shortened version of that used by Holmes, James, Coode-Bate and Deeprose (2009). Instead of varied subject matter (cutting a face, elephant stampede, etc), only the clips relating to road safety were retained, resulting in a 5-min film consisting of 5, thematically consistent clips (see Studies 4a and 4b, Chapter 5).

Post-film IM Questions: Whilst still in the lab, following the film viewing of road safety advertisements, participants were asked if they had experienced any images from the film popping to mind during a 2-minute period when they were left alone. If they indicated that images from the film had come to mind, they were asked by the researcher what these were, and their frequency.

Emotion, Involvement and Bodily Reaction Scales: Immediately before and after watching the film, and at the end of the session, participants rated the degree to which they were feeling certain emotions on a series of 7-point Likert scales (1=*not at all*, 4=*moderately*, 7=*very much*) by indicating how angry, happy, anxious, sad, and disgusted they were feeling (adapted from Weidmann, et al., 2009). In addition, immediately after watching the film, on similar 7-point scales (1=*not at all*, 4=*moderately*, 7=*very much*) participants indicated how distressing they found the entire film clip, and how involved they felt in the events depicted. These were identical to scales used in Studies 4a and 4b. In addition, in Study 5, participants had to also rate the degree to which they experienced bodily sensations in response to the film (1=*not at all*, 4=*moderately*, 7=*very much*).

Debriefing Questionnaire: After returning the both IAM and IM diaries, all participants answered several questions designed to measure compliance with the diary method (see also the questionnaire used for Studies 4a and 4b). Participants had to indicate

how many days (out of 3) they forgot to keep a diary with them, and the reason for this. They were asked how difficult they found keeping a diary of their IAMs or film related IMs (*very easy, somewhat easy, somewhat difficult, very difficult),* and what percentage of all memories they experienced were recorded in the diary. If they deliberately did not record some of their memories in the diary, they were asked the reason for this. Finally, participants were asked whether they found the process of diary keeping at all useful and if so why, and were given space to record any additional comments.

6.2.4 Procedure

All prospective participants were asked to complete the PC-PTSD and HADS online (via Qualtrics) before being invited to the laboratory, to ensure they were not experiencing heightened symptoms of post-traumatic stress, depression or anxiety. As noted above, all participants invited to the lab (and thus included in the final data set) scored 2 or below on the PC-PTSD and 11 or below on the anxiety and depression subscales of the HADS. At this time participants also completed an online version of the VVIQ.

The study consisted of three sessions. For the first, eligible participants were invited to a brief (15 minute) laboratory session in the morning, where they were given written information on all parts of the study and asked to provide informed consent. This included a written and verbal definition of IAMs and how they differ from IMs. They were then given the 24-page IAM diary, and asked to record all instances of this type of thought coming to mind over 3 days. They began this period of time immediately upon leaving the lab. It was emphasised to participants that there were no expectations that they record a certain number of IAMs (e.g. a minimum or maximum number). It was most important, rather, that they monitored their thoughts, and attempted to faithfully record all instances of IAMs naturally coming to mind. Participants were asked to make entries as soon as possible after noticing their IAM, but it was acknowledged that it would not be possible to immediately record an

entry in all cases (if, for example, they were in a meeting or driving a car). Where sufficient time elapsed after the IAM coming to mind, such that a full diary entry was difficult due to forgetting some aspects of the experience, participants were instructed to instead place a tick in the grid printed on the inside cover of the diary.

After one week, participants returned to the lab for a 30-minute session in the morning. They initially returned the IAM diary, and completed a debriefing questionnaire on their compliance with the recording procedure. They were then asked to watch the same 5-minute compilation of road safety advertisements used in Studies 4a and 4b. Immediately before and after watching the film, participants rated five emotions (anger, anxiousness, disgust, happiness and sadness) on 7-point scales. They completed ratings of distress, involvement and bodily sensations on similar, 7-point scales following the viewing of the film. In addition, after the end of the film, the researcher left the lab for 2-minute under the guise of fetching the IM diary for the participant to take away. When the researcher returned, they asked the participant if any images of the film had come to mind during the 2-minute period. Where this had been the case, these were recorded by the researcher. Then participants were given the IM diary in which they were asked to record any film related images which came to mind over the 3 days following the lab session. As with the IAM diary, participants were asked to start monitoring their thoughts and recording in the diary immediately following the lab session. Participants came to the lab a final time (15-minute session) to return the IM diary and complete a second debriefing questionnaire to assess their compliance with the IM recording task. After this, participants were fully debriefed on all aims of the study and signposted to additional support should they need it.

6.3 Results

All participants completed the 3 days of IAM diary keeping, followed by a laboratory session during which they viewed the compilation of road safety advertisements, and a 3-day

period of film-related IM diary keeping. For all analyses the alpha level for determining statistical significance was set at 0.05. In cases where Mauchley's Test was found to violate the assumption of sphericity, degrees of freedom were corrected using Greenhouse-Geisser (ε <.75) or Huyhn Feldt (ε >.75) estimates of sphericity (Field, 2013).

6.3.1 Manipulation Checks and Diary compliance

In order to examine the impact of the film, participants were asked to complete rating scales for five emotions (anger, happiness, anxiousness, sadness and disgust) just before and just after watching the film. The scales were 7-points with higher ratings indicating greater intensity with which that emotion was experienced (1=*not at all*, 4=*moderately*, 7=*very much*). These were entered into a series of one-way repeated measures ANOVAs. The results are presented in Table 6-1. Participants reported significant increases in their ratings for anger, anxiousness, sadness and disgust, and a significant decrease in their happiness rating.

Table 6-1: *Mean (SD) ratings for each emotion as a function of collection time, along with the results on a one-way repeated measures ANOVA.*

	Time 1	Time 2	*F*	*p*	η^2
Angry	1.48 (0.78)	3.4 (1.95)	39.39	.001	.502
Happy	4.85 (0.98)	2.83 (1.38)	73.55	.001	.653
Anxious	2.0 (1.63)	3.60 (1.99)	24.12	.001	.382
Sad	1.85 (1.44)	4.35 (2.01)	47.33	.001	.548
Disgusted	1.18 (0.59)	4.30 (2.09)	76.03	.001	.661

There was a good rate of compliance in both diary keeping tasks, with 35 of 40 participants reporting that they kept the IAM diary with them during all of the 3 days, and 32 of 40 participants in the IM diary condition reporting the same. Across the sample, the mean number of days that the IAM dairy was not completed was 0.25 (*SD* = 0.71), whilst the mean number of days that the IM diary was not completed was 0.40 (*SD* = 0.87). The results of a

paired-samples t-test showed this difference to be non-significant $t(40) = -.85$, $p = .40$. In the IM diary task, participants estimated that they recorded a mean proportion of 71.6 (SD = 29.1) of all film-related IMs experienced.[20]

6.3.2 Reporting frequency in IAM and IM diaries

Participants recorded a total of 257 IAMs and 93 film-related IMs. In addition, there were 151 tick entries in the IAM diary and 59 tick entries in the IM diary, for a total of 408 IAMs and 152 IAMs reported. All participants reported at least one IAM, but there were six participants who did not report any film-related IMs.

Table 6-2: *Mean frequency, SD and range of diary entries.*

	Mean	SD	Range
IAM full entries	6.43	3.86	2-24
IAM tick entries	3.78	4.39	0-18
Total IAMs	10.2	5.47	2-25
IM full entries [a]	2.33	2.04	0-9
IM tick entries	1.48	2.14	0-9
Total IMs	3.8	2.75	0-10

[a] Values are based on the entire sample, including 6 participants who did not report any film-related IMs

The mean frequencies for the IAM and IM diaries (see Table 6-2) were entered into a 2 memory type (IAM vs. IM) by 2 recording type (full vs. tick) repeated measures ANOVA. Results showed a significant main effect of memory type $F(1, 39) = 53.36$, $p < .001$, $\eta^2 = .58$, with more IAMs reported than IMs. There was also a main effect of recording type $F(1, 39) = 8.51$, $p = .006$, $\eta^2 = .18$, with more full entries recorded than tick entries. Finally, the interaction between memory type and recording type approached significance $F(1, 39) =$

[20] Due to experimenter error, this question was omitted from the IAM debriefing questionnaire.

3.34, $p = .075$, $\eta^2 = .08$, which is reflective of smaller differences in the frequencies of full and tick entries in the IM diary than in the IAM diary condition.

The distribution of memories recorded across the three days is presented in Table 6-3. These were entered into a 2 memory type (IAM vs. IM) by 2 recording type (full vs. tick) by 3 recording day (Day 1 vs. Day 2 vs. Day 3) repeated measures ANOVA. Apart from the significant effects reported in the 2-way ANOVA above, there was no main effect of recording day $F(2, 78) = 2.43$, $p = .095$, $\eta^2 = .06$, nor was there an interaction between memory type and day ($F < 1$), or recording type and day $F(1.64, 63.9) = 1.61$, $p = .21$, $\eta^2 = .04$. Finally, there was no interaction between the three factors of memory type, recording type and day $F(2, 78) = 1.41$, $p = .25$, $\eta^2 = .04$.

Table 6-3: *Mean (SD) frequency of memories reported in the diary, distributed by day of diary keeping.*

	Day 1	Day 2	Day 3
IAM (Full Diary)	2.33 (1.35)	2.25 (1.72)	1.85 (1.53)
IM (Full Diary)	0.98 (1.03)	0.75 (0.90)	0.60 (0.84)
IAM (Tick Diary)	1.2 (1.45)	1.23 (1.51)	1.35 (2.14)
IM (Tick Diary)	0.63 (1.0)	0.53 (0.96)	0.33 (0.66)

6.3.3 Triggers for IAMs and IMs

In both the IAM and IM diary tasks, participants were asked to indicate whether their reported memory was triggered by something in the environment, their own thoughts or whether they could not detect a trigger. The mean proportions of each type or trigger were entered into a 2 memory type (IAM vs. IM) by 3 trigger type (environment vs. thoughts vs. no trigger) repeated measures ANOVA. Because mean proportions were used, this analysis did not result in the main effect of memory type ($F<1$), but there was a significant main

effect of trigger type $F(1.78, 58.74) = 33.64$, $p < .001$, $\eta^2 = .51$. Follow up comparisons showed that regardless of memory type, participants reported more environmental triggers than thought triggers ($p < .001$) or instances of no trigger ($p < .001$). Reports of thought triggers and no trigger did not differ from each other ($p = .92$).

This main effect of trigger type, however, was qualified by a significant memory by trigger type interaction $F(2, 66) = 4.08$, $p = .02$, $\eta^2 = .11$ (see Figure 6-1). Tests of simple main effects showed that a proportion of memories reported to be triggered by the environment was marginally higher for IAMs than for IMs ($p = .053$). By contrast, a greater proportion of IMs was reported to have no trigger than IAMs ($p = .011$). Finally, IAMs and IMs did not differ in the proportions of thought triggers reported ($p = .63$).

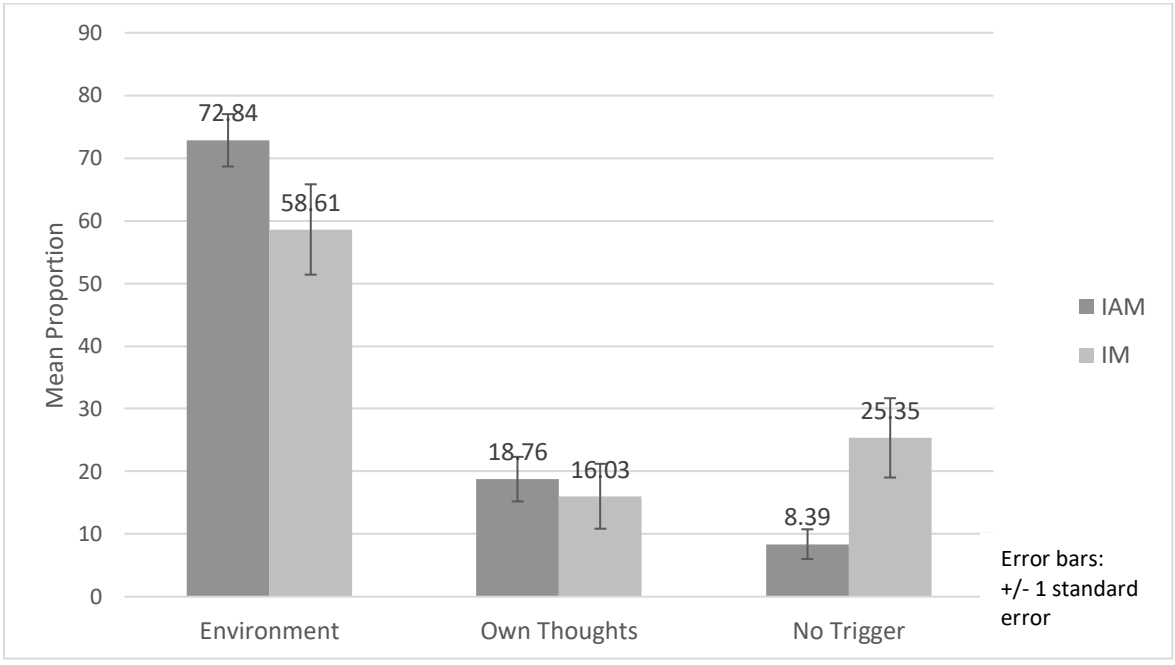


Figure 6-1: *Mean proportions of trigger type as a function of memory type (IAM vs IM).*

Descriptions of triggers, recorded by participants, were also coded according to the scheme developed by Mace (2004) into the categories of abstract/verbal, sensory/perceptual, physiological/emotional state, and unclassifiable (see also Chapter 5). No triggers were

deemed unclassifiable, and this category was removed from further analysis. The mean proportion with which each category of trigger was reported was entered into a 2 memory type (IAM vs. IM) by 3 trigger category (abstract vs. sensory vs. state) repeated measures ANOVA. Results again showed no effect of memory type ($F = 1.00$) but a highly significant main effect of trigger category $F(1.04, 29.18) = 30.73$, $p < .001$, $\eta^2 = .53$. Post hoc comparisons between mean proportions showed that physiological/emotional state triggers were reported much less frequently than abstract/verbal triggers ($p = .001$) or sensory/perceptual triggers ($p = .001$), which did not differ from each other ($p = .18$).

There was a marginally significant interaction between memory type and trigger category $F(1.07, 30.07) = 3.02$, $p = .09$, $\eta^2 = .10$ (see Figure 6-2). Because of the medium effect size, tests of simple main effects were carried out. For IAMs, equal proportions of abstract/verbal and sensory/perceptual triggers were reported ($p = 1.00$), and both were higher than physiological/emotional state triggers ($p < .001$). In contrast, for IMs the proportion of sensory/perceptual triggers was higher than abstract/verbal, and this difference was approaching significance ($p = .066$).

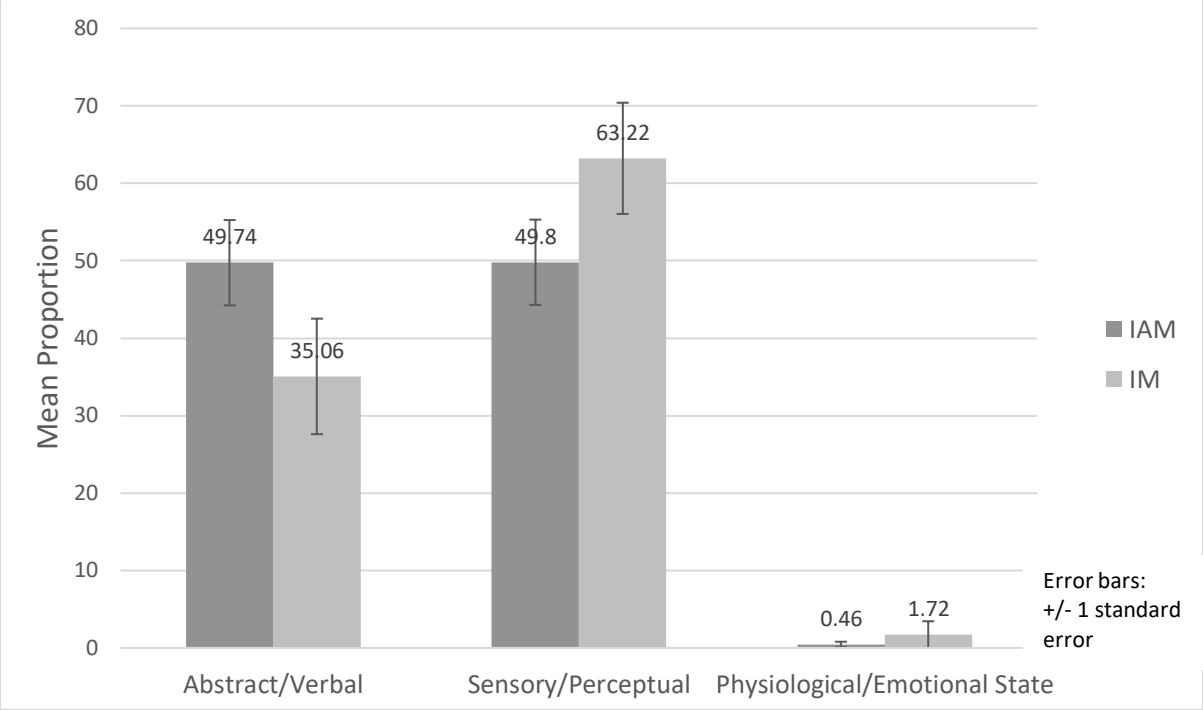


Figure 6-2: *Mean proportions of trigger categories reported as a function of memory type.*

6.3.4 Conditions in which IAMs and IMs are reported to occur

For each IAM and IM reported in the diaries, participants indicated what activity they were engaged in when the memory came to mind. These were subsequently coded as either automatic/habitual (therefore requiring few cognitive resources for successful completion, e.g. 'washing up', 'taking a shower' or 'walking the dog') or controlled and therefore requiring sustained attention (e.g. 'talking with my cousin', 'revising' or 'watching a film'). In the IAM diary, the mean proportion of automatic activities reported was 48.17 (*SD* = 25.49) whilst the mean proportion of controlled activities was 51.82 (*SD* = 25.49). In the IM diary, the mean proportion of automatic activities was 69.63 (*SD* = 37.26) whilst the mean proportion of controlled activities was 30.36 (*SD* = 37.26), suggesting that IMs were much more likely to be experienced under low cognitive load. The results of a 2 memory type (IAM vs. IM) by 2 ongoing activity (automatic vs. controlled) within subjects ANOVA found a main effect of type of activity $F(1, 33) = 4.12$, $p = .05$, $\eta^2 = .11$ with more reports of

automatic activity overall than controlled activities. Because the analysis was run on proportions, SPSS did not calculate *F* values for memory type, but there was a memory by type of activity interaction $F(1, 33) = 10.74$, $p = .002$, $\eta^2 = .25$. Tests of simple main effects showed that for IAMs there was no difference in the frequency with which automatic and controlled activities were reported ($p = .68$), but more automatic activities were reported than controlled in the IM diary condition ($p = .004$; see Figure 6-3).

However, the mean concentration ratings for ongoing tasks reported in the IAM diary and IM diary were 3.09 (SD=0.81) and 3.19 (SD=0.91), respectively, and did not significantly differ from each other ($F<1$).

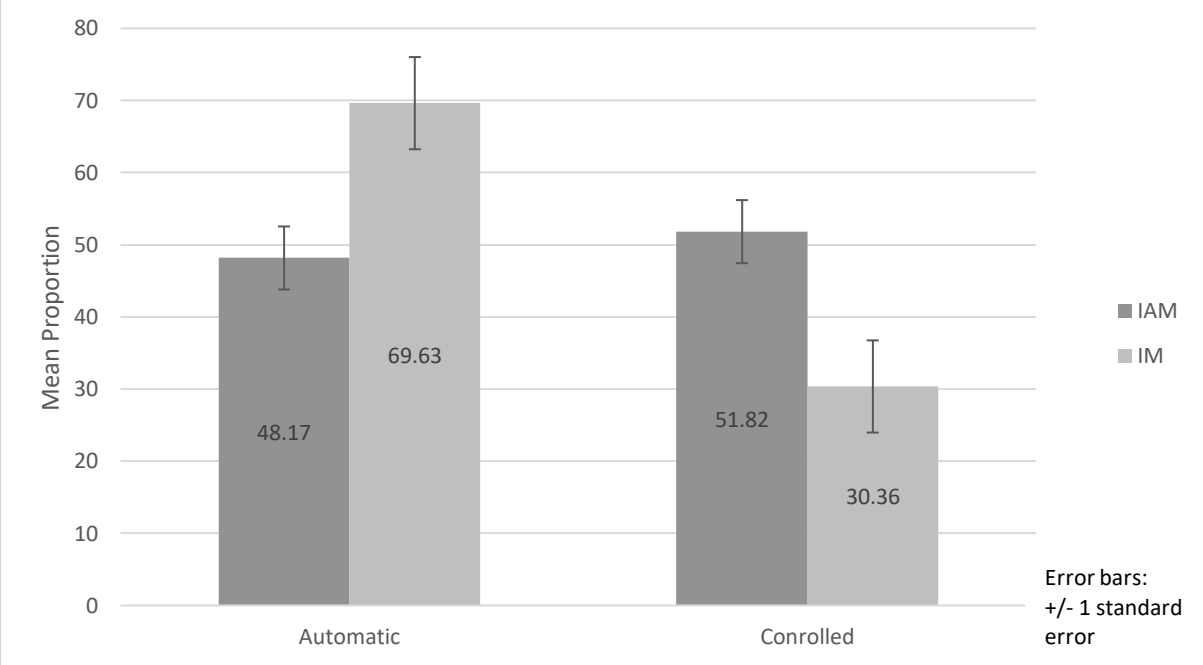


***Figure 6-3**: Mean proportions of automatic and controlled activities.*

6.3.5 Phenomenology

Memories reported in the IAM and IM diaries were also rated along a number of scales, including vividness, mood before experiencing the memory, pleasantness of the

memory, and impact on mood. The mean ratings given for each variable is presented in Table 6-4 as a function of diary type, along with the results of a series of one-way, repeated measures ANOVAs. Perhaps unsurprisingly IAMs were rated as more pleasant than IMs, and had a more positive impact on mood. There were no differences in baseline mood (just before the IAM or IM recorded in the diary was experienced) or vividness.

Table 6-4: *Mean rating (SD) for each variable as a function of diary type, along with the results of a one-way ANOVA.*

	IAM	IM	*F*	*df* [a]	*p*
Vividness	5.39 (0.99)	5.09 (1.15)	2.13	1,33	.15
Mood before	4.58 (0.79)	4.35 (0.93)	2.72	1,33	.11
Pleasantness	4.99 (.99)	2.47 (0.94)	93.12	1,33	.00
Impact on mood	4.66 (0.72)	3.06 (0.55)	94.23	1,33	.00

[a] Of the total sample of 40 participants, six did not report any film related IMs in the diary

6.3.6 Correlational Analyses

6.3.6.1 IM and IAM Frequencies

To examine the relationship between the frequency of IAM and IM reports, a series of two-tailed Spearman's correlations were run on the frequency of full and tick diary entries for both types of memory and reports of IM frequency in the lab shortly after watching the film (see Table 6-5). The only significant positive relationship found was between the number of IAMs and IMs recorded by tick in the diary (p = .002).

Table 6-5: *Spearman correlations (two-tailed) between diary and lab reports of IAMs and IMs.*

	Full IAM Entries	Tick IAM Entries	Lab IMs	Full IM entries	Tick IM entries
Full IAM Entries	1.0				
Tick IAM Entries	-.12	1.0			
Lab IMs	.12	.12	1.0		
Full IM entries	.06	-.15	.16	1.0	
Tick IM entries	-.11	.47**	-.02	-.00	1.0

**Correlation is significant at the 0.01 level (2-tailed).

6.3.6.2 IM and IAM frequencies and ratings of visual imagery, distress, involvement and bodily sensations

At the online screening stage, participants were asked to complete the VVIQ to test the degree of vividness with which they typically experience mental imagery. Table 6-6 shows Spearman's correlations between IM and IAM frequency and VVIQ scores as well as participants' ratings of emotional distress and involvement as well as bodily sensations evoked by watching the film clip in Session 2. For IMs, the table shows correlations both for the frequency of reported IMs in the lab immediately after watching the film and IMs recorded in the diary. None of the correlations for IAMs were significant. However, for IMs, significant positive correlations were obtained between the number of IM reports in the lab and VVIQ scores (p=.03), and between distress scores and full diary entries (p=.002). There was also a significant relationship between bodily sensation scores and full IM diary reports (p=.007).

Table 6-6: *Spearman's Correlations between imagery, distress and involvement scales and frequency of IM reporting (n=40).*

	VVIQ	Distress Scale	Involvement Scale	Bodily Reactions
Full IAM Entries	-.23	-.01	-.03	-.02
Tick IAM Entries	-.21	.25	.01	.06
Lab IMs	-.34*[1]	.28	.21	.15
Full IM entries	-.01	.47**	.09	.39**
Tick IM entries	.02	.09	-.08	.097

* Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
[1] The response scale on the VVIQ means that lower scores equal higher levels of object imagery (e.g. 1 = *perfectly clear and as vivid as normal vision*; 5 = *no image at all, you only "know" that you are thinking of the object*).

6.4 Discussion

The present study used a within-subjects design to compare the frequency, triggers and phenomenology of IAMs and analogue IMs over two separate, 3-day periods of diary keeping. To our knowledge no previous study has employed such a design to examine this particular relationship. Several important findings were obtained. Firstly, reports of IAMs in the present study were significantly higher than reports of IMs. However, the frequency of recorded IAMs was not predictive of the frequency of IM reports. In addition, environmental triggers in both diary conditions were reported most frequently, but reports of no-trigger were higher in the IM diary condition. When triggers were coded according to the scheme developed by Mace (2004), IAMs arose in response to abstract/verbal triggers as often as they did in response to sensory/perceptual triggers, but in the IM diary condition sensory/perceptual triggers were reported more frequently than abstract triggers. In terms of the conditions under which involuntary memories arose, more IMs were reported whilst participants were engaged in automatic/habitual activities, whereas the proportions of automatic versus controlled activities were comparable in the case of IAM reports.

6.4.1 IAM and IM reports in the diary

Neither IAM nor analogue-IM frequency reports were markedly different from results obtained in previous diary studies of each cognitive phenomenon. Given that the IAM diary was completed first, and the order with the IM diary was not counterbalanced, there was no reason to believe that IAM frequency results would not replicate previous findings. And indeed the mean frequency of 10.2 IAMs (combined full and tick entries) over 3 days falls within the range of previous diary studies (Berntsen, 1996; Kvavilashvili & Mandler, 2004; Laughland & Kvavilashvili, 2018; Schlagman & Kvavilashvili, 2008).

Of greater interest was the frequency of analogue IMs. There are a number of other factors which can impact on the frequency of IMs, including the film used and individual differences (see Marks, Franklin, & Zoellner, 2018; Weidmann, Conradi, Gröger, Fehm, & Fydrich, 2009). In addition, as noted previously, studies using the trauma film paradigm have mainly sought to manipulate prior, concurrent, and subsequent tasks to examine the effect of this manipulation on IM frequency. Control conditions in these studies with no additional task have resulted in approximately 4.5 to 7 IMs over a week-long period of diary keeping (Deeprose et al., 2012; Holmes et al., 2009; Holmes et al., 2004). By contrast, studies 4a and 4b of the present thesis had mean reports of 6.04 (*SD*= 4.26) and 5.43 (*SD*= 6.97) IMs – respectively – over three-day periods of diary keeping. These included both full entries and tick entries. But the lower rate of IM reports in the present study (*M*=3.80, *SD*=2.75; both tick and full entries) suggests a possible order effect, whereby the initial period of IAM diary keeping could have resulted in fewer film related IM reports in week 2 of the study. However, the results of a one-way ANOVA comparing mean IM reporting frequencies across the three studies was not significant $F(2, 129) = 1.62$, $p = .20$.

It was anticipated that the frequency of IAM reports would be predictive of the frequency of analogue-IM reports but this did not appear to be the case. The only significant

positive relationship that emerged was between tick entries in the IAM and IM diaries. There was no significant relationship between the frequency of full entries in the IAM and IM diaries, nor between the frequency of combined full and tick entries in each diary. These results suggest possible differences in the processes that give rise to IMs versus IAMs, which may be further reflected in the different in types of triggers reported for each type of memory.

6.4.2 Triggers and circumstances in which IAMs and IMs arise

The observed differences between IAMs and IMs in terms of types of reported triggers may have significant implications for the debate between single versus separate-trace theories of IMs (Lau-Zhu et al., 2019). Whilst Mace (2004) found that the majority of IAM triggers (68%) were abstract and verbal, it has also been found that the proportions of this type of trigger versus sensory/perceptual triggers are roughly equal (Schlagman et al., 2007). The greater susceptibility of analogue IMs to being triggered by sensory/perceptual cues seems to lend initial support to the separate-trace position, namely, the dual representation theory. Indeed, the sensory-based nature of IMs – because of their lack of contextualisation in the autobiographical memory narrative due to peritraumatic dissociation – suggests that they would be more likely to be cued by similar sensory information. That this appears to be the case in the present study also lends further support to the use of the trauma film paradigm as an appropriate approximation of naturally occurring IMs (Brewin et al., 2010; Brewin, Huntley, & Whalley, 2012; James, Lau-Zhu, Clark, et al., 2016).

Additional evidence for possible differences in underlying mechanisms of IMs and IAMs comes from the data on the type of activities that participants reported to have been engaged in at the time they experienced these involuntary memories. Although mean concentration ratings were comparable in the IAM and IM diary conditions, there were important differences in the frequency of automatic versus controlled activities reported. In the IM diary condition, a large proportion of the reported ongoing activities were automatic

in nature (70%), whereas the proportions of automatic versus controlled concurrent activities were comparable in the IAM diary condition (i.e., 48% vs. 52%, respectively). In other words, the results appear to suggest somewhat counterintuitively, that when people are engaged in controlled (i.e., attentionally demanding activities) they are more likely to experience an ordinary (non-intrusive) IAM than IM. Given that IM are probably more highly activated than representations of ordinary IAMs, our initial expectation was that IM would come to mind during the cognitively demanding ongoing activities as easily as during automatic less demanding activities whereas IAMs would be more susceptible to the nature of ongoing activities (i.e., would be more likely to be experienced during undemanding and demanding ongoing activities). However, this was not the case. The results therefore suggest that the frequency with which people experience IMs could be reduced if they were engaged in cognitively demanding ongoing activities, and could have practical implications for therapeutic interventions.

It is noteworthy, however, that there is evidence in the literature on IMs, suggesting that increased cognitive load can result in a failure to supress IMs, leading to an increase in their frequency (Aikins et al., 2009; Nixon, Cain, Nehmy, & Seymour, 2009). Whilst this was found to be the case with both analogue and naturally occurring IMs, the discrepant results as compared to the present study may be a function of the method used – namely a cognitive load induction – which was not employed in the present study. It is obvious therefore, that studying the role of contextual factors (i.e., triggers and the attentional demands of concurrent activities) of IMs in everyday life should become an important avenue for future research.

6.4.3 Phenomenology

In the present study, some ratings of phenomenology recorded in both diaries aligned with what might be expected, whilst others did not. In particular, it would not be expected

that vividness ratings in the IAM diary task would surpass those in the IM diary task. This is likely to be attributable to the fact that the analogue IMs in the present study are based on a film viewed several hours to days ago. The (episodic) memory for the film is unlikely to be as vivid as real lived experience of autobiographical event, independent of the emotional valence of the memory. In addition, lower pleasantness ratings for IMs and greater negative impact on mood aligned with predictions of the study.

6.4.4 Limitations

In the present study all participants completed the IAM diary before watching the trauma film and completing the IM diary. A counterbalancing of the order in which the diary tasks were completed was seriously considered, but was not pursued. The primary reason for this was a desire to avoid participants reporting memories from the film in the IAM diary. This seemed a plausible risk given that many analogue studies have employed a week of diary keeping in which participants have reported IMs beyond the first three days of recording (James, Lau-Zhu, Clark, et al., 2016). Given that participants in Studies 4a and 4b completed almost an identical IM diary without having to keep an IAM diary in the previous week, it was possible to assess the possible effects of lack of counterbalancing on the number of recorded IMs across the present study and Studies 4 a and 4b. Although the mean number of recorded IMs in the present study was numerically lower than IMs recorded in Studies 4a and 4b, the difference was not statistically significant. Nevertheless, it is still possible that the number of recorded IMs would have been higher than reported by participants in the present study if they did not have to keep the IAM diary in week 1. For example, in a fully counterbalanced two week diary study that involved one week of recording IAMs and one week of involuntary semantic memories (mind pops), Kvavilashvili and Mandler (2004) found that participants reported significantly fewer IAMs in the second week (following mind pop recording) than they did during the first week (though there was no such effect for

mind pops). This impact of the order in which diaries were kept therefore merits further investigation.

6.4.5 Conclusion

Through a within-subjects comparison of IAMs and analogue IMs, the present study may offer some insight into the relationship between the IAMs and naturally occurring IMs. This is perhaps most clearly the case with regard to the data on triggers as well as ongoing activities, the results of which support the use of the trauma film paradigm as appropriate experimental approximation of naturally occurring IMs. Further research is required to examine the relationship of IAMs and naturally occurring IMs in both clinical and non-clinical populations in terms of frequency, triggers and phenomenology. A clearer picture of the nature of IMs in daily life and how they relate along these variables to IAMs, will hopefully go some way toward resolving the debate of how best to account for their occurrence.

Chapter 7: General Discussion

In this chapter, I will first summarise the main aims of the thesis and the key findings that emerged from the studies described in Chapters 2 to 6. This will be followed by a more detailed discussion of the main methodological and theoretical implications of each of these key findings. The chapter will conclude by discussing some of the limitations of the present findings and suggesting possible avenues for future research.

7.1 Aims

The present thesis had four primary aims. The first was to examine the feasibility and implications of applying diary and laboratory-based methods, typically used in IAM research, to the investigation of IMs. A very small number of studies have so far used a diary method to investigate naturally occurring IMs (Berntsen, 2001; Berntsen & Rubin, 2008; Kleim et al., 2013; Rubin, Boals, & Berntsen, 2008; Rubin, Dennis, & Beckham, 2011; Williams & Moulds, 2007). It has been used more extensively to study trauma-film induced analogue IMs, but in the majority of these studies it has been used in a truncated format, with the primary aim of capturing the frequency of IMs, with perhaps a few additional variables (James, Lau-Zhu, Clark, et al., 2016). Moreover, given that most research on IMs has been based on retrospective interview and questionnaire methods, the present thesis also attempted, for the first time, to elicit and capture naturally occurring IMs under controlled laboratory conditions (Studies 3a and 3b).

Another key aim of the present thesis was to provide new evidence of the viability and merit of studying naturally occurring IMs in non-clinical populations, both for purposes of better understanding them as a feature of everyday cognition, but also to offer insight into their clinical manifestation. In the substantial body of research on IMs, there are only a limited number of studies that have recruited primarily non-clinical samples (i.e., not as a control condition; Brewin, Christodoulides, & Hutchinson, 1996; Bywaters, Andrade, & Turpin, 2004; Yeung & Fernandes, 2020). This would seem to place additional (and

unnecessary) burden on clinical populations when a considerable amount can be inferred about clinical manifestations of IMs by studying their non-clinical presentation. At the same time, research on IMs in non-clinical populations has merit in its own right, given the mounting body of evidence that this is a common cognitive phenomenon (Yeung & Fernandes, 2020).

A third aim was to examine the triggers for naturally occurring and analogue IMs, and the conditions under which they occur, as a means of inferring the extent to which they can be reasonably compared to each other, and to IAMs. There is a considerable amount of evidence that the majority of IAMs are triggered by environmental (external) cues and to a lesser degree by internal cues (i.e., one's own thoughts) with a much smaller percentage of IAMs reported to have no identifiable trigger (Berntsen, 1998; Mace, 2004; Schlagman & Kvavilashvili, 2008; Kvavilashvili & Mandler, 2004, Study 4). Due to the relative lack of diary research on IMs (or lack of more detailed diary-recording in the case of analogue IMs) there has been little investigation of IM triggers, some notable exceptions aside (Kleim et al., 2013; Lau-Zhu et al., 2019). The present research aimed to address this gap in the literature by asking participants across several studies to identify a trigger for their analogue or naturally occurring IMs each time they completed a full diary entry. Findings have implications for how we understand the relationship of IMs to IAMs, and whether they arise from divergent or similar cognitive mechanisms. This in turn has potential implications for how IMs are understood and treated in clinical settings, namely as a feature of depression and PTSD.

A final aim was to test the therapeutic effects of structured interaction with the contents of IMs, in the form of a diary (Study 2) but also briefer completion of IM questionnaires during a laboratory-based vigilance task (Studies 3a and 3b). Evidence suggests that structured interaction with the contents of IMs can result in reduced distress

associated with such memories. This has been demonstrated with therapeutic techniques such as trauma focused CBT as well as EMDR (Foa & Rothbaum, 1998; Gunter & Bodner, 2008). It has also been demonstrated with questionnaire completion regarding distressing memories (Boals et al., 2011; Rubin et al., 2010) and more recently with a structured electronic diary that prompted people to complete the PCL-C several times per day over a period of two weeks (Dewey et al., 2015). Moreover, there is also evidence to show that having the opportunity to talk about a stressful video (e.g. the Nazi Holocaust) versus not being able to talk about it resulted in fewer retrospective reports of IMs about the film over the subsequent 2-day period (Lepore, Ragan, & Jones, 2000). The present thesis therefore aimed to compare the therapeutic effects of in-person disclosure and questionnaire completion about IMs and an extended (two week) period of diary keeping, to determine which variable appeared to have the greater impact on various indices of psychopathology (e.g., depression, anxiety).

7.2 Main Findings

7.2.1 Findings related to naturally occurring IMs in non-clinical populations

The occurrence of IMs in non-clinical populations was identified some time ago (Brewin et al., 1996), and yet this non-clinical manifestation of a widely acknowledged clinical phenomenon remain under-explored. This is somewhat understandable, given some researcher's access to clinical populations, and the particular imperative to study the most distressing and debilitating manifestations of IMs. And for researchers without access to clinical populations, the trauma film paradigm offers the opportunity to conduct minimal participant screening (to ensure that people are well enough to take part). In light of the above, the present thesis has attempted to make a case for further investigation of IMs in non-clinical populations, and empirically establish the implications (and merit) of doing so.

The results of the study presented in Chapter 2 offered some insight into the prevalence of IMs in a population of undergraduate psychology students. The circulation of an online questionnaire yielded a large number of individual IM reports. This was the pool from which participants in the studies presented in Chapter 4 were selected for invitation to the laboratory (the participants in Chapter 3 were recruited separately). The results obtained from the four studies across Chapters 2-4 suggest that although there may be some differences between IM presentation in non-clinical and clinical populations, studying IMs in non-clinical samples would seem to have much to teach us about IMs in clinical populations.

The coding of IMs, reported in Chapter 2, into the content categories devised by Reynolds and Brewin (1999) allowed for direct comparison with the clinical populations recruited for their study. Analysis showed a significant difference in the content categories into which IMs reported in Chapter 2 fell, and the sample recruited by Reynolds and Brewin (1999) who had depression or PTSD. Despite this, there were also broad and notable similarities. These two clinical diagnoses also differed from each other along this variable. The difference between the clinical groups is perhaps understandable, given that a key criterion for the diagnosis of PTSD is the experience of a life event that threatens with death, serious injury or sexual violence, either against oneself or a relative or close friend. The range of life events that can precipitate the onset of depression is broader (and the events sometimes more distal) even if that spectrum includes experiences that would meet Criterion A for PTSD (American Psychiatric Association, 2013; Brewin, 1998).

The notable overlaps between the IM content categories reported by Reynolds and Brewin's (1999) clinical samples and the non-clinical population recruited for Studies 1-3 (described in Chapters 2 to 4) speaks to the viability of studying IMs in the general population. Moreover, the results for these studies would not seem to simply be an artefact of the (primarily student) population accessed. Indeed, rates of depression among students have

been found to be comparable to their peers in the general population (Quince, Wood, Parker, & Benson, 2012). In addition, the proportion of students that have experienced a Criterion A stressor (84%; Vrana & Lauterbach, 1994) has been found to be similarly comparable to rates found in the general population (with results showing a prevalence of between 67% and 89%; Bernat, Ronfeldt, Calhoun, & Arias, 1998; Cusack et al., 2019; Kilpatrick et al., 2013). And whilst there were no measures of psychopathology collected for online IM questionnaire in Study 1 (Chapter 2), such measures were collected for laboratory-based Studies 3a and 3b (with participants recruited from the sample of the retrospective survey Study 1) as well as for diary Study 2 (in which the majority of the participants were also undergraduate students). BDI scores in the latter study in particular suggest mild to moderate dysphoria and mean PCL-C scores were above the widely used cut-point of 45. Taken together, these results speak to the viability of studying IMs in a general student population, but also adopting non-clinical participant recruitment for IM research in the future.

Thus, important new findings were obtained about the frequency and nature of IMs in a young adult population. As with IAMs, the frequency of IMs in daily life appears to vary as a function of the method employed. Retrospective data from Study 1 suggests a mean frequency of three to four times per week which largely squares with previous retrospective studies with clinical populations (Hackmann et al., 2004; Speckens et al., 2007). The retrospective frequency data from the present thesis was replicated in the smaller samples of participants in Studies 3a and 3b. Few studies, however, have sought to measure the true frequency of IMs using a diary (Kleindienst et al., 2017; Kvavilashvili, Sari, Fong, & Brewin, in preparation; Priebe et al., 2013; Rubin, Dennis, & Beckham, 2011; Williams & Moulds, 2007). These studies found a mean IM frequency per week ranging from 5.78 (Rubin et al., 2011) to 22 in non-clinical populations (Kvavilashvili et al., in preparation), to 74.5 in a sample with PTSD (Priebe et al., 2013). The present study used a paper diary which has been

found in IAM research to yield a higher number of reports than some electronic formats (namely smartphones; Laughland & Kvavilashvili, 2018) even if a small proportion of these are triggered by the diary itself (Kleim et al., 2013). In the two-week diary study (Study 2, Chapter 3), the mean frequency of fully recorded IM entries ranged from 5.64 (*SD*=3.24) to 7.37 (*SD*=8.83) across the two IM-recording conditions (*IM-interview/diary* and *IM-keywords/diary*), though the frequency of tick entries was considerably higher - 9.86 (*SD*=13.95) and 8.32 (*SD*=11.64), respectively. These results provide further evidence that people in the general population experience fairly frequent IMs, which appear to be comparable to some clinical reports obtained retrospectively (Hackmann et al., 2004; Speckens et al., 2007) though not necessarily those obtained with a diary (Kleindienst et al., 2017; Mihailova & Jobson, 2020; Priebe et al., 2013).

Whilst frequency can be an important measure of the disruptiveness of an IM, and the potential for resultant distress, it is just one metric by which to assess this. Indeed, evidence from a number of studies suggests that the defining feature of IMs experienced in PTSD – which distinguishes them from IMs experienced as part of depression or in non-clinical populations - is the sense of 'nowness' that accompanies them (Brewin, 1998; Kleim et al., 2013). Nevertheless, retrospective data from Study 1 (Chapter 2) shows that a considerable majority of participants (69%) reported experiencing their IM with a sense of reliving the event rather than just looking back at the past. And whilst a specific reliving question was not asked in Study 2 (Chapter 3), a question in the diary regarding bodily sensations could be interpreted as a proxy for this. Of all the IMs reported across the *IM-interview/diary* and *IM-keywords/diary* conditions of Study 2, 53% were accompanied by bodily sensations. This was significantly higher than 20% of involuntary PMs that were reported to be accompanied by bodily sensations in the *IM-interview/PM-diary* condition. In summary, although these results suggest that the degree of 'reliving' with which IMs are experienced may differ between

people with PTSD and those without, they would still appear to be a quality characteristic of IMs regardless of their clinical or non-clinical presentation. In addition, the medium to high distress ratings reported in Studies 1 and 2 of the present thesis largely align in degrees of severity with clinical samples (even if the use of different scales precludes direct comparison; Reynolds & Brewin, 1999). This lends further support to the practice of studying those instances of non-clinical IM presentation.

7.2.2 Findings related to the triggers for naturally occurring and analogue IMs, and their relationship to IAMs

A second aim of the present thesis was the examination of triggers for naturally occurring and analogue IMs. This was explored across six different studies, which incorporated both diary and laboratory methods. Triggers for naturally occurring IMs were examined using laboratory-based vigilance tasks and a diary method. The results of the laboratory Study 3a, in particular, strongly suggest that IMs largely result from exposure to meaningful cues in the external environment. This is reflected in the trigger reports for the experimental condition, with participants indicating that 79% of their IMs were triggered by environmental cues (i.e., the phrases on the screen) while the percentages of IMs triggered by internal cues (i.e., by participants' thoughts) or coming to mind without any identifiable triggers constituted only 17% and 4% of reported IMs, respectively. In stark contrast, in the control condition in which participants were exposed to simple maths calculations during the vigilance task, 83% of triggers were reported as being internal (participants' own thoughts) and only 17% as external. In addition, in Study 3b it was demonstrated that personalised verbal cues (based on an IM reported at screening) were more effective at eliciting IMs in the lab than non-personalised cues.

The diary studies of naturally occurring and analogue IMs showed a broadly similar pattern of external/internal trigger reports, though analogue IMs appear to more often be reported as having no trigger. In the diary study for naturally occurring IMs (Study 2 in

Chapter 3), approximately half of IMs were reported as being triggered by environmental cues. Approximately one third were triggered by internal thoughts and the remainder (a mean proportion of 17.06 in the *IM-interview/diary* condition and 22.89 in the *IM-keywords/diary* condition) had no identifiable trigger. Findings from Studies 4a and 4b on analogue IMs showed a similar pattern in that approximately half of the reported triggers for IMs were environmental. But the mean proportion of IMs reported as having no identifiable trigger (36.26 in Study 4a and 28.69 in study 4b) was higher relative to reports of internal triggers (11.98 in Study 4a and 17.55 in Study 4b). This is a key way in which naturally occurring and analogue IMs differ, arguably reflective of the fact that analogue IMs have no true autobiographical element, even if they do approximate some of the decontextualized sensory quality of naturally occurring IMs.

It is interesting that naturalistic IMs reported in Study 2 appear to follow a similar pattern of trigger reporting as IAMs (Berntsen, 1996; Schlagman & Kvavilashvili, 2008), though the proportion of environmental triggers is slightly lower than that found in other IM diary research. For example, Kleim et al. (2013) found that 80% of IM triggers reported by participants with PTSD and trauma without PTSD were environmental. These included people, places similar to where the trauma occurred as well as the actual trauma scene, newspaper and TV reports, conversations, and cues related to the study itself. Only 11% of cues were internal (physiological or trauma related thoughts), 8.9% as "other" and only 2% of IM reports were classed as having no identifiable trigger. This stands in sharp contrast to some retrospectively collected data suggesting that the majority of IM triggers are internal (Birrer, et al., 2007).

The trigger reporting pattern for naturalistic and analogue IMs according the content categories developed by Mace (2004) was more varied. This was evident in Study 2, where the two IM diary keeping conditions diverged in the coding categories into which reported

triggers fell. Whilst roughly equal proportions of abstract/verbal and sensory/perceptual triggers were reported in the *IM-interview/diary* condition (43.75 versus 50.92), in the *IM-keywords/diary* condition, there was a considerable difference between the two (65.63 versus 29.11). The key difference between these two conditions was that participants in the *IM-interview/diary* condition had an opportunity to disclose and rate their IMs with the researcher present, whilst participants in the *IM-keywords/diary* condition did not. The results from the *IM-interview/diary* condition align more with the proportions for IAMs found in Study 5 (49.74 abstract/verbal and 49.8 sensory/perceptual) as well as previous studies on IAMs (Mace, 2004; Schlagman et al., 2007). This suggests that the IM interview maybe be impacting the subsequent pattern of trigger reporting. By contrast, the *IM-keywords/diary* condition offered no opportunity for initial disclosure, but participants subsequently reported a greater proportion of abstract/verbal triggers. This runs counter to the prediction that the majority of IMs would have sensory/perceptual cues rather than abstract/verbal.

Finally, the trigger content categories reported in Studies 4a and 4b (Chapter 5) for trauma-film induced IMs, largely aligned with those found for analogue IMs recorded in Study 5 (Chapter 6). Both showed a clear predominance of sensory/perceptual triggers (proportion of 76.4 in Study 4a and 57.3 in Study 4b), which was replicated in Study 5 (proportion of 63.2). These heightened proportions of sensory/perceptual triggers align more with what might have traditionally been expected for naturally occurring IMs (e.g. Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000). But these results diverge from those obtained in Study 2, in which the *IM-interview/diary* condition showed relative parity between abstract/verbal and sensory/perceptual trigger reports, and the *IM-keyword/diary* condition showed an almost inverse reporting pattern to analogue IMs studies. These findings point to important differences between analogue and naturalistic IMs, but also between both types of IM and IAMs.

7.2.3 Findings related to the therapeutic benefit of diary keeping and questionnaire completion for naturally occurring IMs

In the present thesis, evidence for the therapeutic benefit of engaging with the contents of IMs is overall mixed, but nevertheless it raises important questions that merit further investigation. This potential benefit was assessed via a diary study of naturally occurring IMs (Study 2) that lasted for two weeks, as well a much briefer interaction with contents of IMs in the course of a laboratory vigilance task (Studies 3a and 3b). The impetus for investigating this question lies at the convergence of number of research strands. Firstly, whilst there is ample evidence for the therapeutic benefits of expressive writing (Pennebaker, 1997), the outcomes of its application with people who have PTSD are mixed (Koopman et al., 2005; Sloan et al., 2011; Smyth et al., 2008). Similarly, diary keeping has been acknowledged as therapeutically beneficial in the treatment of a number of conditions (Cohen et al., 2013), and yet this has been empirically investigated in only a couple of studies in relation to IMs (Dewey et al., 2015; Kvavilashvili & Brewin, 2013). The present thesis therefore represented an attempt to draw together these strands and contribute to addressing this gap in the literature.

The briefer interaction with IM contents tested in Studies 3a and 3b – for which participants completed a 9-item questionnaire regarding their thoughts at eight fixed points during a vigilance task – showed no therapeutic effect. Participants were stopped at eight points during the task - instead of being asked to report their IMs as they arose - in order to avoid demand characteristics. It was hypothesised that the participants who reported experiencing their nominated IM during the vigilance task might experience therapeutic benefit relative to participants who did not. It was predicted that this would be reflected in reduced BDI and STAI scores in Study 4a and reduced HADS score in Study 4b. Results of a mixed ANOVA, however, showed no main effects. Participants also rated their mood on a 9-point scale before and after the vigilance task. Interestingly, in Study 3a participants who

reported an IM during the task rated their mood lower overall (which could be predictive of their reporting an IM and/or the result of it) but this was not the case in Study 3b. The mean rating on the mood scale in both studies, however, was lower after the vigilance task relative to before, regardless of whether participants reported an IM during the task.

In the case of the vigilance task it seems likely that the interaction was not sustained enough to produce the therapeutic benefit observed in other instances of engaging with the content of IMs. Only a small proportion of the thoughts reported were IMs, and participants reported thinking about things unrelated to their IMs in substantial number of thought probes. By contrast, studies exploring the impact of expressive writing on PTSD symptoms have engaged people in several writing exercises each of 20 minutes in duration over one day (Smyth et al., 2008), three consecutive days (Sloan et al., 2011), or four weeks (Koopman et al., 2005). Participants were furthermore asked to reflect on the emotions related to the event about which they were writing. Whilst these studies did not produce a reduction in PTSD symptoms, participants in the expressive writing conditions showed improvement in measures of depression (Koopman et al., 2005) and mood overall (Smyth et al., 2008). Even the AMQ that Rubin, Boals and colleagues asked participants to complete contained a number of items, and would have required participants to focus on IM content for a sustained (if undefined) period of time (Boals et al., 2011; Rubin et al., 2010). And EMDR involves asking participants to maintain the aversive memory content in mind whilst engaging in the prescribed eye-tracking task (Shapiro, 2001).

Rather than the conclusive lack of effect observed in the laboratory study, Study 2 produced mixed results in terms of therapeutic effect. It was predicted that the diary of involuntary PMs would provide a control condition to demonstrate the clear benefit of recording IMs in the diary. In addition, the inclusion of an interview and written disclosure about the content of IMs at the beginning of the *IM-interview/diary* condition but not the *IM-*

keyword/diary condition was designed to assess the impact of this relative to the diary keeping alone.

The two conditions that underwent the preliminary IM interview (the *IM-interview/diary* and *IM-interview/PM-diary* conditions) showed some numeric improvement (if not statistically significant in all cases) relative to the condition that did not undergo the preliminary interview (the *IM-keywords/diary* condition). The strongest therapeutic effect, however, was observed in the *IM-Interview/PM Diary* condition. With regard to Beck Depression Inventory (BDI) scores, group differences did not reach statistical significance, but it was evident that the main effect of time of administration was driven primarily by the drop in scores reported in the *IM-Interview/PM-diary* condition (and to a lesser extent by the drop observed in the *IM-interview/diary* condition). With regard to the PTSD Checklist – Civilian Version (PCL-C) results showed that experimental condition had a significant effect on scores obtained at the end of the two-week period of diary keeping, with the *IM-interview/PM-diary* condition showing significantly lower scores. This result appears to have been primarily driven by lower scores at Time 2 on the Criterion B (intrusion) subscale.

There are a number of points to consider regarding these results. The first is why the condition that did not offer participants the opportunity to discuss their IM in the lab showed an almost total lack of improvement in their BDI, STAI and PCL-C scores. The second point relates to why the IM diary – shown in other studies to produce therapeutic benefit – did not do so in the present thesis. Finally, why is it that the *PM Diary* condition appears to have shown the greatest improvement in measures of psychopathology relative to the other conditions, particularly when it was intended to be a control condition? These will be discussed in turn.

With regard to the first point, the results suggest there is something particular about in-person disclosure that may contribute to overall therapeutic benefit (e.g., see Lepore et al.

2000). This has resonance with clinical evidence that the strength of the therapist-client relationship is predictive of therapeutic outcome, across different methods of therapeutic intervention (Martin, Garske, & Davis, 2000). Whilst the researcher-participant interaction in the study under discussion was insufficient to develop a relationship as such, evidence for the centrality of the therapeutic alliance speaks to the importance of human interaction for the achievement of improved outcomes. In addition, people's assessment of their traumatic experience – and what they believe it says about them and their place in the world – has been identified as key to the maintenance of PTSD symptoms, of which IMs are a central component (Halligan, Michael, Clark, & Ehlers, 2003; Steil & Ehlers, 2000). Many of these assessments – about one's weakness, unworthiness, lack of value – arguably engender feelings of shame, which has been found to be predictive of PTSD symptom severity (Bannister, Colvonen, Angkaw, & Norman, 2019; Cunningham, Davis, Wilson, & Resick, 2018). And in some clinical settings failure to disclose experiences or beliefs about the self that may underlie feelings of shame, result in the maintenance of those feelings (Swan & Andrews, 2003). Therefore, the mitigation of shame through disclosure may in turn result in an ability to reassess – at least to some degree – the meaning that the individual has assigned to their having gone through this traumatic experience. Recording memories in the diary without first discussing them with the experimenter would have offered insufficient opportunity to examine these assessments, perhaps resulting in the almost complete lack of change in psychopathology measures in this condition.

In addition, as noted above, the instructions often given to participants in the expressive writing research ask that they reflect on their emotional response to the event in question. There were no such instructions in Study 2 of the present thesis, either for the IM nomination in the lab or the reporting of IMs in the diary. Participants were asked to focus on the details of the memory in both cases, and were given relatively little space to write about it

(one third of a side of A4 in the lab, and just a portion of a side of A5 in the diary). The emotional processing that has been posited as one theoretical explanation for the effect of expressive writing, may not have been fully activated for both reasons of time and instructions given to participants (Sloan & Marx, 2004).

But there were still some modest indications of therapeutic benefit in the *IM-interview/diary* condition. Was this simply a function of the initial disclosure and questionnaire completion, or were these results at all enhanced by the diary? There is evidence to suggest the latter, but two variables that may have impacted on this are the length of the diary-keeping period, and the mode of data collection. In an Ecological Momentary Assessment (EMA) study, Dewey et al. (2015) collected data from participants for two weeks, asking that they completed electronic versions of the PCL-C when prompted to do so at several points during the day. They found that when comparing PCL-C scores taken at baseline and at the end of the study, there was a significant drop. It would therefore seem that the length of diary keeping alone does not explain the lack of effect in the study presented in Chapter 3. It may be this, combined with the request that participants monitor their thoughts and record as many of their IMs as possible, which could have overburdened them and counteracted any therapeutic benefit. Other studies of IMs in clinical and non-clinical populations have limited the number of entries per day to avoid this (though they were not looking at the before and after effects of recording IMs; Kleim et al., 2013). The effect of this combination of length and method of IM collection (event-based rather than time-based; see Rattel et al., 2019) may help to explain how Kvavilashvili and Brewin (2013) observed an improvement in psychopathology scores after one week diary of event based diary keeping. A two week event-based diary might have exceeded the "optimal dose" of exposure to IM content (Echiverri, Jaeger, Chen, Moore, & Zoellner, 2011).

A remaining question, therefore, is why the PM diary combined with the IM interview, appears to have had the greatest therapeutic effect. Indeed, results suggest that having the opportunity to disclose the content of one's IM, followed by the tracking of one's future oriented thoughts, may be a particularly adaptive combination for a reduction of IMs. This may both command cognitive resources that would otherwise be devoted to IMs, but also be adaptive for their orientation toward concrete plans in the future. It has been suggested that the majority of our future thinking is highly pragmatic and primarily focussed on fairly short-term goals and plans, rather than thinking about more abstract or hypothetical scenarios and events (Kvavilashvili & Rummel, 2020). Indeed, the latter mode of thinking has been shown to be more common in dysphoric mood (Plimpton et al., 2015). Conversely, goals have been shown to be important to overall wellbeing, with satisfaction derived from making progress towards achieving goals as well as arriving at the end result (MacLeod, 2017). The mean baseline scores for the diary Study 2, presented in Chapter 3, were well within the range previously accepted for dysphoria (16 or above, see Kvavilashvili & Schlagman, 2011). It therefore seems plausible that therapeutic benefit was derived from engaging participants in an activity which was concrete, goal-oriented, and likely to result in goal completion. Indeed, several participants reported informally that they found the PM diary keeping to be a useful (e.g. "I enjoyed keeping a diary and think I will invest in one to track how I'm coping with plans I make" and "Realising that I had formed intentions made me want to get things done more proactively and also heightened my self-awareness and confidence").

Finally, there is a notable divergence between the subjective measures for improvement that were recorded at the end of the diary study (as part of the compliance questionnaire) and the results obtained from analysing the pre-and post-diary keeping scores on the BDI, STAI and PCL-C. Namely, a majority of participants in the *IM-keywords/diary*

condition (53%) reported that recording their IMs in a diary made them feel worse overall, while they showed virtually no change before and after on the above-mentioned scales. Despite this, only 31% of participants in this condition reported that the diary keeping had no effect on their mood. Conversely, a majority of participants in the *IM-interview/diary* condition (46%) reported that the IM diary-keeping made them feel better overall, with only 36% reporting no effect. Whilst participants in this condition showed numeric improvement on measures of depression, anxiety and PTSD between the first and second administration, this change was not significant. Finally, 73% of participants in the *PM Diary* condition reported that diary keeping had no impact on their mood, with only 27% reporting an improvement. Paradoxically, this was the condition that showed the greatest level of objective improvement as measured by the BDI and PCL-C (though only the latter measures showed change that differed significantly from the other two conditions).

These findings resonate with those of Kvavilashvili and Brewin (2013) who found that participants in their study (who kept diary of IMs for one week – either full entries plus tick as in Chapter 3, or ticks alone) reported improved mood if they kept the full diary (*M*=5.31, *SD*=1.25 on a 7-point scale – 1=*made me feel a lot worse,* 4=*no effect,* 7=*made me feel a lot better*). For the tick-only diary, participants gave a mean rating of 3.86 (*SD*=0.66), indicating little to no effect (but falling slightly on the negative side of the scale). This was despite the fact that both conditions showed a significant improvement in BDI and STAI-State scores when comparing the beginning of the diary keeping to the end.

Whilst a subjective sense of improvement is arguably important, the finding of the present thesis combined with those of Kvavilashvili and Brewin (2013) raise the possibility that participants may experience depression, anxiety and PTSD symptom reduction of which they are not fully aware. It is perhaps unsurprising given the demonstrated lack of meta-awareness for thoughts (Smallwood, McSpadden, & Schooler, 2007; Takarangi et al., 2014),

that there might be similar phenomenon for emotion and overall psychological health. In addition, certain cognitive distortions associated with depression and PTSD – namely the retrieval of over-general autobiographical memories – are known to be key in maintaining these conditions but also predictive of them (Barry, Sze, & Raes, 2019; Hitchcock, Werner-Seidler, Blackwell, & Dalgleish, 2017). That this cognitive style can persist in the absence of clinical symptoms provides further evidence of a possible divergence between subjective and objective measures of psychological health. This in turn supports a clinical practice of collecting both subjective and more objective measures during the course of a particular intervention, as a means of gauging its effectiveness.

7.3 Methodological and Theoretical Implications

The present thesis has made a number of novel methodological contributions to the study of IMs. The first of these is the use of a paper, IAM-style diary for event-based recording of IMs. This method has yielded important findings about the frequency, phenomenology, and triggers of IAMs, and in the present thesis has been shown to do the same with regard to IMs. Measures of frequency would seem to vary depending on the type of diary (electronic versus paper; Laughland & Kvavilashvili, 2018), recording method (event-based versus time-based) and length of the diary keeping period (Kleindienst et al., 2017; Priebe et al., 2013). Nevertheless, evidence suggests that event-based recording in a paper diary (as used in the present thesis) yields good approximation of the frequency of IMs for which participants are meta-aware, though this format could perhaps be optimised going forward with a shorter diary keeping period (see below). In addition, this provides valuable information regarding triggers for IMs and the emotional and physical responses to them, for which there is a limited amount of real-time (as opposed to retrospective) empirical data. And an event-based diary is particularly useful for capturing this fleeting detail.

Similarly, adopting an IAM-style diary for the study of analogue IMs in Studies 4a and 4b in the present thesis has facilitated the capture of detail regarding the conditions under which these cognitions come to mind, namely triggers and concurrent activates. This allows for comparisons with naturalistic IMs and IAMs along these variables, thereby contributing to our understanding of what can be inferred from the study of analogue IMs.

In addition, Studies 3a and 3b demonstrate that it is possible to elicit naturally occurring IMs under controlled laboratory conditions. The feasibility of doing this with IAMs has long been demonstrated (Barzykowski & Niedźwieńska, 2018; Kvavilashvili & Schlagman, 2011; Schlagman & Kvavilashvili, 2008), and deemed possible because of the bottom-up, associative way in which they are triggered and brought to consciousness, making them susceptible to more abstract and language-based cues in the environment (Berntsen, 2009). By contrast, it has traditionally been thought that IMs are more susceptible to being triggered by sensory/perceptual information, because of their lack of autobiographical (or episodic) context, which is the result of peri-traumatic dissociation during the event itself (Brewin, Gregory, Lipton, & Burgess, 2010; Brewin, 2014; Ehlers & Clark, 2000). But Studies 3a and 3b amply demonstrated that it is possible to trigger naturally occurring IMs with cue phrases under controlled conditions. Furthermore, personalising those cue phrases, based on an IM reported at screening, makes them more likely to elicit the target IM. This effect is arguably enhanced by limiting the number of cues overall and thus potential competition for attentional resources. This preliminary finding lays the groundwork for future research that could aim to manipulate a range of different variables (e.g. cognitive load during the vigilance task, time available for retrieval) in order to better illuminate the conditions under which IMs come to mind.

The use of a brief, thematically consistent, and relatively mild (e.g. created for prime-time television) film clip in Studies 4a and 4b has been shown to be effective at eliciting and

IM frequency comparable to previous studies (James, Lau-Zhu, Clark, et al., 2016). Whilst briefer clips have been used before these have either not been thematically consistent (Verwoerd, Wessel, & de Jong, 2012) or have incorporated violent film content that would not be suitable for a prime-time audience (Nixon et al., 2009; Wessel, Huntjens, & Verwoerd, 2010; Wessel, Overwijk, Verwoerd, & de Vrieze, 2008). This makes possible the study of analogue IMs using film content that optimises participants' time, but also lowers the distress threshold associated with viewing that content. Furthermore, the compilation of road safety advertisements allows for manipulating the order of presentation to explore the variables that inform subsequent IM content (e.g. whether the frequency with which images from the film are reported as analogue IMs is a function of recency or content).

Finally, the results presented in this thesis have theoretical implications for our understanding of the relationship between IMs and IAMs. As noted previously, some cognitively oriented researchers argue that IMs are a predicable (if enhanced) output of a normally functioning autobiographical memory system (Berntsen & Rubin, 2008; Berntsen, Willert, & Rubin, 2003; Rubin et al., 2008). The clinical view has been that IMs are the output of a separate if closely related memory system, which is engaged during a distressing or traumatic event, and which maintains the intrusiveness of the memory through failure to situate the sensory content within broader autobiographical narrative (Brewin et al., 2010; Brewin, 2014; Ehlers & Clark, 2000). Both the trigger data across a number of studies and the within subjects study of analogue IMs and IAMs (Study 5) offer new insight on this debate. Indeed, with regard to the latter study in particular, there was no relationship found between the frequency of IAMs and analogue IMs, suggesting they are the outputs of different systems. This is perhaps unsurprising, given that analogue IMs are images from a film rather than actual lived experience, and therefore cannot be considered autobiographical in the same way. Analogue IMs are, however, considered a good approximation of

naturalistic IMs and there is evidence to support this (James, Lau-Zhu, Clark, et al., 2016; Marks et al., 2018). The disassociation between the IAMs and analogue IMs provides some evidence for the view that IAMs and naturalistic IMs are also outputs of separate systems.

The picture is slightly complicated, however, by the data on triggers. These similarities in the proportions of external (environmental) and internal (own thought) triggers in naturalistic IMs and IAMs could be interpreted as suggesting some overlap in the retrieval mechanisms for each type of cognition (Berntsen, 2009; Conway & Pleydell-Pearce, 2000). The pattern for analogue IMs differed only slightly, with a greater proportion of entries reporting 'no trigger' that was the case for naturalistic IMs and IAMs. Trigger reports for these three types of cognition according to the coding categories developed by Mace (2004) diverge more sharply, and suggest important differences in the cognitive architecture underlying each. Analogue IMs, for example, appear to be more often triggered by sensory/perceptual information than abstract or verbal. Again this is perhaps unsurprising given that they represent sensory data divorced form a life story or autobiographical narrative.

By contrast, the triggers for IAMs have been shown to divide quite equally between abstract/verbal and sensory/perceptual, with some data suggesting the former may even be slightly more frequent (Mace, 2004; Schlagman et al., 2007). This was the pattern of trigger reports in the *IM-interview/diary* condition in Study 2, but the *IM-keyword/diary* condition showed a much greater proportion of abstract/verbal trigger reports. It would therefore appear to be the case that not having the opportunity to disclose, discuss and rate IMs in the lab with the researcher (and only nominating them with keywords) resulted in these IMs being susceptible to triggering by a broader range of verbal information. This could still be considered reflective of the lack of incorporation into autobiographical narrative. But instead of this lack of incorporation resulting in greater susceptibility to IM cuing by

sensory/perceptual information, it produced a broadening of the associative networks that can bring memory content to consciousness (Berntsen, 2009; Conway & Pleydell-Pearce, 2000). This could be another mechanism by which IMs retain intrusiveness, in a manner not fully accounted for by prevailing clinical and cognitive theories.

7.4 Limitations and Future Directions

The findings of the present thesis reflect some limitations but also avenues for future research. Firstly, there is a need for more diary studies of naturally occurring IMs, to create a fuller picture of their nature and phenomenology. As noted above there are only a handful of studies that have aimed to measure the frequency of these IMs through unrestricted participant reporting (i.e. event based sampling - EBS). The timeframe for doing so has varied from three days (Kleindienst et al., 2017) to one week (Kvavilashvili et al., *in preparation*; Williams & Moulds, 2007) or even two weeks (Rubin et al., 2011). Results from a recent diary study of IAMs suggests that the length of the diary keeping period can also impact the frequency of diary entries made. Laughland and Kvavilashvili (2018) found that asking participants to record their IAMs for one day yielded significantly higher frequency of reports when compared to the first day of a 7-day diary study. This resonates with the finding of Priebe et al. (2013) that time-based experience sampling (in response to prompts every two hours), over a three day period, resulted in higher IM frequency reports than self-initiated event-based sampling. It seems most likely that these higher reported frequencies are a result of participants noticing and reporting cognitions that they would otherwise not notice or chose not to report. These findings therefore suggest that limiting the period of time that participants have to monitor their thoughts facilitate greater focus on the task and arguably better meta-awareness.

Particularly for IMs, which can occur at varying frequencies, the reduction of the diary keeping period carries with it the risk that participants will not experience any IMs

during that time interval dictated by the study. One way to address this could be the adoption of an online screening procedure such as that used in Studies 3a and 3b. This would facilitate more targeted recruitment of participants who report (albeit retrospectively) experiencing above a certain number of IMs in a day or a week. This would then make it easier for the researcher to manipulate the period of diary keeping, whilst being more confident of capturing IMs during these reduced recording intervals. As noted earlier, Priebe et al. (2013) asked participants to record their IMs for three days. It would be interesting to compare this to results obtained from a one day diary study of IMs, or possibly an even shorter interval (Laughland & Kvavilashvili, 2018).

The results regarding triggers raise interesting questions about mechanisms that result in IMs coming to consciousness. The patterns reported in the present thesis would seem to suggest some alignment between naturally occurring IMs and IAMs in terms of the types of cues that produce these cognitions. But if more robust theoretical inferences are to be drawn, these results need to be replicated using either the present or similar coding scheme designed to highlight the types of cues to which IMs are most susceptible.

Finally, the results of the present thesis regarding the therapeutic benefit of recording IMs were unexpected and merit further investigation. The potential for recording future oriented cognitions to have therapeutic benefit (particularly following discussion or disclosure of the content of a distressing IM or IMs) raises interesting questions about the impact of goal completion on mental health and general well-being. It also raises questions about the optimal level of interaction with IM content to achieve therapeutic benefit. Is it possible to 'over-expose' someone to the content of their IM, such that the potentially constructive aspects of this practice tip over into something more aligned with unconstructive, ruminative thought (Watkins, 2008)? Or perhaps it is less a question of volume of interaction and more the way that it is structured. Perhaps monitoring – as

facilitated by the diary task – produces benefit only up to a certain point, after which effort must be made to amend the processing style (Watkins & Roberts, 2020). These important questions merit further research.

7.5 Conclusion

The present thesis aimed to apply methods from IAM research to the study of IMs whilst recruiting non-clinical participants. Results suggest some interesting convergence between IMs and IAMs in terms of reported triggers. Results also suggest that in person discussion/disclosure of IM content may have greater benefit than diary completion, though the results of this may be maximised if the diary task focuses on a different type of future oriented cognition like involuntary PMs. Overall, these results make an important initial contribution to our understanding of IMs which merit further investigation and replication. They also raise interesting and novel avenues for future research into this important topic. While IMs would appear to be a widespread experience, a greater understanding of their occurrence will contribute to reducing the distress often associated with them whether presenting clinically or not.

References

Aikins, D. E., Johnson, D. C., Borelli, J. L., Klemanski, D. H., Morrissey, P. M., Benham, T. L., … Tolin, D. F. (2009). Thought suppression failures in combat PTSD: A cognitive load hypothesis. *Behaviour Research and Therapy*, *47*(9), 744–751. https://doi.org/10.1016/j.brat.2009.06.006

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders : DSM-5. American Psychiatric Association*. *DSM*. https://doi.org/10.1176/appi.books.9780890425596.744053

Andrews, B., & Wilding, J. M. (2004). The relation of depression and anxiety to life-stress and achievement in students, 509–521.

Baikie, K. A., & Wilhelm, K. (2005). Emotional and physical health benefits of expressive writing. *Advances in Psychiatric Treatment*, *11*(5), 338–346. https://doi.org/10.1192/apt.11.5.338

Ball, C. T. (2007). Can We Elicit Involuntary Autobiographical Memories in the Laboratory? In J. H. Mace (Ed.), *Involuntary Memory* (pp. 127–152). Oxford, UK: Blackwell Publishing Ltd.

Ball, S. C., & Brewin, C. R. (2012). The Effect of Rumination on Intrusive Images and Mood: An Experimental Investigation Using the Trauma Film Paradigm. *Journal of Experimental Psychopathology*, *3*(2), 297–309. https://doi.org/10.5127/jep.019511

Bannister, J. A., Colvonen, P. J., Angkaw, A. C., & Norman, S. B. (2019). Differential relationships of guilt and shame on posttraumatic stress disorder among veterans. *Psychological Trauma: Theory, Research, Practice, and Policy*, *11*(1), 35–42. https://doi.org/10.1037/tra0000392

Barry, T. J., Sze, W. Y., & Raes, F. (2019). A meta-analysis and systematic review of Memory Specificity Training (MeST) in the treatment of emotional disorders. *Behaviour Research and Therapy*, *116*(November 2018), 36–51.

https://doi.org/10.1016/j.brat.2019.02.001

Barzykowski, K., & Niedźwieńska, A. (2018). Involuntary autobiographical memories are relatively more often reported during high cognitive load tasks. *Acta Psychologica*, *182*(January 2017), 119–128. https://doi.org/10.1016/j.actpsy.2017.11.014

Barzykowski, K., & Niedźwieńska, A. (2016). The Effects of Instruction on the Frequency and Characteristics of Involuntary Autobiographical Memories. *PLoS ONE*, *11*(6), 1–15. https://doi.org/10.1371/journal.pone.0157121

Beck, A.T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561–571. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/13688369

Beck, Aaron T., Steer, R. A., & Carbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review*. https://doi.org/10.1016/0272-7358(88)90050-5

Bernat, J. A., Ronfeldt, H. M., Calhoun, K. S., & Arias, I. (1998). Prevalence of traumatic events and peritraumatic predictors of posttraumatic stress symptoms in a nonclinical sample of college students. *Journal of Traumatic Stress*, *11*(4), 645–664. https://doi.org/10.1023/A:1024485130934

Berntsen, D. (1996). Involuntary Autobiographical Memories. *Applied Cognitive Psychology*, *10*(January), 435–454.

Berntsen, D. (1998). Voluntary and Involuntary Access to Autobiographical Memory. *Memory*, *6*(2), 113–141.

Berntsen, D. (2001). Involuntary Memories of Emotional Events: Do Memories of Traumas and Extremely Happy Events Differ? *Applied Cognitive Psychology*, *15*(7 SPEC. ISS.), 135–158. https://doi.org/10.1002/acp.838

Berntsen, D. (2007). Involuntary Autobiographical Memories: Speculations, Findings, and an

Attempt to Integrate Them. In J. H. Mace (Ed.), *Involuntary Memory*. Oxford, UK: Blackwell Publishing Ltd. https://doi.org/10.1002/9780470774069.ch2

Berntsen, D. (2009). *Involuntary Autobiographical Memories: An Introduction to the Unbidden Past*. Cambridge, UK: Cambridge University Press.

Berntsen, D. (2010). The Unbidden Past: Involuntary Autobiographical Memories as a Basic Mode of Remembering. *Current Directions in Psychological Science*, *19*(3), 138–142. https://doi.org/10.1177/0963721410370301

Berntsen, D. (2012). Spontaneous Recollections: involuntary autobiographical memories are a basic mode of remembering. In D. Berntsen & D. C. Rubin (Eds.), *Understanding Autobiographical Memory: Theories and Approaches*. Cambridge University Press.

Berntsen, D., & Hall, N. M. (2004). The episodic nature of involuntary autobiographical memories. *Memory & Cognition*, *32*(5), 789–803. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15552356

Berntsen, D., & Jacobsen, A. S. (2008). Involuntary (spontaneous) mental time travel into the past and future. *Consciousness and Cognition*, *17*(4), 1093–1104. https://doi.org/10.1016/j.concog.2008.03.001

Berntsen, D., & Rubin, D. C. (2006). The centrality of event scale: A measure of integrating a trauma into one's identity and its relation to post-traumatic stress disorder symptoms. *Behaviour Research and Therapy*. https://doi.org/10.1016/j.brat.2005.01.009

Berntsen, D., & Rubin, D. C. (2008). The reappearance hypothesis revisited: Recurrent involuntary memories after traumatic events and in everyday life. *Memory & Cognition*, *36*(2), 449–460. https://doi.org/10.3758/MC.36.2.449

Berntsen, D., Rubin, D. C., & Salgado, S. (2015). The frequency of involuntary autobiographical memories and future thoughts in relation to daydreaming, emotional distress, and age. *Consciousness and Cognition*, *36*, 352–372.

https://doi.org/10.1016/j.concog.2015.07.007

Berntsen, D., Willert, M., & Rubin, D. C. (2003). Splintered Memories or Vivid Landmarks ? Qualities and Organization of Traumatic Memories with and Without PTSD, *693*(April), 675–693. https://doi.org/10.1002/acp.894

Birrer, E., Michael, T., & Munsch, S. (2007). Intrusive images in PTSD and in traumatised and non-traumatised depressed patients: A cross-sectional clinical study. *Behaviour Research and Therapy*, *45*(9), 2053–2065. https://doi.org/10.1016/j.brat.2007.03.005

Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric Properties of the PTSD Checklist (PCL). *Behaviour Research and Therapy*, *34*(8), 669–673.

Blanco, C., Okuda, M., Wright, C., Hasin, D., Grant, B., Liu, S.-M., & Olfson, M. (2008). Mental Health of College Students and Their Non–College-Attending Peers, *65*(12), 1429–1437.

Boals, A., Hathaway, L. M., & Rubin, D. C. (2011). The Therapeutic Effects of Completing Autobiographical Memory Questionnaires for Positive and Negative Events: An Experimental Approach. *Cognitive Therapy and Research*, *35*(6), 544–549. https://doi.org/10.1007/s10608-011-9412-9

Bourne, C., Frasquilho, F., Roth, A. D., & Holmes, E. a. (2010). Is it mere distraction? Peri-traumatic verbal tasks can increase analogue flashbacks but reduce voluntary memory performance. *Journal of Behavior Therapy and Experimental Psychiatry*, *41*(3), 316–324. https://doi.org/10.1016/j.jbtep.2010.03.001

Brewin, C. (2003). *Post-traumatic Stress Disorder: Malady or Myth?* New Haven & London: Yale University Press.

Brewin, C., Christodoulides, J., & Hutchinson, G. (1996). Intrusive Thoughts and Intrusive Memories in a Nonclinical Sample. *Cognition and Emotion*.

https://doi.org/10.1080/026999396380411

Brewin, C. R., Hunter, E., Carroll, F., & Tata, P. (2009). Intrusive memories in depression: an index of schema activation? *Psychological Medicine*, *26*(06), 1271. https://doi.org/10.1017/s0033291700035996

Brewin, C R. (2001). A cognitive neuroscience account of posttraumatic stress disorder and its treatment. *Behaviour Research and Therapy*, *39*(4), 373–393. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11280338

Brewin, C R, Dalgleish, T., & Joseph, S. (1996). A dual representation theory of posttraumatic stress disorder. *Psychological Review*, *103*(4), 670–686. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8888651

Brewin, Chris R. (2016). Coherence, disorganization, and fragmentation in traumatic memory reconsidered: A Response to Rubin et al. (2016). *Journal of Abnormal Psychology*, *125*(7), 1011–1017. https://doi.org/10.1037/abn0000154

Brewin, Chris R. (2018). Memory and Forgetting. *Current Psychiatry Reports*, *20*(87). https://doi.org/10.1080/03064220600746474

Brewin, Chris R., Christodoulides, J., & Hutchinson, G. (1996). Intrusive Thoughts and Intrusive Memories in a Nonclinical Sample. *Cognition and Emotion*, *10*(1), 107–112. https://doi.org/10.1080/026999396380411

Brewin, Chris R., Gregory, J. D., Lipton, M., & Burgess, N. (2010). Intrusive images in psychological disorders: characteristics, neural mechanisms, and treatment implications. *Psychological Review*, *117*(1), 210–232. https://doi.org/10.1037/a0018113

Brewin, Chris R., Watson, M., McCarthy, S., Hyman, P., & Dayson, D. (1998). Intrusive memories and depression in cancer patients. *Behaviour Research and Therapy*, *36*(12), 1131–1142. https://doi.org/10.1016/S0005-7967(98)00084-9

Brewin, Chris R. (1998). Intrusive Autobiographical Memories in Depression and Post-

traumatic Stress Disorder, *12*(March), 359–370.

Brewin, Chris R. (2014). Episodic memory, perceptual memory, and their interaction: foundations for a theory of posttraumatic stress disorder. *Psychological Bulletin*, *140*(1), 69–97. https://doi.org/10.1037/a0033722

Brewin, Chris R, Dalgleish, T., & Joseph, S. (1996). A dual theory of posttraumatic stress disorder. *Psychological Review*, *103*(4), 670–686. Retrieved from https://search-proquest-com.ezp1.villanova.edu/docview/614328636/fulltextPDF/8E35D65FE7674B36PQ/1?accountid=14853

Brewin, Chris R, Huntley, Z., & Whalley, M. G. (2012). Source memory errors associated with reports of posttraumatic flashbacks: a proof of concept study. *Cognition*, *124*(2), 234–238. https://doi.org/10.1016/j.cognition.2012.05.002

Brewin, Chris R, & Saunders, J. (2001). The effect of dissociation at encoding on intrusive memories for a stressful lm. *British Journal of Medical Psychology*, *74*, 467–472.

Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition*. https://doi.org/10.1016/0010-0277(77)90018-X

Bryant, R. A., & Harvey, A. G. (1996). Visual imagery in posttraumatic stress disorder. *Journal of Traumatic Stress*, *9*(3), 613–619. https://doi.org/10.1002/jts.2490090317

Bywaters, M., Andrade, J., & Turpin, G. (2004). Intrusive and non-intrusive memories in a non-clinical sample: the effects of mood and affect on imagery vividness. *Memory (Hove, England)*, *12*(4), 467–478. https://doi.org/10.1080/09658210444000089

Campbell, S. B., Krenek, M., & Simpson, T. L. (2017). The Role of Patient Characteristics in the Concordance of Daily and Retrospective Reports of PTSD. *Behavior Therapy*, *48*(4), 448–461. https://doi.org/10.1016/j.beth.2017.01.003

Campos, A., & Pérez-Fabello, M. J. (2009). Psychometric quality of a revised version

Vividness of Visual Imagery Questionnaire. *Perceptual and Motor Skills*, *108*(3), 798–802. https://doi.org/10.2466/PMS.108.3.798-802

Castillo, L. G., & Schwartz, S. J. (2013). Introduction to the Special Issue on College Student Mental Health, *69*(4), 291–297. https://doi.org/10.1002/jclp.21972

Chemtob, C., Roitblat, H. L., Hamada, R. S., Carlson, J. G., & Twentyman, C. T. (1988). A cognitive action theory of post-traumatic stress disorder. *Journal of Anxiety Disorders*. https://doi.org/10.1016/0887-6185(88)90006-0

Chung, C. K., & Pennebaker, J. W. (2008). Variations in the spacing of expressive writing sessions. *British Journal of Health Psychology*, *13*(1), 15–21. https://doi.org/10.1348/135910707X251171

Clum, G. A., & Curtin, L. (1993). Validity and reactivity of a system of self-monitoring suicide ideation. *Journal of Psychopathology and Behavioral Assessment*. https://doi.org/10.1007/BF00965039

Cohen, J. S., Edmunds, J. M., Brodman, D. M., Benjamin, C. L., & Kendall, P. C. (2013). Using Self-Monitoring: Implementation of Collaborative Empiricism in Cognitive-Behavioral Therapy. *Cognitive and Behavioral Practice*, *20*(4), 419–428. https://doi.org/10.1016/j.cbpra.2012.06.002

Cole, S., & Kvavilashvili, L. (2019). Spontaneous and deliberate future thinking: a dual process account. *Psychological Research*, (0123456789). https://doi.org/10.1007/s00426-019-01262-7

Conway, M. a. (2005). Memory and the self☆. *Journal of Memory and Language*, *53*(4), 594–628. https://doi.org/10.1016/j.jml.2005.08.005

Conway, Martin A, & Pleydell-Pearce, C. W. (2000). The Construction of Autobiographical Memories in the Self-Memory System, *107*(2), 261–288. https://doi.org/10.1037//0033-295X.

Conybeare, D., Behar, E., Solomon, A., Newman, M. G., & Borkovec, T. D. (2012). The PTSD Checklist-Civilian Version: Reliability, Validity, and Factor Structure in a Nonclinical Sample. *Journal of Clinical Psychology*. https://doi.org/10.1002/jclp.21845

Cunningham, K. C., Davis, J. L., Wilson, S. M., & Resick, P. A. (2018). A relative weights comparison of trauma-related shame and guilt as predictors of DSM-5 posttraumatic stress disorder symptom severity among US veterans and military members. *British Journal of Clinical Psychology*, *57*(2), 163–176. https://doi.org/10.1111/bjc.12163

Cusack, S. E., Hicks, T. A., Bourdon, J., Sheerin, C. M., Overstreet, C. M., Kendler, K. S., … Amstadter, A. B. (2019). Prevalence and predictors of PTSD among a college sample. *Journal of American College Health*, *67*(2), 123–131. https://doi.org/10.1080/07448481.2018.1462824

Deeprose, C., Zhang, S., Dejong, H., Dalgleish, T., & Holmes, E. a. (2012). Imagery in the aftermath of viewing a traumatic film: using cognitive tasks to modulate the development of involuntary memory. *Journal of Behavior Therapy and Experimental Psychiatry*, *43*(2), 758–764. https://doi.org/10.1016/j.jbtep.2011.10.008

del Palacio-Gonzalez, A., & Berntsen, D. (2019). The tendency for experiencing involuntary future and past mental time travel is robustly related to thought suppression: an exploratory study. *Psychological Research*, *83*(4), 788–804. https://doi.org/10.1007/s00426-018-1132-2

Dewey, D., McDonald, M. K., Brown, W. J., Boyd, S. J., Bunnell, B. E., & Schuldberg, D. (2015). The impact of ecological momentary assessment on posttraumatic stress symptom trajectory. *Psychiatry Research*, *230*(2), 300–303. https://doi.org/10.1016/j.psychres.2015.09.009

Di Blasio, P., Camisasca, E., Caravita, S. C. S., Ionio, C., Milani, L., & Valtolina, G. G. (2015). The effects of expressive writing on postpartum depression and posttraumatic

stress symptoms. *Psychological Reports*, *117*(3), 856–882. https://doi.org/10.2466/02.13.PR0.117c29z3

Dritschel, B., Beltsos, S., & McClintock, S. M. (2014). An “alternating instructions” version of the Autobiographical Memory Test for assessing autobiographical memory specificity in non-clinical populations. *Memory*, *22*(8), 881–889. https://doi.org/10.1080/09658211.2013.839710

Ebbinghaus, H. (1885). *Memory. A contribution experimental psychology*. New York: Dover Publications.

Echiverri, A. M., Jaeger, J. J., Chen, J. A., Moore, S. A., & Zoellner, L. A. (2011). “Dwelling in the Past”: The role of rumination in the treatment of posttraumatic stress disorder. *Cognitive and Behavioral Practice*, *18*(3), 338–349. https://doi.org/10.1016/j.cbpra.2010.05.008

Ehlers, A., & Clark, D. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, *38*(2), 319–345. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10761279

Ehlers, A., Hackmann, A., & Michael, T. (2004). Intrusive re-experiencing in post-traumatic stress disorder: Phenomenology, theory, and therapy. *Memory*, *12*(4), 403–415. https://doi.org/10.1080/09658210444000025

Ehlers, A., Hackmann, A., Steil, R., Clohessy, S., Wenninger, K., & Winter, H. (2002). The nature of intrusive memories after trauma: The warning signal hypothesis. *Behaviour Research and Therapy*, *40*(9), 995–1002. https://doi.org/10.1016/S0005-7967(01)00077-8

Field, A. (2009). *Discovering statistics using SPSS* (Third Edit). London: SAGE Publications LTD. https://doi.org/10.5860/choice.43-3433

Field, A. (2013). *Discovering statistics using SPSS: and sex and drugs and rock “n” roll (4th*

edition). London: SAGE Publications LTD.

Foa, Edna, B., & Rothbaum, B. O. (1998). *Treating the Trauma of Rape: Cognitive Behavioral Therapy for PTSD*. New York: The Guilford Press.

Foa, E. B. (1995). The posttraumatic diagnostic scale (PDS) manual. *Minneapolis, MN: National Computer Systems*.

Frattaroli, J. (2006). Experimental disclosure and its moderators: A meta-analysis. *Psychological Bulletin*, *132*(6), 823–865. https://doi.org/10.1037/0033-2909.132.6.823

Frederiksen, L. W. (1975). Treatment of ruminative thinking by self-monitoring. *Journal of Behavior Therapy and Experimental Psychiatry*. https://doi.org/10.1016/0005-7916(75)90115-9

Gardner, R. S., & Ascoli, G. A. (2015). The natural frequency of human prospective memory increases with age. *Psychology and Aging*, *30*(2), 209–219. https://doi.org/10.1037/a0038876

Giambra, L. M. (1989). Task-unrelated-thought frequency as a function of age: a laboratory study. *Psychology and Aging*, *4*(2), 136–143. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/2789741

Giambra, L. M. (1995). A Laboratory Method of Investigating Influence on Switching Attention to Task-Unrelated Imagery and Thought. *Consciousness and Cognition*, *4*, 1–21.

Gortner, E. M., Rude, S. S., & Pennebaker, J. W. (2006). Benefits of Expressive Writing in Lowering Rumination and Depressive Symptoms. *Behavior Therapy*, *37*(3), 292–303. https://doi.org/10.1016/j.beth.2006.01.004

Green, D. M., Strange, D., Lindsay, D. S., & Takarangi, M. K. T. (2016a). Trauma-related versus positive involuntary thoughts with and without meta-awareness. *Consciousness and Cognition*, *46*, 163–172. https://doi.org/10.1016/j.concog.2016.09.019

Green, D. M., Strange, D., Lindsay, D. S., & Takarangi, M. K. T. (2016b). Trauma-related versus positive involuntary thoughts with and without meta-awareness. *Consciousness and Cognition*, *46*, 163–172. https://doi.org/10.1016/j.concog.2016.09.019

Greenberg, M. A., Wortman, C. B., & Stone, A. A. (1996). Emotional Expression and Physical Health: Revising Traumatic Memories or Fostering Self-Regulation? *Journal of Personality and Social Psychology*, *71*(3), 588–602. https://doi.org/10.1037/0022-3514.71.3.588

Gunter, R. W., & Bodner, G. E. (2008). How eye movements affect unpleasant memories: Support for a working-memory account. *Behaviour Research and Therapy*, *46*(8), 913–931. https://doi.org/10.1016/j.brat.2008.04.006

Hackmann, A., Ehlers, A., Speckens, A., & Clark, D. M. (2004). Characteristics and Content of Intrusive Memories in PTSD and Their Changes with treament. *Journal of Traumatic Stress*, *17*(3), 231–240. Retrieved from http://web.b.ebscohost.com.jerome.stjohns.edu:81/ehost/pdfviewer/pdfviewer?sid=4d9b11ec-9718-4cc4-8f6c-b3177398ed64%40sessionmgr114&vid=31&hid=106

Hall, N. M., & Berntsen, D. (2008). The effect of emotional stress on involuntary and voluntary conscious memories. *Memory*, *16*(1), 48–57. https://doi.org/10.1080/09658210701333271

Halligan, S. L., Michael, T., Clark, D. M., & Ehlers, A. (2003). Posttraumatic stress disorder following assault: The role of cognitive processing, trauma memory, and appraisals. *Journal of Consulting and Clinical Psychology*, *71*(3), 419–431. https://doi.org/10.1037/0022-006X.71.3.419

Hellawell, S. J., & Brewin, C. R. (2004). A comparison of flashbacks and ordinary autobiographical memories of trauma: content and language. *Behaviour Research and Therapy*, *42*, 1–12. https://doi.org/10.1016/S0005-7967(01)00080-8

Hertel, P. T. (1998). Relation between rumination and impaired memory in dysphoric moods. *Journal of Abnormal Psychology*, *107*(1), 166–172. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9505050

Hintzman, D. L. (2011). Research strategy in the study of memory: Fads, fallacies, and the search for the "coordinates of truth." *Perspectives on Psychological Science*, *6*(3), 253–271. https://doi.org/10.1177/1745691611406924

Hirst, W., & Phelps, E. A. (2016). Flashbulb Memories. *Current Directions in Psychological Science*, *25*(1), 36–41. https://doi.org/10.1177/0963721415622487

Hitchcock, C., Rodrigues, E., Rees, C., Gormley, S., Dritschel, B., & Dalgleish, T. (2019). Misremembrance of Things Past: Depression Is Associated With Difficulties in the Recollection of Both Specific and Categoric Autobiographical Memories. *Clinical Psychological Science*, *7*(4), 693–700. https://doi.org/10.1177/2167702619826967

Hitchcock, C., Werner-Seidler, A., Blackwell, S. E., & Dalgleish, T. (2017). Autobiographical episodic memory-based training for the treatment of mood, anxiety and stress-related disorders: A systematic review and meta-analysis. *Clinical Psychology Review*, *52*, 92–107. https://doi.org/10.1016/j.cpr.2016.12.003

Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories : A review of the trauma film paradigm, *127*, 553–566. https://doi.org/10.1016/j.actpsy.2007.11.002

Holmes, E. A., James, E. L., Coode-Bate, T., & Deeprose, C. (2009). Can Playing the Computer Game "Tetris" Reduce the Build-Up of Flashbacks for Trauma? A Proposal from Cognitive Science, *4034*(1), 1–6. https://doi.org/10.1371/journal.pone.0004153

Holmes, E. a, Brewin, C. R., & Hennessy, R. G. (2004). Trauma films, information processing, and intrusive memory development. *Journal of Experimental Psychology. General*, *133*(1), 3–22. https://doi.org/10.1037/0096-3445.133.1.3

Hørlyck, L. D., Bisby, J. A., King, J. A., & Burgess, N. (2019). Wakeful rest compared to vigilance reduces intrusive but not deliberate memory for traumatic videos, *9*. https://doi.org/10.1038/s41598-019-49634-8

Hyman, I. E., Cutshaw, K. I., Hall, C. M., Snyders, M. E., Masters, S. A., Au, V. S. K., & Graham, J. M. (2015). Involuntary to intrusive: Using involuntary musical imagery to explore individual differences and the nature of intrusive thoughts. *Psychomusicology: Music, Mind, and Brain*, *25*(1), 14–27. https://doi.org/10.1037/pmu0000075

Isaacs, J. S. (2004). Traumatology. https://doi.org/10.1177/153476560401000104

James, E. L., Lau-Zhu, A., Clark, I. A., Visser, R. M. R. M., Muriel, A., Holmes, E. A., … Holmes, E. A. (2016). The trauma film paradigm as an experimental psychopathology model of psychological trauma: intrusive memories and beyond. *Clinical Psychology Review*. https://doi.org/10.1016/j.cpr.2016.04.010

James, E. L., Lau-Zhu, A., Tickle, H., Horsch, A., & Holmes, E. A. (2016). Playing the computer game Tetris prior to viewing traumatic film material and subsequent intrusive memories: Examining proactive interference. *Journal of Behavior Therapy and Experimental Psychiatry*, *53*, 25–33. https://doi.org/10.1016/j.jbtep.2015.11.004

Johannessen, K. B., & Berntsen, D. (2010). Current concerns in involuntary and voluntary autobiographical memories. *Consciousness and Cognition*, *19*(4), 847–860. https://doi.org/10.1016/j.concog.2010.01.009

Kessler, R. C., Aguilar-Gaxiola, S., Alonso, J., Benjet, C., Bromet, E. J., Cardoso, G., … Koenen, K. C. (2017). Trauma and PTSD in the WHO World Mental Health Surveys. *European Journal of Psychotraumatology*, *8*. https://doi.org/10.1080/20008198.2017.1353383

Kilpatrick, D. G., Resnick, H. S., Milanak, M. E., Miller, M. W., Keyes, katherine M., & Friedman, M. J. (2013). Prevalence Using DSM-IV and DSM-5 Criteria. *J Trauma*

Stress, *26*(5), 537–547. https://doi.org/10.1002/jts.21848.National

Kleim, B., Graham, B., Bryant, R. a, & Ehlers, A. (2013). Capturing intrusive re-experiencing in trauma survivors' daily lives using ecological momentary assessment. *Journal of Abnormal Psychology*, *122*(4), 998–1009. https://doi.org/10.1037/a0034957

Kleindienst, N., Priebe, K., Petri, M., Hecht, A., Santangelo, P., Bohus, M., & Schulte-Herbrüggen, O. (2017). Trauma-related memories in PTSD after interpersonal violence: an ambulatory assessment study. *European Journal of Psychotraumatology*, *8*(1), 1409062. https://doi.org/10.1080/20008198.2017.1409062

Klinger, E. (2009). Daydreaming and Fantasising: Thought Flow and Motivation. In *Handbook of Imagination and Mental Stimulation* (pp. 225–239). New York: Psychology Press.

Koopman, C., Ismailji, T., Holmes, D., Classen, C. C., Palesh, O., & Wales, T. (2005). The effects of expressive writing on pain, depression and posttraumatic stress disorder symptoms in survivors of intimate partner violence. *Journal of Health Psychology*, *10*(2), 211–221. https://doi.org/10.1177/1359105305049769

Krans, J., Becker, E. N. I. S., & Holmes, E. A. (2009). Intrusive Trauma Memory : A Review and Functional Analysis, *1088*, 1076–1088. https://doi.org/10.1002/acp

Krans, J., de Bree, J., & Moulds, M. L. (2015). Involuntary cognitions in everyday life: Exploration of type, quality, content, and function. *Frontiers in Psychiatry*, *6*(FEB). https://doi.org/10.3389/fpsyt.2015.00007

Krans, J., Pearson, D. G., Maier, B., & Moulds, M. L. (2016). Contextual representations of negative images modulate intrusion frequency in an intrusion provocation paradigm. *Journal of Behavior Therapy and Experimental Psychiatry*, *53*, 52–58. https://doi.org/10.1016/j.jbtep.2015.09.004

Kvavilashvili, L, & Rummel, J. (2019). On the Nature of Everyday Prospection: A Review

and Theoretical Integration of Research on Mind-Wandering, Future Thinking and Prospective Memory. *Review of General Psychology*.

Kvavilashvili, Lia. (2014). Solving the mystery of intrusive flashbacks in posttraumatic stress disorder: comment on Brewin (2014). *Psychological Bulletin*, *140*(1), 98–104. https://doi.org/10.1037/a0034677

Kvavilashvili, Lia, & Brewin, C. R. (2013). Therapeutic effects of recording intrusive memories in non-clincial participants: A diary study. In *Annual Convention of the American Psycological Association, Honolulu*. Retrieved from http://www.liakvavilashvili.com/uploads/1/8/8/2/18820518/apa-poster-ims-13.pdf

Kvavilashvili, Lia, & Fisher, L. (2007). Is time-based prospective remembering mediated by self-initiated rehearsals? Role of incidental cues, ongoing activity, age, and motivation. *Journal of Experimental Psychology: General*, *136*(1), 112–132. https://doi.org/10.1037/0096-3445.136.1.112

Kvavilashvili, Lia, & Mandler, G. (2004). Out of one's mind: A study of involuntary semantic memories. *Cognitive Psychology*, *48*(1), 47–94. https://doi.org/10.1016/S0010-0285(03)00115-4

Kvavilashvili, Lia, Niedźwieńska, A., Gilbert, S. J., & Markostamou, I. (2020). Deficits in Spontaneous Cognition as an Early Marker of Alzheimer's Disease. *Trends in Cognitive Sciences*, *xx*(xx), 1–17. https://doi.org/10.1016/j.tics.2020.01.005

Kvavilashvili, Lia, Sari, B., Fong, V., & Brewin, C. (n.d.). *The nature and frequency of intrisive memories in a non-clinical sample: A diary study*. *In preparation*.

Kvavilashvili, Lia, & Schlagman, S. (2011). Involuntary autobiographical memories in dysphoric mood: a laboratory study. *Memory (Hove, England)*, *19*(4), 331–345. https://doi.org/10.1080/09658211.2011.568495

Lang, T. J., Moulds, M. L., & Holmes, E. A. (2009). Reducing depressive intrusions via a

computerized cognitive bias modification of appraisals task: Developing a cognitive vaccine. *Behaviour Research and Therapy*, *47*(2), 139–145. https://doi.org/10.1016/j.brat.2008.11.002

Lau-Zhu, A., Henson, R. N., & Holmes, E. A. (2019). Intrusive memories and voluntary memory of a trauma film: effects of a cognitive interference task after encoding. *Journal of Experimental Psychology. General*.

Laughland, A., & Kvavilashvili, L. (2018). Should Participants be Left to their Own Devices? Comparing Paper and Smartphone Diaries in Psychological Research. *Journal of Applied Research in Memory and Cognition*, *7*(4), 552–563. https://doi.org/10.1016/j.jarmac.2018.09.002

Lepore, S. J., Ragan, J. D., & Jones, S. (2000). Talking facilitates cognitive-emotional processes of adaptation to an acute stressor. *Journal of Personality and Social Psychology*, *78*(3), 499–508. https://doi.org/10.1037/0022-3514.78.3.499

Mace, J. H. (2004). Involuntary autobiographical memories are highly dependent on abstract cuing: the Proustian view is incorrect. *Applied Cognitive Psychology*, *18*(7), 893–899. https://doi.org/10.1002/acp.1020

Mace, J. H. (2006). Episodic remembering creates access to involuntary conscious memory: demonstrating involuntary recall on a voluntary recall task. *Memory (Hove, England)*, *14*(8), 917–924. https://doi.org/10.1080/09658210600759766

Mace, J. H., Bernas, R. S., & Clevinger, A. (2014). Individual differences in recognising involuntary autobiographical memories: Impact on the reporting of abstract cues. *Memory (Hove, England)*, *0*(0), 1–8. https://doi.org/10.1080/09658211.2014.900083

MacLeod, A. (2017). *Prospection, well-being, and mental health*. Oxford University Press. https://doi.org/10.1093/med:psych/9780198725046.003.0011

Malta, L. S., Giosan, C., Szkodny, L. E., Altemus, M. M., Rizzo, A. A., Silbersweig, D. A.,

& Difede, J. (2020). Predictors of involuntary and voluntary emotional episodic memories of virtual reality scenarios in Veterans with and without PTSD. *Memory*, *0*(0), 1–17. https://doi.org/10.1080/09658211.2020.1770289

Marks, D. F. (1973). Visual Imagery Differences in the Recall of Pictures. *British Journal of Psychology*, *64*(1), 17–24.

Marks, D. F. (1989). Construct Validity of the Vividness of Visual Imagery Questionnaire. *Percpetual and Motor Skills*, (1), 459–465.

Marks, E. H., Franklin, A. R., & Zoellner, L. A. (2018). Can't get it out of my mind: A systematic review of predictors of intrusive memories of distressing events. *Psychological Bulletin*, *144*(6), 584–640. https://doi.org/10.1037/bul0000132

Martin, D. J., Garske, J. P., & Davis, M. K. (2000). Relation of the Therapeutic Alliance with outcome and other variables: A Meta-Analytic Review. *Journal of Consulting and Clinical Psychology*, *68*(3), 438–450.

Mazzoni, G., Vannucci, M., & Batool, I. (2014). Manipulating cues in involuntary autobiographical memory: Verbal cues are more effective than pictorial cues. *Memory & Cognition*. https://doi.org/10.3758/s13421-014-0420-3

McFall, R. M. (1970). Effects of self-monitoring on normal smoking behavior. *Journal of Consulting and Clinical Psychology*. https://doi.org/10.1037/h0030087

McGaugh, J. L. (2013). Making lasting memories: Remembering the significant. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(SUPPL2), 10402–10407. https://doi.org/10.1073/pnas.1301209110

McGuire, K. M. B., Greenberg, M. A., & Gevirtz, R. (2005). Autonomic effects of expressive writing in individuals with elevated blood pressure. *Journal of Health Psychology*, *10*(2), 197–209. https://doi.org/10.1177/1359105305049767

Metzger, R. L. (1976). A reliability and validity study of the state-trait anxiety inventory.

Journal of Clinical Psychology. https://doi.org/10.1002/1097-4679(197604)32:2<276::AID-JCLP2270320215>3.0.CO;2-G

Michael, T., Ehlers, A., Halligan, S. L., & Clark, D. M. (2005). Unwanted memories of assault: What intrusion characteristics are associated with PTSD? *Behaviour Research and Therapy*, *43*(5), 613–628. https://doi.org/10.1016/j.brat.2004.04.006

Mihailova, S., & Jobson, L. (2018). Association between intrusive negative autobiographical memories and depression: A meta-analytic investigation. *Clinical Psychology and Psychotherapy*, *25*(4), 509–524. https://doi.org/10.1002/cpp.2184

Mihailova, S., & Jobson, L. (2020). Cross-cultural exploration of the characteristics, content and themes of intrusive autobiographical memories recalled during depression. *Memory*, *28*(5), 701–711. https://doi.org/10.1080/09658211.2020.1767143

Naragon-Gainey, K., Simpson, T. L., Moore, S. A., Varra, A. A., & Kaysen, D. L. (2012). The correspondence of daily and retrospective PTSD reports among female victims of sexual assault. *Psychological Assessment*, *24*(4), 1041–1047. https://doi.org/10.1037/a0028518

Neisser, U. (2014). *Cognitive Psychology*. *Cognitive Psychology*. https://doi.org/10.4324/9781315736174

Nelis, S., Holmes, E., Griffith, J. W., & Raes, F. (2014). Mental imagery during daily life: Psychometric evaluation of the Spontaneous Use of Imagery Scale (SUIS). *Psychologica …*, *54*, 19–32. https://doi.org/10.5334/pb.ag

Newby, J. M., Lang, T., Werner-Seidler, A., Holmes, E. A., & Moulds, M. L. (2014). Alleviating distressing intrusive memories in depression: A comparison between computerised cognitive bias modification and cognitive behavioural education. *Behaviour Research and Therapy*, *56*(1), 60–67. https://doi.org/10.1016/j.brat.2014.03.001

Newby, J. M., & Moulds, M. L. (2011). Characteristics of intrusive memories in a community sample of depressed, recovered depressed and never-depressed individuals. *Behaviour Research and Therapy*, *49*(4), 234–243. https://doi.org/10.1016/j.brat.2011.01.003

Newby, J. M., & Moulds, M. L. (2012). A comparison of the content, themes, and features of intrusive memories and rumination in major depressive disorder. *British Journal of Clinical Psychology*, *51*(2), 197–205. https://doi.org/10.1111/j.2044-8260.2011.02020.x

Niles, A. N., Haltom, K. E. B., Mulvenna, C. M., Lieberman, M. D., & Stanton, A. L. (2014). Randomized controlled trial of expressive writing for psychological and physical health: The moderating role of emotional expressivity. *Anxiety, Stress and Coping*, *27*(1), 1–17. https://doi.org/10.1080/10615806.2013.802308

Nixon, R. D. V., Cain, N., Nehmy, T., & Seymour, M. (2009). The Influence of Thought Suppression and Cognitive Load on Intrusions and Memory Processes Following an Analogue Stressor. *Behavior Therapy*, *40*(4), 368–379. https://doi.org/10.1016/j.beth.2008.10.004

Ono, M., Devilly, G. J., & Shum, D. H. K. (2016). A Meta-Analytic Review of Overgeneral Memory: The Role of Trauma History, Mood, and the Presence of Posttraumatic Stress Disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*, *8*(2), 157–164. https://doi.org/10.1037/tra0000027

Oulton, J. M., & Takarangi, M. K. T. (2018). Written cues provoke involuntary cognitions about a trauma analogue. *Journal of Applied Research in Memory and Cognition*, *7*(2), 270–279. https://doi.org/10.1016/j.jarmac.2017.12.001

Parry, L., & Kearney, R. O. (2014). A comparison of the quality of intrusive memories in post-traumatic stress disorder and depression A comparison of the quality of intrusive memories in post-traumatic stress disorder and depression, *22*(4), 408–425.

https://doi.org/10.1080/09658211.2013.795975

Patel, T., Brewin, C. R., Wheatley, J., Wells, A., Fisher, P., & Myers, S. (2007). Intrusive images and memories in major depression. *Behaviour Research and Therapy*. https://doi.org/10.1016/j.brat.2007.06.004

Pavlacic, J. M., Buchanan, E. M., Maxwell, N. P., Hopke, T. G., & Schulenberg, S. E. (2019). A Meta-Analysis of Expressive Writing on Posttraumatic Stress, Posttraumatic Growth, and Quality of Life. *Review of General Psychology*, *23*(2), 230–250. https://doi.org/10.1177/1089268019831645

Pearson, D. G., & Sawyer, T. (2011). Effects of Dual Task Interference on Memory Intrusions for Affective Images. *International Journal of Cognitive Therapy*, *4*(1), 122–133.

Pearson, M., Brewin, C. R., Rhodes, J., & McCarron, G. (2008). Frequency and nature of rumination in chronic depression: A preliminary study. *Cognitive Behaviour Therapy*, *37*(3), 160–168. https://doi.org/10.1080/16506070801919224

Pennebaker, J W, & Beall, S. K. (1986). Confronting a traumatic event: toward an understanding of inhibition and disease. *Journal of Abnormal Psychology*, *95*(3), 274–281. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3745650

Pennebaker, James W. (1997). Writing about Emotional Experience as a Therapeutic Process. *Psychological Science*, *8*(3), 162–166.

Petrie, K. J., Fontanilla, I., Thomas, M. G., Booth, R. J., & Pennebaker, J. W. (2004). Effect of Written Emotional Expression on Immune Function in Patients with Human Immunodeficiency Virus Infection: A Randomized Trial. *Psychosomatic Medicine*, *66*(2), 272–275. https://doi.org/10.1097/01.psy.0000116782.49850.d3

Plimpton, B., Patel, P., & Kvavilashvili, L. (2015). Role of triggers and dysphoria in mind-wandering about past, present and future: A laboratory study. *Consciousness and*

Cognition, *33*, 261–276. https://doi.org/10.1016/j.concog.2015.01.014

Priebe, K., Kleindienst, N., Zimmer, J., Koudela, S., Ebner-Prieme, U., & Bohus, M. (2013). Frequency of intrusions and flashbacks in patients with posttraumatic stress disorder related to childhood sexual abuse: An electronic diary study. *Psychological Assessment*, *25*(4), 1370–1376. https://doi.org/10.1037/a0033816

Prins, A., Ouimette, P., Kimerling, R., Cameron, R. P., Hugelshofer, D. S., Shaw-Hegwer, J., … Sheikh, J. I. (2003). The primary care PTSD screen (PC-PTSD): Development and operating characteristics. *Primary Care Psychiatry*. https://doi.org/10.1185/135525703125002360

Prins, A., Ouimette, P., Kimerling, R., Camerond, R. P., Hugelshofer, D. S., Shaw-Hegwer, J., … Sheikh, J. I. (2003). The primary care PTSD screen (PC–PTSD): development and operating characteristics. *Primary Care Psychiatry*, *9*(1), 9–14. https://doi.org/10.1185/135525703125002360

Quince, T. A., Wood, D. F., Parker, R. A., & Benson, J. (2012). Prevalence and persistence of depression among undergraduate medical students: A longitudinal study at one UK medical school. *BMJ Open*, *2*(4), 1–8. https://doi.org/10.1136/bmjopen-2012-001519

Rasmussen, A. S., & Berntsen, D. (2011). The unpredictable past: spontaneous autobiographical memories outnumber autobiographical memories retrieved strategically. *Consciousness and Cognition*, *20*(4), 1842–1846. https://doi.org/10.1016/j.concog.2011.07.010

Rattel, J. A., Grünberger, L. M., Reichenberger, J., Liedlgruber, M., Miedl, S. F., Blechert, J., & Wilhelm, F. H. (2019). Frequency of Intrusions and Appraisal of Related Distress After Analogue Trauma: A Comparative Ecological Momentary Assessment Methods Study. *Cognitive Therapy and Research*, *43*(1), 174–184. https://doi.org/10.1007/s10608-018-9941-6

Reavley, N. J., Mccann, T. V, & Jorm, A. F. (2012). Original Article Actions taken to deal with mental health problems in Australian higher education students, (June 2010), 159–165. https://doi.org/10.1111/j.1751-7893.2011.00294.x

Reisberg, D., Pearson, D. G., & Kosslyn, S. M. (2003). Intuitions and introspections about imagery: The role of imagery experience in shaping an investigator's theoretical views. *Applied Cognitive Psychology*. https://doi.org/10.1002/acp.858

Reynolds, M, & Brewin, C. R. (1999). Intrusive memories in depression and posttraumatic stress disorder. *Behaviour Research and Therapy*, *37*(3), 201–215. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10087639

Reynolds, Martina, & Brewin, C. R. (1998). Intrusive cognitions, coping strategies and emotional responses in depression, post-traumatic stress disorder and a non-clinical population. *Behaviour Research and Therapy*, *36*(2), 135–147. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9613021

Rosenberg, H. J., Rosenberg, S. D., Ernstoff, M. S., Wolford, G. L., Amdur, R. J., Elshamy, M. R., … Pennebaker, J. W. (2002). Expressive disclosure and health outcomes in a prostate cancer population. *International Journal of Psychiatry in Medicine*, *32*(1), 37–53. https://doi.org/10.2190/AGPF-VB1G-U82E-AE8C

Rubin, D. C., Berntsen, D., Ogle, C. M., Deffler, S. A., & Beckham, J. C. (2016). Scientific evidence versus outdated beliefs: A response to Brewin (2016). *Journal of Abnormal Psychology*, *125*(7), 1018–1021. https://doi.org/10.1037/abn0000211

Rubin, D. C., Boals, A., & Berntsen, D. (2008). Memory in posttraumatic stress disorder: properties of voluntary and involuntary, traumatic and nontraumatic autobiographical memories in people with and without posttraumatic stress disorder symptoms. *Journal of Experimental Psychology. General*, *137*(4), 591–614. https://doi.org/10.1037/a0013165

Rubin, D. C., Boals, A., & Klein, K. (2010). Autobiographical Memories for Very Negative Events: The Effects of Thinking about and Rating Memories. *Cognitive Therapy and Research*, *34*, 35–48. https://doi.org/10.1007/s10608-008-9226-6

Rubin, D. C., Dennis, M. F., & Beckham, J. C. (2011). Autobiographical memory for stressful events: the role of autobiographical memory in posttraumatic stress disorder. *Consciousness and Cognition*, *20*(3), 840–856. https://doi.org/10.1016/j.concog.2011.03.015

Rubin, D. C., Schrauf, R. W., & Greenberg, D. L. (2003). Belief and recollection of autobiographical memories. *Memory & Cognition*, *31*(6), 887–901. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14651297

Rutner, I. T., & Bugle, C. (1969). An Experimental Procedure for the Modification of Pyschotic Behaviour. *Jounral of Consulting and Clinical Psychology*, *33*(6), 651–653. https://doi.org/10.1007/bf03393706

Schlagman, S., Kliegel, M., Schulz, J., & Kvavilashvili, L. (2009). Differential effects of age on involuntary and voluntary autobiographical memory. *Psychology and Aging*, *24*(2), 397–411. https://doi.org/10.1037/a0015785

Schlagman, S., & Kvavilashvili, L. (2008). Involuntary autobiographical memories in and outside the laboratory: How different are they from voluntary autobiographical memories? *Memory & Cognition*, *36*(5), 920–932. https://doi.org/10.3758/MC.36.5.920

Schlagman, S., Kvavilashvili, L., & Schulz. (2007). Effects of Age on Involuntary Autobiographical Memories. In J. H. Mace (Ed.), *Involuntary Memory* (pp. 87–112). Oxford, UK: Blackwell Publishing Ltd.

Schlagman, S., Schulz, J., & Kvavilashvili, L. (2006). A content analysis of involuntary autobiographical memories: Examining the positivity effect in old age. *Memory (Hove, England)*, *14*(2), 161–175. https://doi.org/10.1080/09658210544000024

Schneider, S., & Stone, A. A. (2016). Ambulatory and diary methods can facilitate the measurement of patient-reported outcomes. *Quality of Life Research*, *25*(3), 497–506. https://doi.org/10.1007/s11136-015-1054-z

Schönfeld, S., & Ehlers, A. (2017). Posttraumatic Stress Disorder and Autobiographical Memories in Everyday Life. *Clinical Psychological Science*, *5*(2), 325–340. https://doi.org/10.1177/2167702616688878

Schooler, J. W., Reichle, E. D., & Halpern, D. V. (2004). Zoning Out while Reading: Evidence for Dissociations between Experience and Metaconsciousness. In D. T. Levin (Ed.), *Thinking and Seeing: Visual Metacognition in Adults and Children* (pp. 204–226). Cambridge, MA: MIT Press.

Schoutrop, M., Lange, A., Hanewald, G., Duurland, C., & Bermond, B. (1997). The Effects of Structured Writing Assignments on Overcoming Major Stressful Events: An Uncontrolled Study. *Clinical Psychology and Psychotherapy*, *4*(3), 179–185. https://doi.org/10.1002/(SICI)1099-0879(199709)4:3<179::AID-CPP123>3.0.CO;2-C

Schuler, K., Ruggero, C. J., Mahaffey, B., Gonzalez, A., L. Callahan, J., Boals, A., … Kotov, R. (2019). When Hindsight Is Not 20/20: Ecological Momentary Assessment of PTSD Symptoms Versus Retrospective Report. *Assessment*. https://doi.org/10.1177/1073191119869826

Segovia, D. A., Strange, D., & Takarangi, M. K. T. (2016). Encoding disorganized memories for an analogue trauma does not increase memory distortion or analogue symptoms of PTSD. *Journal of Behavior Therapy and Experimental Psychiatry*, *50*, 127–134. https://doi.org/10.1016/j.jbtep.2015.07.003

Sergeant, S., & Mongrain, M. (2014). An online optimism intervention reduces depression in pessimistic individuals. *Journal of Consulting and Clinical Psychology*, *82*(2), 263–274. https://doi.org/10.1037/a0035536

Shapiro, F. (2001). *Eye movement desensitization and reprocessing: Basic principles, protocols, and procedures (2nd ed.). Eye movement desensitization and reprocessing: Basic principles, protocols, and procedures (2nd ed.).*

Shen, L., Yang, L., Zhang, J., & Zhang, M. (2018). Benefits of expressive writing in reducing test anxiety: A randomized controlled trial in Chinese samples. *PLoS ONE*, *13*(2), 1–15. https://doi.org/10.1371/journal.pone.0191779

Shiffman, S., Hufford, M., Hickcox, M., Paty, J. A., & et al. (1997). Remember that? A comparison of real-time versus retrospective recall of smoking lapses. *Journal of Consulting and Clinical Psychology*, *65*(2), 292–300. https://doi.org/10.1037//0022-006x.65.2.292.a

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological Momentary Assessment. *Annual Review of Clinical Psychology*, *4*(1), 1–32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

Sloan, D. M., & Marx, B. P. (2004). Taking pen to hand: Evaluating theories underlying the written disclosure paradigm. *Clinical Psychology: Science and Practice*, *11*(2), 121–137. https://doi.org/10.1093/clipsy/bph062

Sloan, D. M., Marx, B. P., & Greenberg, E. M. (2011). A test of written emotional disclosure as an intervention for posttraumatic stress disorder. *Behaviour Research and Therapy*, *49*(4), 299–304. https://doi.org/10.1016/j.brat.2011.02.001

Smallwood, J., McSpadden, M., & Schooler, J. W. (2007). The lights are on but no one's home : Meta-awareness and the decoupling of attention when the mind wanders. *Pschonomic Bulletin*, *14*(3), 527–533.

Smallwood, J., & O'Connor, R. C. (2011). Imprisoned by the past: unhappy moods lead to a retrospective bias to mind wandering. *Cognition & Emotion*, *25*(8), 1481–1490. https://doi.org/10.1080/02699931.2010.545263

Smallwood, J., O'Connor, R. C., Sudbery, M. V., & Obonsawin, M. (2007). Mind-wandering and dysphoria. *Cognition & Emotion*, *21*(4), 816–842. https://doi.org/10.1080/02699930600911531

Smallwood, J., & Schooler, J. W. (2006). The restless mind. *Psychological Bulletin*, *132*(6), 946–958. https://doi.org/10.1037/0033-2909.132.6.946

Smyth, J. M., Hockemeyer, J. R., & Tulloch, H. (2008). Expressive writing and post-traumatic stress disorder: effects on trauma symptoms, mood states, and cortisol reactivity. *British Journal of Health Psychology*, *13*(Pt 1), 85–93. https://doi.org/10.1348/135910707X250866

Speckens, A. E. M., Ehlers, A., Hackmann, A., & Clark, D. M. (2006). Changes in intrusive memories associated with imaginal reliving in posttraumatic stress disorder. *Journal of Anxiety Disorders*, *20*(3), 328–341. https://doi.org/10.1016/j.janxdis.2005.02.004

Speckens, A. E. M., Ehlers, A., Hackmann, A., Ruths, F. A., & Clark, D. M. (2007). Intrusive memories and rumination in patients with post-traumatic stress disorder: A phenomenological comparison. *Memory*, *15*(3), 249–257. https://doi.org/10.1080/09658210701256449

Spenceley, A., & Jerrom, B. (1997). Intrusive Traumatic Childhood Memories in Depression: A Comparison Between Depressed, Recovered and Never Depressed Women. *Behavioural and Cognitive Psychotherapy*, *25*, 309–318. https://doi.org/10.1017/s1352465800018713

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). STAI manual for the state-trait anxiety inventory. Self-Evaluation Questionnaire. *MANUAL*. https://doi.org/10.1037/t06496-000

Stawarczyk, D., Majerus, S., Maj, M., Van der Linden, M., & D'Argembeau, A. (2011). Mind-wandering: phenomenology and function as assessed with a novel experience

sampling method. *Acta Psychologica*, *136*(3), 370–381. https://doi.org/10.1016/j.actpsy.2011.01.002

Steil, R., & Ehlers, A. (2000). Dysfunctional meaning of posttraumatic intrusions in chronic PTSD, *38*, 537–558.

Stern, A. F. (2014). The Hospital Anxiety and Depression Scale. *Occcupational Medicine*, *64*, 393–394. https://doi.org/10.1093/occmed/kqu024

Stone, A. A., Broderick, J. E., Schwartz, J. E., Shiffman, S., Litcher-Kelly, L., & Calvanese, P. (2003). Intensive momentary reporting of pain with an electronic diary: Reactivity, compliance, and patient satisfaction. *Pain*, *104*(1–2), 343–351. https://doi.org/10.1016/S0304-3959(03)00040-X

Stone, A. A., Schwartz, J. E., Broderick, J. E., & Shiffman, S. S. (2005). Variability of momentary pain predicts recall of weekly pain: A consequence of the peak (or salience) memory heuristic. *Personality and Social Psychology Bulletin*, *31*(10), 1340–1346. https://doi.org/10.1177/0146167205275615

Stuart, A. D. P., Holmes, E. a, & Brewin, C. R. (2006). The influence of a visuospatial grounding task on intrusive images of a traumatic film. *Behaviour Research and Therapy*, *44*(4), 611–619. https://doi.org/10.1016/j.brat.2005.04.004

Swan, S., & Andrews, B. (2003). The relationship between shame, eating disorders and disclosure in treatment. *British Journal of Clinical Psychology*, *42*(4), 367–378. https://doi.org/10.1348/014466503322528919

Takarangi, M. K. T., Nayda, D., Strange, D., & Nixon, R. D. V. (2017). Do meta-cognitive beliefs affect meta-awareness of intrusive thoughts about trauma? *Journal of Behavior Therapy and Experimental Psychiatry*, *54*, 292–300. https://doi.org/10.1016/j.jbtep.2016.10.005

Takarangi, M. K. T., Strange, D., & Lindsay, D. S. (2014). Self-report may underestimate

trauma intrusions. *Consciousness and Cognition*, *27C*, 297–305. https://doi.org/10.1016/j.concog.2014.06.002

Talarico, J. M., & Rubin, D. C. (2018). Ordinary memory processes shape flashbulb memories of extraordinary events: A review of 40 years of research. In O. Luminet & A. Curci (Eds.), *Flashbulb Memories: New Challenges and Future Perspectives* (Second Edi). Routledge.

Tulving, E. (1983). *Elements of Episodic Memory*. Oxford, UK: Clarendon Press.

Van den Hout, M. A., Engelhard, I. M., Rijkeboer, M. M., Koekebakker, J., Hornsveld, H., Leer, A., … Akse, N. (2011). EMDR: Eye movements superior to beeps in taxing working memory and reducing vividness of recollections. *Behaviour Research and Therapy*, *49*(2), 92–98. https://doi.org/10.1016/j.brat.2010.11.003

Vannucci, M., Batool, I., Pelagatti, C., & Mazzoni, G. (2014). Modifying the frequency and characteristics of involuntary autobiographical memories. *PloS One*, *9*(4), e89582. https://doi.org/10.1371/journal.pone.0089582

Vannucci, M., Pelagatti, C., Chiorri, C., & Mazzoni, G. (2015). Visual object imagery and autobiographical memory: Object Imagers are better at remembering their personal past. *Memory*, *24*(4), 455–470. https://doi.org/10.1080/09658211.2015.1018277

Vannucci, M., Pelagatti, C., Hanczakowski, M., & Chiorri, C. (2019). Visual attentional load affects the frequency of involuntary autobiographical memories and their level of meta-awareness. *Memory and Cognition*, *47*(1), 117–129. https://doi.org/10.3758/s13421-018-0854-0

Vannucci, M., Pelagatti, C., Hanczakowski, M., Mazzoni, G., & Paccani, C. R. (2014). Why are we not flooded by involuntary autobiographical memories? Few cues are more effective than many. *Psychological Research*, *79*(6), 1077–1085. https://doi.org/10.1007/s00426-014-0632-y

Vannucci, M., Pelagatti, C., & Marchetti, I. (2017). Manipulating cues in mind wandering: Verbal cues affect the frequency and the temporal focus of mind wandering. *Consciousness and Cognition*, *53*(May), 61–69. https://doi.org/10.1016/j.concog.2017.06.004

Verwoerd, J., Wessel, I., & de Jong, P. J. (2012). Fewer intrusions after an attentional bias modification training for perceptual reminders of analogue trauma. *Cognition and Emotion*, *26*(1), 153–165. https://doi.org/10.1080/02699931.2011.563521

Vrana, S., & Lauterbach, D. (1994). Prevalence of Traumatic Events and Post-Traumatic Psychological Symptoms in a Nonclinical Sample of College Students. *Journal of Traumatic Stress*, *7*(2), 289–302. https://doi.org/10.1023/A:1024485130934

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin*, *134*(2), 163–206. https://doi.org/10.1037/0033-2909.134.2.163

Watkins, E. R., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mechanisms and treatment of rumination. *Behaviour Research and Therapy*, *127*(January). https://doi.org/10.1016/j.brat.2020.103573

Watson A., L., & Berntsen, D. (2015). *Clinical Perspectives on Autobiographical Memory*. *Clinical Perspectives on Autobiographical Memory*. https://doi.org/10.26530/oapen_606764

Watson, L. A., Berntsen, D., Kuyken, W., & Watkins, E. R. (2012). The characteristics of involuntary and voluntary autobiographical memories in depressed and never depressed individuals. *Consciousness and Cognition*, *21*(3), 1382–1392. https://doi.org/10.1016/j.concog.2012.06.016

Watson, L. A., Berntsen, D., Kuyken, W., & Watkins, E. R. (2013). Involuntary and voluntary autobiographical memory specificity as a function of depression. *Journal of Behavior Therapy and Experimental Psychiatry*, *44*(1), 7–13.

https://doi.org/10.1016/j.jbtep.2012.06.001

Weathers, Litz, Huska, & Keane. (1994). PCL-C for DSM-IV. *National Center for PTSD-Behavioral Science Division*.

Weidmann, A., Conradi, A., Gröger, K., Fehm, L., & Fydrich, T. (2009). Using stressful films to analyze risk factors for PTSD in analogue experimental studies - which film works best? *Anxiety, Stress and Coping*, *22*(5), 549–569. https://doi.org/10.1080/10615800802541986

Wessel, I., Huntjens, R. J. C., & Verwoerd, J. R. L. (2010). Cognitive control and suppression of memories of an emotional film. *Journal of Behavior Therapy and Experimental Psychiatry*, *41*(2), 83–89. https://doi.org/10.1016/j.jbtep.2009.10.005

Wessel, I., Overwijk, S., Verwoerd, J., & de Vrieze, N. (2008). Pre-stressor cognitive control is related to intrusive cognition of a stressful film. *Behaviour Research and Therapy*, *46*(4), 496–513. https://doi.org/10.1016/j.brat.2008.01.016

Westermeyer, J., Shiroma, P., Thuras, P., Kattar, K., Johnson, D., & Crosby, R. D. (2015). Daily versus monthly reporting of post-traumatic symptoms: A study of reliability across time and instruments. *Psychiatry Research*, *227*(2–3), 309–312. https://doi.org/10.1016/j.psychres.2015.03.017

Wild, J., Smith, K. V, Thompson, E., Béar, F., Lommen, M. J. J., & Ehlers, A. (2020). A prospective study of pre-trauma risk factors for post-traumatic stress disorder and depression, (2016), 2571–2582. https://doi.org/10.1017/S0033291716000532

Williams, A. D., & Moulds, M. L. (2007). An investigation of the cognitive and experiential features of intrusive memories in depression. *Memory*, *15*(8), 912–920. https://doi.org/10.1080/09658210701508369

Williams, J. Mark G., Barnhofer, T., Crane, C., Herman, D., Raes, F., Watkins, E., & Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder.

Psychological Bulletin, *133*(1), 122–148. https://doi.org/10.1037/0033-2909.133.1.122

Williams, J. Mark G., & Broadbent, K. (1986). Autobiographical Memory in Suicide Attempters. *Journal of Abnormal Psychology*, *95*(2), 144–149. https://doi.org/10.1037/0021-843X.95.2.144

Williams, J.M.G., & Dritschel, B. H. (1988). Emotional disturbance and the specificity of autobiographical memory. *Cognition and Emotion*. https://doi.org/10.1080/02699938808410925

Williams, J.M.G., & Scott, J. (1988). Autobiographical memory in depression. *Psychological Medicine*, *18*, 689–695. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed10&NEWS=N&AN=2012179554

Williams, J Mark G, & Dritschel, B. H. (1992). Categoric and Extended Autobiographical Memories. In M. A. Conway, D. C. Rubin, H. Spinnler, & W. A. Wagenaar (Eds.), *Theoretical Perspectives on Autobiographical Memory* (pp. 391–410). Dordrecht, The Netherlands: Kluwer Academic Publishers. https://doi.org/10.1007/978-94-015-7967-4_23

Yeung, R. C., & Fernandes, M. A. (2020). Recurrent involuntary autobiographical memories : characteristics and links to mental health status mental health status. *Memory*, *0*(0), 1–13. https://doi.org/10.1080/09658211.2020.1777312

Zachariae, R., & O'Toole, M. S. (2015). The effect ofexpressive writing intervention on psychological and physical health outcomes in cancer patients—a systematic review and meta-analysis. *Psycho-Oncology*, *24*, 1349–1359. https://doi.org/10.1371/journal.pone.0131802

Zigmond, a S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370. https://doi.org/10.1111/j.1600-

0447.1983.tb09716.x

Appendix I: Online Intrusive Memory Questionnaire (Study 1, Chapter 2)

Please provide a detailed description (50 word minimum) of your most intrusive, repetitive memory (the one that you experience at least once a day).

How long ago did the event in the memory occur? Please be as specific as possible:

>>

How frequently have you experienced this memory in the past week?

- ○ Never
- ○ Once or twice a week
- ○ 3 or 4 times a week
- ○ Once a day
- ○ 2-3 times a day
- ○ 3-5 times a day
- ○ More than 5 times a day

When you experienced the memory how long did it last on average?

- ○ Seconds
- ○ Minutes
- ○ Up to an hour
- ○ Several hours
- ○ Constantly

How clear and vivid was this memory?

	1	2	3	4	5	6	7	
Not vivid (Vague)	○	○	○	○	○	○	○	Extremely vivid

Was the memory accompanied with any strong bodily responses (e.g. heart racing, sweating, shaking, nausea, headache, chills/flushes, stomach butterflies)?

Did you experience the memory as:

How distressing was the memory?

	1	2	3	4	5	6	7	
Not at all distressing	○	○	○	○	○	○	○	Very distressing

How much do you feel it disrupted your day-to-day activity?

	1	2	3	4	5	6	7	
Not at all disruptive	○	○	○	○	○	○	○	Very disruptive

How much did you try to avoid thinking about this event?

	1	2	3	4	5	6	7	
Not at all	○	○	○	○	○	○	○	As much as possible

How much do you avoid reminders of this event?

	1	2	3	4	5	6	7	
Not at all	○	○	○	○	○	○	○	As much as possible

>>

Appendix II: Diary of Intrusive Memories and Diary of Prospective Memories (Study 2, Chapter 3)

Intrusive memory diary:

1. When did you have the memory? **Time**:_____ **Date**:_____
2. When did you record it? **Time**:_____ **Date**:_____
3. What was the content of your intrusive memory?

4. Was the memory triggered by something… (circle as appropriate)
   (a) in your thoughts
   (b) in your environment
   (c) there was no trigger – **if so move to Question 6**

5. What was the trigger?

6. ***Where*** were you, and ***what*** were you doing when the memory came to mind?

7. How much were you concentrating on this activity? (circle as appropriate)

Not at all 1 2 3 4 5 Fully concentrating

8. How vivid was this memory? (circle as appropriate)

Very vague, almost no image 1 2 3 4 5 6 7 Extremely vivid, almost like normal vision

9. Did this memory evoke any emotions? (e.g., sadness, helplessness, guilt etc.)
☐ No
☐ Yes. Please specify:_____

10. Did you experience any bodily sensations? (e.g., sweating, shaking, heart racing etc.)
☐ No
☐ Yes. Please specify:_____

11. How long ago did the event in your memory take place? (Be as specific as possible)

12. Have you ever had a memory of this event before? (circle)

Never Once or twice A few times Several times Many times

13. If you have experienced a memory of this event before, is this memory… (circle as appropriate)
   (a) exactly the same as previous memories of this event
   (b) of the same event but from a different detail or time segment of the event

Prospective Memory Diary:

1. When did you have the memory? **Time:_____ Date:_____**
2. When did you record it? **Time:_____ Date:_____**
3. What was the content of your memory?

4. Was the memory triggered by something… (circle as appropriate)
   (d) in your thoughts
   (e) in your environment
   (f) there was no trigger – **if so move to Question 6**

5. What was the trigger?

6. ***Where*** were you, and ***what*** were you doing when the memory came to mind?

7. How much were you concentrating on this activity? (circle as appropriate)

   Not at all 1 2 3 4 5 Fully concentrating

8. How vivid was this memory? (circle as appropriate)

   Very vague, almost no image 1 2 3 4 5 6 7 Extremely vivid, almost like normal vision

9. Did this memory evoke any emotions? (e.g., sadness, helplessness, guilt etc.)
☐ No
☐ Yes. Please specify:_____

10. Did you experience any bodily sensations? (e.g., sweating, shaking, heart racing etc.)
☐ No
☐ Yes. Please specify:_____

11. When did you originally form this intention? (be as specific as possible, i.e., how many minutes, hours, days, weeks ago)

12. When is this intention due to be performed? (be as specific as possible, i.e., how many minutes, hours, days, weeks ago)

Tick grid (IM and PM diaries):

Acknowledging the memories you were unable to record:

If you are unable to record your memory soon after it has occurred, and later have forgotten some details, you may be unable to fill in the diary page. If this occurs then please acknowledge this by ticking a box next to the corresponding day that you experienced the memory. If this is a new memory (i.e. not one nominated during the first session, please write an 'N' next to the tick.

Day 1							**Day 8**						
Date:							Date:						
Day 2							**Day 9**						
Date:							Date:						
Day 3							**Day 10**						
Date:							Date:						
Day 4							**Day 11**						
Date:							Date:						
Day 5							**Day 12**						
Date:							Date:						
Day 6							**Day 13**						
Date:							Date:						
Day 7							**Day 14**						
Date:							Date:						

NOTE: If at any point you start to run out of diary pages, please call me on 0750 562 9212 or email me at b.plimpton@herts.ac.uk so that I can provide you with a new diary.

Appendix III: Debriefing Questionnaires (Study 2, Chapter 3)

IM Debriefing Questionnaire:

Debriefing Questionnaire

Below is a list of questions relating to your experience of keeping a diary of intrusive memories.

Some of the questions may seem to repeat sections of your diary entries. Please still provide an answer as the purpose of this questionnaire is to find out whether the use of a diary method worked well or not and whether you felt this was a useful and/or interesting experience.

If you forgot some of the instructions about keeping the diary, or chose not to follow them, please answer honestly when completing the questionnaire. There are no right or wrong answers.

1. Did you keep your diary with you every day?

   Yes No

   If not, how many days did you forget to keep the diary? Please, be specific.

2. If you did not keep your diary with you all the time was there a reason for this? If so, please indicate this in the space below:

3. Did you find it easy or difficult to try to keep your diary with you at all times?

   Very easy Somewhat easy Somewhat difficult Very difficult

4. Out of all the memories during the week, what was the percentage of memories (from 0% to 100%) that you managed to record in the diary?

5. If you deliberately did not record some of your intrusive memories, what was the reason for this?

6. How easy or difficult did you find it to record your intrusive memories using the diary provided?

Very easy Somewhat easy Somewhat difficult Very difficult

7. If you found it difficult what made it difficult for you?

8. Did you find the process of recording your intrusive memories useful in any way?

No Yes (please indicate below how it was useful)

9. Do you feel that keeping a diary of your intrusive memories had any effect on your mood?

Made me feel a lot worse	1	2	3	4 No effect	5	6	7	Made me feel a lot better

10. Do you feel that keeping a diary of your ***intrusive memories*** has affected your ***intrusive memories*** in terms of…

a. <u>Frequency (how often they occur):</u>

Overall more frequent Overall the same Overall less frequent Not sure

b. <u>Intensity (how strong or powerful they are):</u>

Overall more intense Overall the same Overall less intense Not sure

c. <u>Controllability (how easy they are to control):</u>

Overall more controllable Overall the same Overall less controllable Not sure

11. Finally, please take this space to note down any other comments you have regarding the diary method or the effects of the diary for you.

PM Debriefing Questionnaire:

Debriefing Questionnaire

Below is a list of questions relating to your experience of keeping a diary of involuntary memories.

Some of the questions may seem to repeat sections of your diary entries. Please still provide an answer as the purpose of this questionnaire is to find out whether the use of a diary method worked well or not and whether you felt this was a useful and/or interesting experience.

If you forgot some of the instructions about keeping the diary, or chose not to follow them, please answer honestly when completing the questionnaire. There are no right or wrong answers.

1. Did you keep your diary with you every day?

   Yes No

   If no, on how many days did you forget to keep the diary? Please be specific.

2. If you did not keep your diary with you all the time was there a reason for this and, if so, please write what the reason was?

3. Did you find it easy or difficult to try to keep your diary with you at all times?

   Very easy Somewhat easy Somewhat difficult Very difficult

4. Out of all the memories during the week, what was the percentage of memories (from 0% to 100%) that you managed to record in the diary?

5. If you deliberately did not record some of your involuntary memories, what was the reason for this?

6. How easy or difficult did you find it to record your involuntary memories using the diary provided?

   Very easy Somewhat easy Somewhat difficult Very difficult

7. If you found it difficult, what made it difficult for you?

8. Did you find the process of recording your involuntary memories useful in any way?

   No Yes (please indicate below how it was useful)

9. Do you feel that keeping a diary of your involuntary memories had any effect on your mood?

   Made me feel a lot worse 1 2 3 4 No effect 5 6 7 Made me feel a lot better

10. Do you feel that keeping a diary of your ***future intention memories*** has affected your ***intrusive memories*** in terms of…

    a. Frequency (how often they occur):

    Overall more frequent Overall the same Overall less frequent Not sure

    b. Intensity (how strong or powerful they are):

    Overall more intense Overall the same Overall less intense Not sure

    c. Controllability (how easy they are to control):

    Overall more controllable Overall the same Overall less controllable Not sure

11. Finally, please use this space to note any other comments you have regarding the diary method or the effects of the diary for you.

Appendix IV: Spielberger State-Trait Anxiety Inventory (STAI)

Mood Questionnaire

A number of statements which people have used to describe themselves are given below. Read each statement and then cross the appropriate circle to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but **give the answer which seems to best describe your present feelings at this moment**.

	Not at all	Somewhat	Moderately so	Very much so
1. I feel calm……	①	②	③	④
2. I feel secure……	①	②	③	④
3. I am tense……	①	②	③	④
4. I am regretful……	①	②	③	④
5. I feel at ease……	①	②	③	④
6. I feel upset……	①	②	③	④
7. I am presently worrying over possible misfortunes……	①	②	③	④
8. I feel rested……	①	②	③	④
9. I feel anxious……	①	②	③	④
10. I feel comfortable……	①	②	③	④
11. I feel self-confident……	①	②	③	④
12. I feel nervous……	①	②	③	④
13. I am jittery……	①	②	③	④
14. I feel 'high strung'……	①	②	③	④
15. I am relaxed……	①	②	③	④
16. I feel content……	①	②	③	④
17. I am worried……	①	②	③	④
18. I feel over-excited and 'rattled'……	①	②	③	④
19. I feel joyful……	①	②	③	④
20. I feel pleasant……	①	②	③	④

Mood Questionnaire - Continued

A number of statements which people have used to describe themselves are given below. Read each statement and then cross the appropriate circle to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but **give the answer which seems to describe how you generally feel best**.

	Almost never	Sometimes	Often	Almost always
21. I feel pleasant……	①	②	③	④
22. I tire quickly……..	①	②	③	④
23. I feel like crying……	①	②	③	④
24. I wish I could be as happy as others seem to be……..	①	②	③	④
25. I am losing out on things because I can't make up my mind soon enough……..	①	②	③	④
26. I feel rested……..	①	②	③	④
27. I am 'calm, cool and collected'……..	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them…….	①	②	③	④
29. I worry too much over something that really doesn't matter……..	①	②	③	④
30. I am happy……..	①	②	③	④
31. I am inclined to take things hard……..	①	②	③	④
32. I lack self-confidence…….	①	②	③	④
33. I feel secure……..	①	②	③	④
34. I try to avoid facing a crisis or difficulty…….	①	②	③	④
35. I feel blue……	①	②	③	④
36. I am content…….	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me……..	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind……..	①	②	③	④

39. I am a steady person……..	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests…….	①	②	③	④

Appendix V: Beck Depression Inventory (BDI)

Mood Questionnaire 2

A number of statements are given below. Read each statement and then circle the number of the statement to **indicate which best applies to you over the past week**. There are no right or wrong answers so please answer honestly.

A

0 I do not feel sad
1 I feel blue or sad
2a I am blue or sad all the time and I can't snap out of it
2b I am so sad or unhappy that it is very painful
3 I am so sad or unhappy that I can't stand it

B

0 I am not particularly pessimistic or discouraged about the future
1 I feel discouraged about the future
2a I feel I have nothing to look forward to
2b I feel that I won't ever get over my troubles
3 I feel that the future is hopeless and that things cannot improve

C

0 I do not feel like a failure
1 I feel I have failed more than the average person
2a I feel I have accomplished very little that is worthwhile or that means anything
2b As I look back on my life all I can see is a lot of failures
3 I feel I am a complete failure as a person (parent, husband, wife)

D

0 I am not particularly dissatisfied
1a I feel bored most of the time
1b I don't enjoy things the way I used to
2 I don't get satisfaction out of anything any more
3 I am dissatisfied with everything

E

0 I don't feel particularly guilty
1 I feel bad or unworthy a good part of the time
2a I feel quite guilty
2a I feel bad or unworthy practically all the time now
3 I feel as though I am very bad or worthless

F

0 I don't feel I am being punished
1 I have a feeling that something bad may happen to me
2 I feel I am being punished or will be punished
3a I feel I deserve to be punished
3b I want to be punished

G

0	I don't feel disappointed in myself
1a	I am disappointed in myself
1b	I don't like myself
2	I am disgusted with myself
3	I hate myself

H

0	I don't feel I am any worse than anybody else
1	I am very critical of myself for weaknesses or mistakes
2a	I blame myself for everything that goes wrong
2b	I feel I have many bad faults

I

0	I don't have any thoughts of harming myself
1	I have thoughts of harming myself but I would not carry them out
2a	I feel I would be better off dead
2b	I have definite plans about committing suicide
2c	I feel my family would be better off if I were dead
3	I would kill myself if I could

J

0	I don't cry my more than usual
1	I cry more now than I used to
2	I cry all the time now. I can't stop it
3	I used to be able to cry but now I can't cry at even though I want to

K

0	I am no more irritated now than I ever am
1	I get annoyed or irritated more easily than I used to
2	I feel irritated all the time
3	I don't get irritated at all at the things that used to irritate me

L

0	I have not lost interest in other people
1	I am less interested in other people now than I used to be
2	I have lost most of my interest in other people and have little feeling for them
3	I have lost all my interest in other people and don't care about them at all

M

0	I make decisions about as well as ever
1	I am less sure of myself now and try to put off making decisions
2	I can't make decisions any more without help
3	I can't make any decisions at all any more

N

0 I don't feel I look any worse than I used to
1 I am worried that I am looking old or unattractive
2 I feel that there are permanent changes in my appearance and they make me look unattractive
3 I feel that I am ugly or repulsive looking

O

0 I can work about as well as before
1a It takes extra effort to get started at doing something
1b I don't work as well as I used to
2 I have to push myself very hard to do anything
3 I can't do any work at all

P

0 I can sleep as well as usual
1 I wake up more tired in the morning than I used to
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep
3 I wake up early every day and can't get more than 5 hours sleep

Q

0 I don't get any more tired than usual
1 I get tired more easily than I used to
2 I get tired from doing anything
3 I get too tired to do anything

R

0 My appetite is no worse than usual
1 My appetite is not as good as it used to be
2 My appetite is much worse now
3 I have no appetite at all any more

S

0 I haven't lost much weight, if any, lately
1 I have lost more than 5 pounds
2 I have lost more than 10 pounds
3 I have lost more than 15 pounds

T

0 I am no more concerned about my health than usual
1 I am concerned about aches and pains or upset stomach or constipation or other unpleasant feelings in my body
2 I am so concerned with how I feel or what I feel that it's hard to think of much else
3 I am completely absorbed in what I feel

U

0 I have not noticed any recent change in my interest in sex
1 I am less interested in sex than I used to be
2 I am much less interested in sex now
3 I have lost interest in sex completely

Appendix VI: PTSD Checklist – Civilian Version (PCL-C)

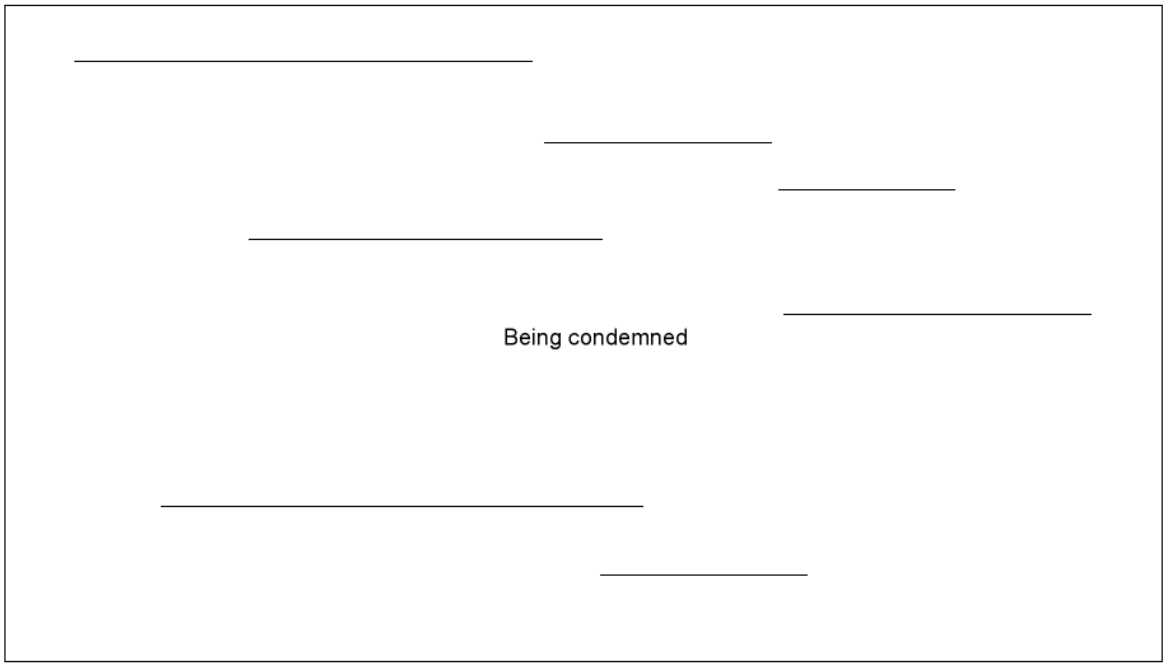
Stress Questionnaire

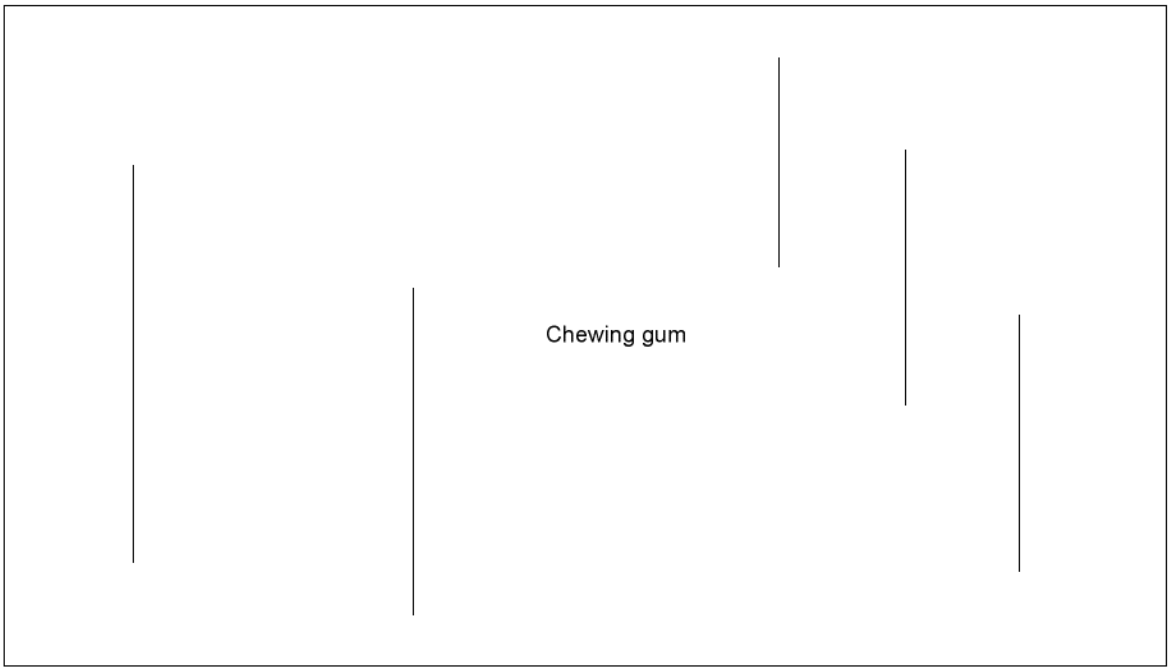
Instructions: Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem in the last week.

No.	Response	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing *memories, thoughts, or images* of a stressful experience from the past?					
2.	Repeated, disturbing *dreams* of a stressful experience from the past?					
3.	Suddenly *acting* or *feeling* as if a stressful experience *were happening* again (as if you were reliving it)?					
4.	Feeling *very upset* when *something reminded* you of a stressful experience from the past?					
5.	Having *physical reactions* (e.g., heart pounding, trouble breathing, or sweating) when *something reminded* you of a stressful experience from the past?					
6.	Avoid *thinking about* or *talking about* a stressful experience from the past or avoid *having feelings* related to it?					
7.	Avoid *activities* or *situations* because they *remind you* of a stressful experience from the past?					
8.	Trouble *remembering important parts* of a stressful experience from the past?					

No.	Response	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
9.	Loss of *interest in things that you used to enjoy?*					
10.	Feeling *distant* or *cut* off from other people?					
11.	Feeling *emotionally numb* or being unable to have loving feelings for those close to you?					
12.	Feeling as if your *future* will somehow be *cut short*?					
13.	Trouble *falling* or *staying asleep*?					
14.	Feeling *irritable* or having *angry outbursts*?					
15.	Having *difficulty concentrating*?					
16.	Being *"super alert"* or watchful on guard?					
17.	Feeling *jumpy* or easily startled?					

Appendix VII: Sample vigilance task slides (Studies 3a and 3b, Chapter 4)


Being condemned


Chewing gum

Appendix VIII: Cue phrase list for the experimental condition in Study 3a (Chapter 4)

Event Number	Stimuli/Event Name	Cue-word	Valence
1.	NS002	Coffee Mug	*Neutral*
2.	NS003	Young free & single	*Positive*
3.	NS004	Going to a party	*Positive*
4.	NS005	Gaining insight	*Positive*
5.	NS007	Learning disability	*Negative*
6.	NS008	Disney World	*Positive*
7.	NS009	Good business	*Positive*
8.	NS010	Terrible nightmare	*Negative*
9.	NS011	Photocopying paper	*Neutral*
10.	NS012	Summer romance	*Positive*
11.	NS013	Feeling frustrated	*Negative*
12.	NS014	A square shape	*Neutral*
13.	NS016	Sports injury	*Negative*
14.	NS017	Small scissors	*Neutral*
15.	NS018	Healthy glow	*Positive*
16.	NS019	Valentines day	*Positive*
17.	NS020	Missed opportunity	*Negative*
18.	NS022	Bad music	*Negative*
19.	NS023	Sound of a whistle	*Neutral*
20.	NS024	Christmas presents	*Positive*
21.	NS026	Address book	*Neutral*
22.	NS028	Masking tape	*Neutral*
23.	NS030	Tube of superglue	*Neutral*
24.	NS031	Snake bite	*Negative*
25.	NS033	Boring job	*Negative*
26.	NS034	Losing money	*Negative*
27.	NS035	Going on holiday	*Positive*
28.	NS036	Finding money	*Positive*
29.	NS039	Over reacting	*Negative*
30.	NS040	Lock smiths	*Neutral*
31.	NS041	Crossing the road	*Neutral*
32.	NS042	Old family photographs	*Positive*
33.	NS045	Overhead projector	*Neutral*
34.	NS046	Garden shed	*Neutral*
35.	NS047	Paying fines	*Negative*
36.	NS048	Bedside lamp	*Neutral*
37.	NS049	Friendly boss	*Positive*
38.	NS050	Stars & stripes	*Neutral*
39.	NS051	Favorite painting	*Positive*
40.	**NS052 TARG**	**Being ill**	***Negative***
41.	NS057	Deliberate harm	*Negative*
42.	NS058	Ideal home	*Positive*
43.	NS060	Flat tire	*Negative*
44.	NS061	Head-lice	*Negative*

45.	NS062	Filing a complaint	*Negative*
46.	NS063	Favorite teacher	*Positive*
47.	NS064	Drawing the curtains	*Neutral*
48.	NS066	Wall mirror	*Neutral*
49.	NS067	A big hug	*Positive*
50.	NS070	Red pen	*Neutral*
51.	NS071	Spot light	*Neutral*
52.	NS073	Flu symptoms	*Negative*
53.	NS075	Super smile	*Positive*
54.	NS076	Family pet	*Positive*
55.	NS077	Falling off a horse	*Negative*
56.	NS079	Tumble dryer	*Neutral*
57.	NS080	Romantic walk	*Positive*
58.	NS082	Being followed	*Negative*
59.	NS083	Web page	*Neutral*
60.	NS084	Feeling homesick	*Negative*
61.	NS086	New relationship	*Positive*
62.	NS087	Road rage	*Negative*
63.	NS089	Music concert	*Positive*
64.	NS090	Family doctor	*Neutral*
65.	NS091	Forgotten appointment	*Negative*
66.	NS092	Red light	*Neutral*
67.	NS093	Flip flops	*Neutral*
68.	NS094	Lukewarm water	*Neutral*
69.	NS095	Drug addict	*Negative*
70.	NS096	Clear blue sky	*Positive*
71.	NS097	Smelly feet	*Negative*
72.	NS098	Skiing accident	*Negative*
73.	NS099	Bad breath	*Negative*
74.	NS100	Sitting on the fence	*Neutral*
75.	NS101	Nail clippers	*Neutral*
76.	NS102	Jealous behavior	*Negative*
77.	NS103	Window shutters	*Neutral*
78.	NS104	Nasty feeling	*Negative*
79.	NS105	Great fun	*Positive*
80.	NS106	Rectangular bookmark	*Neutral*
81.	NS107	Crying all night	*Negative*
	Thought Probe 1		
82.	NS110	Driving instructor	*Neutral*
83.	NS111	Lousy day	*Negative*
84.	NS112	Unexpected disaster	*Negative*
85.	NS113	Post man	*Neutral*
86.	NS114	Mop & bucket	*Neutral*
87.	NS115	Filing cabinet	Neutral
88.	NS117	Long hair	*Neutral*
89.	NS118	Devoted friend	*Positive*

90.	NS120	Being content	*Positive*
91.	NS121	Local newspaper	*Neutral*
92.	NS122	Diary entry	*Neutral*
93.	NS123	Paint brush	*Neutral*
94.	NS125	Hand cream	*Neutral*
95.	NS127	Mean spirited	*Negative*
96.	NS128	Remaining neutral	*Neutral*
97.	NS129	Favourite food	*Positive*
98.	NS130	Feeling degraded	*Negative*
99.	NS131	London taxi	*Neutral*
100.	**NS133TARG**	**Daily chores**	***Neutral***
101.	NS136	Fat cat	*Neutral*
102.	NS138	Best effort	*Positive*
103.	NS139	Shoe shop	*Neutral*
104.	NS141	A glass of wine	*Positive*
105.	NS143	Something for nothing	*Positive*
106.	NS144	Yellow pages	*Neutral*
107.	NS146	Freezing cold	*Negative*
108.	NS147	Stars at night	*Positive*
109.	NS149	Relaxing on a beach	*Positive*
110.	NS150	Rubix cube	*Neutral*
111.	NS151	Being bullied	*Negative*
112.	NS153	Chapped lips	*Negative*
113.	NS156	Horrible sound	*Negative*
114.	NS157	Fear of heights	*Negative*
115.	NS158	Grim reaper	*Negative*
116.	NS159	Nice atmosphere	*Positive*
117.	NS160	Easy life	*Positive*
118.	NS162	Place of work	*Neutral*
119.	NS163	Drawing lines	*Neutral*
120.	NS164	No solution	*Negative*
121.	NS167	Remote control	*Neutral*
122.	NS168	Laugh out loud	*Positive*
123.	NS170	Deck chair	*Neutral*
124.	NS171	Sense of discomfort	*Negative*
125.	NS173	Shopping basket	*Neutral*
126.	NS174	Light feather	*Neutral*
127.	NS175	No electricity	*Negative*
128.	NS177	Childhood nightmares	*Negative*
129.	NS178	Serving dish	*Neutral*
	Thought Probe 2		
130.	NS179	Being arrested	*Negative*
131.	NS180	Dry cleaning	*Neutral*
132.	NS181	Christmas tree	*Positive*
133.	NS182	Good news	*Positive*
134.	NS183	Family feud	*Negative*

135.	NS184	Color paper	*Neutral*
136.	NS185	Failed driving test	*Negative*
137.	NS186	Value for money	*Positive*
138.	NS188	Coughing all night	*Negative*
139.	NS189	Being grateful	*Positive*
140.	NS190	Warm fire	*Positive*
141.	NS191	Washing hands	*Neutral*
142.	NS192	Financially secure	*Positive*
143.	NS193	Feeling refreshed	*Positive*
144.	NS194	Grandmothers birthday	*Positive*
145.	NS196	Getting divorced	*Negative*
146.	NS197	Looking good	*Positive*
147.	NS198	Exotic honeymoon	*Positive*
148.	NS200	Blocked drain	*Negative*
149.	NS201	Computer disk	*Neutral*
150.	**NS202TARG**	**Having an argument**	***Negative***
151.	NS203	Giving directions	*Neutral*
152.	NS204	Being greedy	*Negative*
153.	NS205	Perfect day	*Positive*
154.	NS207	Open-minded	*Positive*
155.	NS209	Opening blinds	*Neutral*
156.	NS212	Question mark	*Neutral*
157.	NS213	Sun burn	*Negative*
158.	NS214	Holiday home	*Positive*
159.	NS216	Sense of humor	*Positive*
160.	NS217	Family air loom	*Positive*
161.	NS218	Tender touch	*Positive*
162.	NS219	Having acne	*Negative*
163.	NS220	Making an appointment	*Neutral*
164.	NS221	Being punished	*Negative*
165.	NS222	Going to hospital	*Negative*
166.	NS224	Visiting an old friend	*Positive*
167.	NS226	Romantic dinner	*Positive*
168.	NS227	Attending a meeting	*Neutral*
169.	NS228	Eye infection	*Negative*
170.	NS231	Beautiful view	*Positive*
171.	NS232	Tin can	*Neutral*
172.	NS235	Bad karma	*Negative*
173.	NS236	Life time achievement	*Positive*
174.	NS238	Head over heels in love	*Positive*
175.	NS239	Family get together	*Positive*
176.	NS240	Favorite music	*Positive*
177.	NS241	Bad taste	*Negative*
178.	NS242	Good decision	*Positive*
179.	NS243	Locked out	*Negative*
180.	NS244	Setting alarm	*Neutral*

181.	NS245	New clothes	*Positive*
182.	NS248	Stuck in an elevator	*Negative*
183.	NS249	Miracle Cure	*Positive*
184.	NS250	Falling down stairs	*Negative*
185.	NS251	White picket fence	*Neutral*
186.	NS252	Easy success	*Positive*
187.	NS254	Dinner with friends	*Positive*
188.	NS256	Aerobic class	*Neutral*
189.	NS258	Stepping out	*Neutral*
190.	NS259	Jet lag	*Negative*
191.	NS260	Successful career	*Positive*
192.	NS262	Brick house	*Neutral*
193.	NS263	Obtaining a degree	*Positive*
194.	NS265	Rocking chair	*Neutral*
195.	**NS266TARG**	**Delicious food**	***Positive***
196.	NS268	Unable to cope	*Negative*
197.	NS270	Polishing furniture	*Neutral*
198.	NS272	Standing still	*Neutral*
199.	NS274	Villa in France	*Positive*
200.	NS275	Stubbed toe	*Negative*
201.	NS276	Note book	*Neutral*
202.	NS277	Wall paper	*Neutral*
203.	NS278	London Bridge	*Neutral*
204.	NS279	Delicious cocktail	*Positive*
205.	NS282	Santa Claus	*Positive*
206.	NS284	Parking ticket	*Negative*
207.	NS286	Fathers day	*Positive*
208.	NS287	Unable to adapt	*Negative*
209.	NS288	Sea sick	*Negative*
210.	NS290	Happy thoughts	*Positive*
211.	NS291	Wedding anniversary	*Positive*
212.	NS292	Sleeping bag	*Neutral*
213.	NS294	Drying clothes	*Neutral*
214.	NS295	Middle of the week	*Neutral*
215.	NS297	Name tag	*Neutral*
216.	NS299	Soap dish	*Neutral*
217.	NS300	Winning a prize	*Positive*
218.	NS302	Comfy chair	*Positive*
219.		***Personalized Cue 1***	
	Thought Probe 3		
220.	NS305	Being let down	*Negative*
221.	NS306	Happy memories	*Positive*
222.	NS307	Social security	*Neutral*
223.	NS308	Uncomfortable pillow	*Negative*
224.	NS310	Suicide attempt	*Negative*
225.	NS311	Car crash	*Negative*

226.	NS312	Wanting for nothing	*Positive*
227.	NS313	Parents anniversary	*Positive*
228.	NS314	Winning a race	*Positive*
229.	NS315	Fresh bread	*Positive*
230.	NS317	World peace	*Positive*
231.	NS318	Receiving inheritance	*Positive*
232.	NS319	TV cabinet	*Neutral*
233.	NS320	Aiming high	*Positive*
234.	NS321	Terminal illness	*Negative*
235.	NS322	Feeling bored	*Negative*
236.	NS323	Circus clown	*Neutral*
237.	NS324	Bathroom cabinet	*Neutral*
238.	NS326	Post office	*Neutral*
239.	NS328	Birthday party	*Positive*
240.	NS329	Distant relative	*Neutral*
241.	NS330	Sunny day	*Positive*
242.	NS332	Hanging clothes	*Neutral*
243.	NS334	Bruised knee	*Negative*
244.	NS336	Computer desk	*Neutral*
245.	NS337	Feeling grumpy	*Negative*
246.	NS338	Best man	*Positive*
247.	NS339	Car seat	*Neutral*
248.	NS340	No sensation	*Negative*
249.	NS341	Old mirror	*Neutral*
250.	**NS342TARG**	**Chewing gum**	***Neutral***
251.	NS343	Happy face	*Positive*
252.	NS344	Cup & saucer	*Neutral*
253.	NS345	Performing well	*Positive*
254.	NS346	Delayed flight	*Negative*
255.	NS347	Putting up a tent	*Neutral*
256.	NS349	Book shelves	*Neutral*
257.	NS351	Failing an exam	*Negative*
258.	NS352	New Years Eve	*Positive*
259.	NS353	Painful toothache	*Negative*
260.	NS354	Christmas decorations	*Positive*
261.	NS355	Suffering from vertigo	*Negative*
262.	NS356	Quick progress	*Positive*
263.	NS357	Asthma attack	*Negative*
264.	NS358	Exquisite dinner	*Positive*
265.	NS359	Full of regret	*Negative*
266.	NS360	Dangerous driving	*Negative*
267.	NS361	Feeling afraid	*Negative*
268.	NS363	Feeling lonely	*Negative*
269.	NS365	House fire	*Negative*
270.	NS366	Glue sniffing	*Negative*
271.	NS367	Sofa-bed	*Neutral*

272.	NS369	Graduation ceremony	*Positive*
273.	NS370	Helpful comments	*Positive*
274.	NS371	Stung by a jellyfish	*Negative*
275.	NS372	Double decker bus	*Neutral*
276.	NS373	Winning the jackpot	*Positive*
277.	NS374	Something small	*Neutral*
278.	NS377	Country kitchen	*Neutral*
279.	NS379	Losing a race	*Negative*
280.	NS380	Shaving cut	*Negative*
281.	NS381	Losing your home	*Negative*
282.	NS382	Lack of energy	*Negative*
283.	NS383	Grandmothers cooking	*Positive*
284.	NS384	Walking into a room	*Neutral*
285.	NS385	Paper towel	*Neutral*
286.	NS387	Dinner at a good restaurant	*Positive*
287.	NS388	Good night sleep	*Positive*
288.	NS389	Cotton tablecloth	*Neutral*
289.	NS391	Picture frame	*Neutral*
290.	NS392	Friendly waiter	*Positive*
	Thought Probe 4		
291.	NS393	Giving money to charity	*Positive*
292.	NS394	Run of the mill	*Neutral*
293.	NS395	Country pub	*Positive*
294.	NS396	Good fortune	*Positive*
295.	NS397	Soiled clothes	*Negative*
296.	NS398	Broken nose	*Negative*
297.	NS400	A loaf of bread	*Neutral*
298.	NS402	Hells angel	*Negative*
299.	NS404	Bow tie	*Neutral*
300.	NS405	Bad hair day	*Negative*
301.	NS407	Heart attack	*Negative*
302.	NS409	Cozy room	*Positive*
303.	NS411	Mixing paint	*Neutral*
304.	NS412	Comfy slippers	*Positive*
305.	NS413	Grandfather clock	*Neutral*
306.	NS415	Smashed window	*Negative*
307.	**NS416TARG**	**Achieving a goal**	***Positive***
308.	NS417	TV presenter	*Neutral*
309.	NS418	Pool table	*Neutral*
310.	NS419	Feeling paranoid	*Negative*
311.	NS420	Shopping list	*Neutral*
312.	NS421	Frying pan	*Neutral*
313.	NS423	Childhood dreams	*Positive*
314.	NS424	Treasured friend	*Positive*
315.	NS425	Badminton court	*Neutral*
316.	NS426	Computer crashed	*Negative*

317.	NS428	Having a picnic	*Positive*
318.	NS429	Brushing teeth	*Neutral*
319.	NS430	Sour grapes	*Negative*
320.	NS431	Children playing	*Positive*
321.	NS433	Big mistake	*Negative*
322.	NS434	Haunted house	*Negative*
323.	NS435	Feeling ecstatic	*Positive*
324.	NS436	Lack of motivation	*Negative*
325.	NS439	Receiving a letter	*Positive*
326.	NS440	Joining a union	*Neutral*
327.	NS441	Wooden beam	*Neutral*
328.	NS443	Receiving flowers	*Positive*
329.	NS445	Family reunion	*Positive*
330.	NS446	Being helpful	*Positive*
331.	NS448	Having no money	*Negative*
332.	NS449	Electric shock	*Negative*
333.	NS451	Parents meeting	*Neutral*
334.	NS453	First snow	*Positive*
335.	NS454	Oppressive regime	*Negative*
336.	NS455	Best friend	*Positive*
337.	NS456	Chased by police	*Negative*
338.	NS457	Place mat	*Neutral*
339.	NS458	Stolen car	*Negative*
340.	NS459	Muddy shoes	*Negative*
341.	NS461	Coat hangers	*Neutral*
342.	NS462	Big ego	*Negative*
343.	NS463	Satisfied client	*Positive*
344.	NS464	Ice-cream & fudge	*Positive*
345.	NS465	Prison sentence	*Negative*
346.	NS466	Highlighter pen	*Neutral*
347.	NS467	Poor hygiene	*Negative*
348.	**NS468TARG**	**Train driver**	***Neutral***
349.	NS469	Traveling the world	*Positive*
350.	NS470	Shortage of food	*Negative*
351.	NS473	Accident site	*Negative*
352.	NS474	Falling out of bed	*Negative*
353.	NS476	Nasty smell	*Negative*
354.	NS477	Self doubt	*Negative*
355.	NS478	Hospitable host	*Positive*
356.	NS480	Good genes	*Positive*
357.	NS482	Bull fighting	*Negative*
358.	NS483	Broken glass	*Negative*
359.	NS485	Lost keys	*Negative*
360.	NS486	Shop lifting	*Negative*
361.	NS487	Empty box	*Neutral*
362.	NS489	Being late	*Negative*

363.	NS490	Feeling unwanted	*Negative*
364.	NS491	No response	*Negative*
365.	NS492	Black stapler	*Neutral*
366.	NS493	Sandy beach	*Positive*
367.	NS494	Lottery win	*Positive*
368.	NS495	Good luck	*Positive*
369.	NS497	Summer barbeques	*Positive*
370.	NS498	Severe allergies	*Negative*
371.	NS499	Good health	*Positive*
372.	NS500	Sleepless night	*Negative*
373.	NS502	Spiders web	*Neutral*
374.	NS503	Failed relationship	*Negative*
375.	NS504	Angry neighbor	*Negative*
376.	NS505	Being tormented	*Negative*
377.	NS506	Local business	*Neutral*
378.	NS508	Table lamp	*Neutral*
379.	NS510	Brown paper	*Neutral*
380.	NS511	Feeling ugly	*Negative*
381.	NS512	Dressing up	*Positive*
382.	NS514	Unable to concentrate	*Negative*
383.	NS515	Feeling optimistic	*Positive*
384.	NS516	Chatting with friends	*Positive*
385.	NS517	Hanging execution	*Negative*
386.		***Personalized Cue 2***	
	Thought Probe 5		
387.	NS519	Coming home	*Positive*
388.	NS520	Luxurious surroundings	*Positive*
389.	NS521	Feeling exhausted	*Negative*
390.	NS522	Cheese grater	*Neutral*
391.	NS523	Racist comment	*Negative*
392.	NS524	Suspicious behavior	*Negative*
393.	NS525	Toiletry bag	*Neutral*
394.	NS527	Generous offer	*Positive*
395.	NS528	Understanding friend	*Positive*
396.	NS529	Being loved	*Positive*
397.	NS530	Paper weight	*Neutral*
398.	NS531	Key chain	*Neutral*
399.	NS533	Being punched	*Negative*
400.	NS534	Fear of flying	*Negative*
401.	**NS536TARG**	**Noisy neighbors**	***Negative***
402.	NS537	A million dollars	*Positive*
403.	NS539	Ink pen	*Neutral*
404.	NS540	Paper bag	*Neutral*
405.	NS541	Living life to the fullest	*Positive*
406.	NS543	Angry conversation	*Negative*
407.	NS545	Lavish banquet	*Positive*

408.	NS546	Engagement party	*Positive*
409.	NS547	First time abroad	*Positive*
410.	NS548	Global warming	*Negative*
411.	NS550	Something amazing	*Positive*
412.	NS551	Panic attack	*Negative*
413.	NS553	Bumpy road	*Negative*
414.	NS555	Red bricks	*Neutral*
415.	NS556	Capital letter	*Neutral*
416.	NS557	Pocket thief	*Negative*
417.	NS558	Day off work	*Positive*
418.	NS559	Excellent singing	*Positive*
419.	NS560	Cancelled plans	*Negative*
420.	NS563	Expensive gift	*Positive*
421.	NS564	Town hall	*Neutral*
422.	NS565	Bee sting	*Negative*
423.	NS566	Receiving praise	*Positive*
424.	NS568	Having money to spare	*Positive*
425.	NS569	Salt & pepper	*Neutral*
426.	NS570	Grandfathers birthday	*Positive*
427.	NS571	Slap on the face	*Negative*
428.	NS573	Glass cabinet	*Neutral*
429.	NS574	Demanding parent	*Negative*
430.	NS575	Blue coat	*Neutral*
431.	NS576	Peace & harmony	*Positive*
432.	NS577	A suburban street	*Neutral*
433.	NS578	Plastic bag	*Neutral*
434.	NS579	Armed services	*Neutral*
435.	NS580	Helpful landlord	*Positive*
436.	NS583	Stomach ache	*Negative*
437.	NS584	Quality time	*Positive*
438.	NS588	Tying a knot	*Neutral*
439.	NS589	Fully content	*Positive*
440.	NS590	Being undermined	*Negative*
441.	NS591	Smiling face	*Positive*
442.	NS593	Garden tools	*Neutral*
443.	NS594	Glass bowl	*Neutral*
444.	NS595	Delinquent behavior	*Negative*
445.	NS596	Receding hairline	*Negative*
446.	NS597	Being spoiled	*Negative*
447.	NS598	Shower curtain	*Neutral*
448.	NS599	Social Worker	*Neutral*
449.	NS600	Social outcast	*Negative*
450.	NS602	Summer time	*Positive*
451.	NS603	Skipping rope	*Neutral*
452.	NS606	Lost luggage	*Negative*
453.	NS608	Crashing into a lamppost	*Negative*

454.	NS609	Box of matches	*Neutral*
455.	NS610	Shop assistant	*Neutral*
456.	NS611	Going blind	*Negative*
457.	NS613	Computer monitor	*Neutral*
458.	**NS614TARG**	**Christmas day**	***Positive***
459.	NS615	Daily routine	*Neutral*
460.	NS617	Laughing with friends	*Positive*
461.	NS618	Cotton thread	*Neutral*
462.	NS619	Easter holiday	*Positive*
463.	NS620	A good book	*Positive*
464.	NS621	Lucky charm	*Positive*
465.	NS622	Clear skies	*Positive*
466.	NS623	First kiss	*Positive*
467.	NS624	Stained clothes	*Negative*
468.	NS625	Being carefree	*Positive*
469.	NS626	Broken leg	*Negative*
470.	NS627	A lying friend	*Negative*
471.	NS628	Making a drink	*Neutral*
472.	NS629	Getting married	*Positive*
473.	NS630	Lamp post	*Neutral*
474.	NS632	Short hair	*Neutral*
475.	NS633	Black stopwatch	*Neutral*
476.	NS634	Failed attempt	*Negative*
477.	NS636	Being betrayed	*Negative*
478.	NS638	Bad movies	*Negative*
479.	NS641	Heavy criticism	*Negative*
480.	NS642	Relaxing bubble bath	*Positive*
481.	NS643	White shoelace	*Neutral*
482.	NS644	Wallpaper paste	*Neutral*
483.	NS646	Dry mouth	*Negative*
484.	NS647	Expecting a baby	*Positive*
485.	NS648	Being overjoyed	*Positive*
486.	NS651	Blank postcard	*Neutral*
487.	NS653	Being robbed	*Negative*
488.	NS654	Bath mat	*Neutral*
489.		***Personalized Cue 3***	
	Thought Probe 6		
490.	NS657	Strawberries & cream	*Positive*
491.	NS658	Favorite show	*Positive*
492.	NS659	Office chair	*Neutral*
493.	NS660	Scent of perfume	*Positive*
494.	NS661	Tap water	*Neutral*
495.	NS662	White board	*Neutral*
496.	NS663	A wish come true	*Positive*
497.	NS664	Sneaking around	*Negative*
498.	NS665	Exciting prospects	*Positive*

499.	NS666	Horrible taste	*Negative*
500.	NS667	Chest of drawers	*Neutral*
501.	NS668	Collecting laundry	*Neutral*
502.	NS670	Being overweight	*Negative*
503.	NS671	Bad luck	*Negative*
504.	NS672	Receiving a gift	*Positive*
505.	NS674	Online banking	*Neutral*
506.	NS675	Pay raise	*Positive*
507.	NS676	Broken heart	*Negative*
508.	**NS677TARG**	**Getting lost**	***Negative***
509.	NS681	Buttering bread	*Neutral*
510.	NS682	Dinner at a restaurant	*Positive*
511.	NS684	Computer keyboard	*Neutral*
512.	NS685	Feeling grumpy	*Negative*
513.	NS687	Terrible nightmare	*Negative*
514.	NS688	Sibling rivalry	*Negative*
515.	NS689	Extended holiday	*Positive*
516.	NS690	State of turmoil	*Negative*
517.	NS692	Great idea	*Positive*
518.	NS693	Getting a bonus	*Positive*
519.	NS694	Shopping in New York	*Positive*
520.	NS695	Fear of spiders	*Negative*
521.	NS696	Summer vacation	*Positive*
522.	NS697	Long weekend	*Positive*
523.	NS698	Broken jaw	*Negative*
524.	NS699	Water jug	*Neutral*
525.	NS701	Root canal treatment	*Negative*
526.	NS702	Plastic cutlery	*Neutral*
527.	NS703	Deep voice	*Neutral*
528.	NS704	Tall building	*Neutral*
529.	NS705	Headline news	*Neutral*
530.	NS706	Being chased	*Negative*
531.	NS707	Aircraft hanger	*Neutral*
532.	NS710	Opening door	*Neutral*
533.	NS714	Down in the dumps	*Negative*
534.	NS715	First love	*Positive*
535.	NS716	Breaking up	*Negative*
536.	NS718	Rushed decision	*Negative*
537.	NS719	Bomb alert	*Negative*
538.	NS720	Sharpening a pencil	*Neutral*
539.	NS723	Flooded home	*Negative*
540.	NS725	Feeling unhappy	*Negative*
541.	NS726	Brown envelope	*Neutral*
542.	NS728	Bells ringing	*Neutral*
543.	NS729	Black socks	*Neutral*
544.	NS731	Spilt milk	*negative*

545.	NS732	Metallic paint	*Neutral*
546.	NS733	Broken nail	*Negative*
547.	NS734	Light bulb	*Neutral*
548.	NS735	Brick wall	*Neutral*
549.	NS736	Stainless steel	*Neutral*
	Thought Probe 7		
550.	NS739	Meeting room	*Neutral*
551.	NS740	Talk show	*Neutral*
552.	NS741	Excessive Sweating	*Negative*
553.	NS742	Doing nothing	*Neutral*
554.	NS743	Sense of identity	*Positive*
555.	NS744	Buying new shoes	*Positive*
556.	NS745	Plastic plates	*Neutral*
557.	NS746	Getting a bargain	*Positive*
558.	NS747	First car	*Positive*
559.	NS748	Wednesday afternoon	*Neutral*
560.	NS749	Seeing the sunrise	*Positive*
561.	NS750	Interesting conversation	*Positive*
562.	NS751	Traffic lights	*Neutral*
563.	NS752	Being in love	*Positive*
564.	NS753	Good company	*Positive*
565.	NS754	Feeling trapped	*Negative*
566.	NS755	Eating disorder	*Negative*
567.	NS756	Being creative	*Positive*
568.	**NS757TARG**	**Children playing in the park**	***Positive***
569.	NS758	Watching sports	*Positive*
570.	NS759	Listening to music	*Positive*
571.	NS760	Receiving a bill	*Negative*
572.	NS763	Waste paper basket	*Neutral*
573.	NS766	Secluded beach	*Positive*
574.	NS767	Senseless tragedy	*Negative*
575.	NS768	Red lipstick	*Neutral*
576.	NS769	Goldfish bowl	*Neutral*
577.	NS770	Refreshing drink	*Positive*
578.	NS771	Performing arts	*Neutral*
579.	NS772	Offending a friend	*Negative*
580.	NS774	Walking down stairs	*Neutral*
581.	NS775	Quilt cover	*Neutral*
582.	NS777	Beautiful woman	*Positive*
583.	NS778	Moody people	*Negative*
584.	NS779	Feeling neutral	*Neutral*
585.	NS780	Head lights	*Neutral*
586.	NS781	Church wedding	*Positive*
587.	NS782	Tuesday afternoon	*Neutral*
588.	NS784	Buying your first home	*Positive*
589.	NS786	A wall clock	*Neutral*

590.	NS787	Gun shot	*Negative*
591.	NS788	Insect bite	*Negative*
592.	NS790	Hand towel	*Neutral*
593.	NS791	A funny joke	*Positive*
594.	NS792	Being persecuted	*Negative*
595.	NS793	Bed linen	*Neutral*
596.	NS794	Beating the odds	*Positive*
597.	NS795	Lost earring	*Negative*
598.	NS798	Daydreaming	*Positive*
599.		***Personalized Cue 4***	
	Thought Probe 8		
600.	NS800	Being spontaneous	*Positive*

Appendix IX: Cue phrase list, experimental and control conditions, Study 3b (Chapter 4)

Event Number	Stimuli/Event Name	Cue-word	Valence
1.	NS002		
2.	NS003		
3.	NS004	Going to a party	*Positive*
4.	NS005		
5.	NS007	Learning disability	*Negative*
6.	NS008		
7.	NS009		
8.	NS010		
9.	NS011		
10.	NS012	Summer romance	*Positive*
11.	NS013		
12.	NS014		
13.	NS016	Sports injury	*Negative*
14.	NS017	Small scissors	*Neutral*
15.	NS018		
16.	NS019		
17.	NS020		
18.	NS022	Bad music	*Negative*
19.	NS023	Sound of a whistle	*Neutral*
20.	NS024		
21.	NS026		
22.	NS028	Young, free & single	*Positive*
23.	NS030		
24.	NS031		
25.	NS033	Boring job	*Negative*
26.	NS034		
27.	NS035	Going on holiday	*Positive*
28.	NS036		
29.	NS039	Over reacting	*Negative*
30.	NS040		
31.	NS041		
32.	NS042		
33.	NS045		
34.	NS046	Garden shed	*Neutral*
35.	NS047		
36.	NS048		
37.	NS049		
38.	NS050		
39.	NS051		
40.	**NS052TARG1**		
41.	NS057		
42.	NS058	Window shutters	*Neutral*

43.	NS060		
44.	NS061		
45.	NS062	Filing a complaint	*Negative*
46.	NS063		
47.	NS064		
48.	NS066		
49.	NS067		
50.	NS070		
51.	NS071	Spot light	*Neutral*
52.	NS073		
53.	NS075		
54.	NS076		
55.	NS077		
56.	NS079		
57.	NS080		
58.	NS082		
59.	NS083	Web page	*Neutral*
60.	NS084		
61.	NS086	New relationship	*Positive*
62.	NS087		
63.	NS089		
64.	NS090	Family doctor	*Neutral*
65.	NS091	Forgotten appointment	*Negative*
66.	NS092		
67.	NS093		
68.	NS094		
69.	NS095		
70.	NS096		
71.	NS097	Smelly feet	*Negative*
72.	NS098		
73.	NS099		
74.	NS100	Crossing the road	*Neutral*
75.	NS101		
76.	NS102		
77.	NS103		
78.	NS104		
79.	NS105	Great fun	*Positive*
80.	NS106		
81.	NS107		
82.	NS110		
83.	NS111		
84.	NS112		
85.	NS113	Driving instructor	*Neutral*
86.	NS114		
87.	NS115		
	Thought probe 1		

88.	NS117	Long hair	*Neutral*
89.	NS118		
90.	NS120	Being content	*Positive*
91.	NS121	Local newspaper	*Neutral*
92.	NS122		
93.	NS123		
94.	NS125		
95.	NS127	Overhead projector	*Neutral*
96.	NS128		
97.	NS129		
98.	NS130	Demanding parent	*Negative*
99.	NS131		
100.	**NS133TARG2**		
101.	NS136		
102.	NS138		
103.	NS139	Shoe shop	*Neutral*
104.	NS141		
105.	NS143	Road rage	*Negative*
106.	NS144		
107.	NS146		
108.	NS147		
109.	NS149		
110.	NS150	Rubix cube	*Neutral*
111.	NS151		
112.	NS153	Falling out of bed	*Negative*
113.	NS156		
114.	NS157		
115.	NS158		
116.	NS159		
117.	NS160	Losing money	*Negative*
118.	NS162		
119.	NS163		
120.	NS164	Stained clothes	*Negative*
121.	NS167		
122.	NS168		
123.	NS170		
124.	NS171	Music concert	*Positive*
125.	NS173		
126.	NS174		
127.	NS175	No electricity	*Negative*
128.	NS177		
129.	NS178	Serving dish	*Neutral*
130.	NS179		
131.	NS180		
132.	NS181		
133.	NS182	Coffee mug	*Neutral*

134.	NS183		
135.	NS184	Easy life	*Positive*
136.	NS185		
137.	NS186		
	Thought probe 2		
138.	NS188		
139.	NS189		
140.	NS190		
141.	NS191		
142.	NS192		
143.	NS193		
144.	NS194	Being bullied	*Negative*
145.	NS196		
146.	NS197		
147.	NS198		
148.	NS200	Nice atmosphere	*Positive*
149.	NS201		
150.	**NS202TARG3**		
151.	NS203		
152.	NS204		
153.	NS205	Perfect day	*Positive*
154.	NS207		
155.	NS209	Opening blinds	*Neutral*
156.	NS212		
157.	NS213	Lost luggage	*Negative*
158.	NS214		
159.	NS216		
160.	NS217		
161.	NS218	Tender touch	*Positive*
162.	NS219		
163.	NS220		
164.	NS221		
165.	NS222		
166.	NS224	Holiday home	*Positive*
167.	NS226		
168.	NS227		
169.	NS228		
170.	NS231	Beautiful view	*Positive*
171.	NS232		
172.	NS235		
173.	NS236		
174.	NS238		
175.	NS239	Family get together	*Positive*
176.	NS240		
177.	NS241	Bad taste	*Negative*
178.	NS242		

179.	NS243		
180.	NS244		
181.	NS245		
182.	NS248		
183.	NS249	Miracle Cure	*Positive*
184.	NS250		
185.	NS251		
186.	NS252		
187.	NS254		
188.	NS256		
189.	NS258		
190.	NS259		
191.	NS260	Successful career	*Positive*
192.	NS262	Brick house	*Neutral*
193.	NS263		
194.	NS265	Rocking chair	*Neutral*
195.	**NS266TARG4**		
196.	NS268		
197.	NS270		
198.	NS272		
199.	NS274		
200.	NS275	Stubbed toe	*Negative*
201.	NS276		
202.	NS277	Drying clothes	*Neutral*
203.	NS278		
204.	NS279		
205.	NS282		
206.	NS284		
207.	NS286		
208.	NS287	Sense of humor	*Positive*
209.	NS288		
210.	NS290		
211.	NS291		
212.	NS292	Sleeping bag	*Neutral*
213.	NS294		
214.	NS295	Middle of the week	*Neutral*
215.	NS297		
216.	NS299		
217.	NS300	Winning a prize	*Positive*
218.	NS302		
219.	NS303		
220.	NS305	Muddy shoes	*Negative*
221.	NS306		
222.	NS307		
223.	NS308		
224.	NS310		

225.	NS311	Personalised Cue or “Asthma attack”	*Negative*
226.	NS312		
227.	NS313		
	Thought probe 3		
228.	NS314		
229.	NS315		
230.	NS317		
231.	NS318		
232.	NS319		
233.	NS320	Aiming high	*Positive*
234.	NS321		
235.	NS322		
236.	NS323		
237.	NS324		
238.	NS326	Post office	*Neutral*
239.	NS328		
240.	NS329		
241.	NS330	Sunny day	*Positive*
242.	NS332		
243.	NS334		
244.	NS336	Computer desk	*Neutral*
245.	NS337		
246.	NS338		
247.	NS339	Car seat	*Neutral*
248.	NS340		
249.	NS341		
250.	**NS342TARG5**		
251.	NS343	Exquisite dinner	*Positive*
252.	NS344		
253.	NS345		
254.	NS346		
255.	NS347	Putting up a tent	*Neutral*
256.	NS349		
257.	NS351		
258.	NS352		
259.	NS353	Painful toothache	*Negative*
260.	NS354	Christmas decorations	*Positive*
261.	NS355		
262.	NS356	Quick progress	*Positive*
263.	NS357		
264.	NS358		
265.	NS359		
266.	NS360		
267.	NS361		
268.	NS363		
269.	NS365		

270.	NS366		
271.	NS367	Sofa-bed	*Neutral*
272.	NS369		
273.	NS370	Excellent singing	*Positive*
274.	NS371		
275.	NS372		
276.	NS373		
277.	NS374		
278.	NS377		
279.	NS379		
280.	NS380		
281.	NS381	Losing your home	*Negative*
282.	NS382		
283.	NS383		
284.	NS384	Best friends	*Positive*
285.	NS385		
286.	NS387		
287.	NS388		
288.	NS389	Personalised Cue or “Feeling afraid”	*Negative*
289.	NS391		
290.	NS392		
	Thought probe 4		
291.	NS393		
292.	NS394		
293.	NS395		
294.	NS396		
295.	NS397	Picture frame	*Neutral*
296.	NS398		
297.	NS400		
298.	NS402		
299.	NS404	Summer barbeques	*Positive*
300.	NS405		
301.	NS407		
302.	NS409		
303.	NS411	Mixing paint	*Neutral*
304.	NS412		
305.	NS413		
306.	NS415		
307.	**NS416TARG6**		
308.	NS417	TV presenter	*Neutral*
309.	NS418		
310.	NS419		
311.	NS420	Shopping list	*Neutral*
312.	NS421		
313.	NS423		
314.	NS424		

315.	NS425		
316.	NS426		
317.	NS428		
318.	NS429	Bells ringing	*Neutral*
319.	NS430		
320.	NS431	Children playing	*Positive*
321.	NS433		
322.	NS434		
323.	NS435	Oppressive regime	*Negative*
324.	NS436		
325.	NS439		
326.	NS440		
327.	NS441		
328.	NS443	Lottery win	*Positive*
329.	NS445		
330.	NS446	Being helpful	*Positive*
331.	NS448		
332.	NS449		
333.	NS451		
334.	NS453		
335.	NS454		
336.	NS455		
337.	NS456	Chased by police	*Negative*
338.	NS457		
339.	NS458		
340.	NS459		
341.	NS461		
342.	NS462		
343.	NS463	Satisfied client	*Positive*
344.	NS464		
345.	NS465		
346.	NS466		
347.	NS467	Daily routine	*Neutral*
348.	**NS468TARG7**		
349.	NS469		
350.	NS470		
351.	NS473		
352.	NS474		
353.	NS476		
354.	NS477	Self doubt	*Negative*
355.	NS478		
356.	NS480		
357.	NS482	Good luck	*Positive*
358.	NS483		
359.	NS485		
360.	NS486		

361.	NS487		
362.	NS489		
363.	NS490		
364.	NS491		
365.	NS492	Black stapler	*Neutral*
366.	NS493		
367.	NS494	Receiving flowers	*Positive*
368.	NS495	Personalised Cue or "Excessive sweating"	*Negative*
369.	NS497		
370.	NS498		
	Thought probe 5		
371.	NS499	Good health	*Positive*
372.	NS500		
373.	NS502		
374.	NS503		
375.	NS504		
376.	NS505	Being tormented	*Negative*
377.	NS506		
378.	NS508		
379.	NS510		
380.	NS511		
381.	NS512		
382.	NS514	Unable to concentrate	*Negative*
383.	NS515		
384.	NS516	Chatting with friends	*Positive*
385.	NS517		
386.	NS518		
387.	NS519		
388.	NS520		
389.	NS521		
390.	NS522		
391.	NS523	Racist comment	*Negative*
392.	NS524		
393.	NS525	Toiletry bag	*Neutral*
394.	NS527		
395.	NS528		
396.	NS529	Being loved	*Positive*
397.	NS530		
398.	NS531		
399.	NS533	Terrible nightmare	*Negative*
400.	NS534		
401.	**NS536TARG8**		
402.	NS537		
403.	NS539	Ink pen	*Neutral*
404.	NS540		

405.	NS541		
406.	NS543		
407.	NS545		
408.	NS546	Engagement party	*Positive*
409.	NS547		
410.	NS548	Being undermined	*Negative*
411.	NS550		
412.	NS551		
413.	NS553		
414.	NS555		
415.	NS556		
416.	NS557	Long weekend	*Positive*
417.	NS558		
418.	NS559		
419.	NS560		
420.	NS563	Expensive gift	*Positive*
421.	NS564		
422.	NS565		
423.	NS566	Receiving praise	*Positive*
424.	NS568		
425.	NS569	Salt & pepper	*Neutral*
426.	NS570		
427.	NS571		
428.	NS573		
429.	NS574		
430.	NS575	Broken jaw	*Negative*
431.	NS576		
432.	NS577		
433.	NS578	Black socks	*Neutral*
434.	NS579		
435.	NS580	Helpful landlord	*Positive*
436.	NS583		
437.	NS584		
438.	NS588		
439.	NS589		
440.	NS590	Sleepless night	*Negative*
441.	NS591		
442.	NS593		
443.	NS594		
444.	NS595		
445.	NS596		
446.	NS597		
447.	NS598	Personalised Cue or “Social outcast”	*Negative*
448.	NS599		
449.	NS600		
	Thought probe 6		

450.	NS602		
451.	NS603		
452.	NS606		
453.	NS608		
454.	NS609		
455.	NS610		
456.	NS611	Going blind	*Negative*
457.	NS613		
458.	**NS614TARG9**		
459.	NS615		
460.	NS617		
461.	NS618		
462.	NS619	Flip flops	*Neutral*
463.	NS620		
464.	NS621	Lucky charm	*Positive*
465.	NS622		
466.	NS623	First kiss	*Positive*
467.	NS624		
468.	NS625		
469.	NS626	Broken leg	*Negative*
470.	NS627		
471.	NS628		
472.	NS629		
473.	NS630		
474.	NS632	Short hair	*Neutral*
475.	NS633		
476.	NS634		
477.	NS636		
478.	NS638	Bad movies	*Negative*
479.	NS641		
480.	NS642		
481.	NS643	Lukewarm water	*Neutral*
482.	NS644		
483.	NS646	Dry mouth	*Negative*
484.	NS647		
485.	NS648		
486.	NS651		
487.	NS653	Being robbed	*Negative*
488.	NS654		
489.	NS655		
490.	NS657		
491.	NS658		
492.	NS659		
493.	NS660		
494.	NS661		
495.	NS662	White board	*Neutral*

496.	NS663		
497.	NS664	Sneaking around	*Negative*
498.	NS665		
499.	NS666		
500.	NS667		
501.	NS668	Collecting laundry	*Neutral*
502.	NS670		
503.	NS671	Bad luck	*Negative*
504.	NS672		
505.	NS674		
506.	NS675		
507.	NS676		
508.	**NS677TARG10**		
509.	NS681		
510.	NS682	Dinner at a restaurant	*Positive*
511.	NS684		
512.	NS685		
513.	NS687		
514.	NS688	Sibling rivalry	*Negative*
515.	NS689		
516.	NS690	State of turmoil	*Negative*
517.	NS692	Great idea	*Positive*
518.	NS693		
519.	NS694		
520.	NS695	Fear of spiders	*Negative*
521.	NS696		
522.	NS697		
523.	NS698		
524.	NS699		
525.	NS701		
526.	NS702		
527.	NS703		
528.	NS704	Water jug	*Neutral*
529.	NS705		
530.	NS706		
	Thought probe 7		
531.	NS707		
532.	NS710	Opening door	*Neutral*
533.	NS714		
534.	NS715		
535.	NS716	Breaking up	*Negative*
536.	NS718		
537.	NS719		
538.	NS720		
539.	NS723	Flooded home	*Negative*
540.	NS725		

541.	NS726		
542.	NS728		
543.	NS729		
544.	NS731		
545.	NS732		
546.	NS733		
547.	NS734		
548.	NS735	Brick wall	*Neutral*
549.	NS736		
550.	NS739		
551.	NS740	Talk show	*Neutral*
552.	NS741	Subway station	*Neutral*
553.	NS742		
554.	NS743		
555.	NS744		
556.	NS745		
557.	NS746		
558.	NS747		
559.	NS748		
560.	NS749		
561.	NS750	Hand towel	*Neutral*
562.	NS751		
563.	NS752		
564.	NS753	Good company	*Positive*
565.	NS754	Feeling trapped	*Negative*
566.	NS755		
567.	NS756		
568.	NS757		
569.	NS758		
570.	NS759		
571.	NS760	Daydreaming	*Positive*
572.	NS763		
573.	NS766		
574.	NS767	Offending a friend	*Negative*
575.	NS768		
576.	NS769		
577.	NS770		
578.	NS771	Buying your first home	*Positive*
579.	NS772		
580.	NS774		
	Thought probe 8		
581.	NS775		
582.	NS777		
583.	NS778	Goldfish bowl	*Neutral*
584.	NS779		
585.	NS780		

586.	NS781	Priceless comment	*Positive*
587.	NS782		
588.	**NS784TARG11**		
589.	NS786		
590.	NS787		
591.	NS788	Insect bite	*Negative*
592.	NS790		
593.	NS791	A funny joke	*Positive*
594.	NS792		
595.	NS793		
596.	NS794		
597.	NS795		
598.	NS798		
599.	NS799		
600.	NS800		

Appendix X: Thought Probe Questionnaire (Studies 3a and 3b, Chapter 4)

1) Please give below a description of your thoughts, if any, prior to being stopped:

2a) Was the thought you described above: *(Please tick appropriate answer)*

Deliberate ☐ Spontaneous ☐

2b) If you ticked *Spontaneous*, was you thought: (Please tick appropriate answer)

Triggered by the enviroment ☐ Triggered by own thoughts ☐

No trigger ☐

If your thoughts were triggered by something please state what it was below:

.....

3) How much were you concentrating on the task? *(On a scale of 1- 5. Please circle your chosen response.)*

Not at all ___1_____ 2_____3_____4_____5____Fully Concentrating

4) How vivid was your thought? *(On a scale of 1- 7. Please circle your chosen response.)*

Very vague,___1_____ 2_____3_____4_____5_____6_____7__Very vivid, almost like normal vision

After completing the questions, please return to the task.

Please go back to your description of your thought and read it carefully. Once you have done this please answer the following questions:

5) Categorise your thought into ONE of the following: (*Please tick appropriate answer)*

Past memory ☐ Future event ☐

Current/Ongoing Situation☐

6) If you ticked *Past memory* or *Future event*, indicate how long ago the memory was, or how far ahead in the future it is.

……

7) How frequently have you had this thought prior to the experiment? *(On a scale of 1- 5. Please circle your chosen response.)*

1	2	3	4	5
Never	Once or twice	A few times	Several times	Many times

8) How pleasant would you rate this thought? *(On a scale of 1- 5. Please circle your chosen response.)*

1	2	3	4	5
Very Unpleasant		Neutral		Very Pleasant

9) How specific was the thought/memory? (*Please tick appropriate answer)*

One-off event/thing ☐ General thought about a repetitive event ☐

General thought about an extended event ☐

<u>End of Questionnaire</u>

Appendix XI: Hospital Anxiety and Depression Scale (HADS)

Clinicians are aware that emotions play an important part in most illnesses. If your clinician knows about these feelings he or she will be able to help you more. This questionnaire is designed to help your clinician to know how you feel. Read each item below and **underline the reply** which comes closest to how you have been feeling in the past week. Don't take too long over your replies, your immediate reaction to each item will probably be more accurate than a long, thought-out response.

I feel tense or 'wound up':	**A**
Most of the time	3
A lot of the time	2
Time to time, occasionally	1
Not at all	0

I still enjoy the things I used to enjoy:	**D**
Definitely as much	0
Not quite so much	1
Only a little	2
Not at all	3

I get a sort of frightened feeling like something awful is about to happen:	**A**
Very definitely and quite badly	3
Yes, but not too badly	2
A little, but it doesn't worry me	1
Not at all	0

I can laugh and see the funny side of things:	**D**
As much as I always could	0
Not quite so much now	1
Definitely not so much now	2

Not at all	3
Worrying thoughts go through my mind:	**A**
A great deal of the time	3
A lot of the time	2
From time to time but not too often	1
Only occasionally	0
I feel cheerful:	**D**
Not at all	3
Not often	2
Sometimes	1
Most of the time	0
I can sit at ease and feel relaxed:	**A**
Definitely	0
Usually	1
Not often	2
Not at all	3
I feel as if I am slowed down:	**D**
Nearly all of the time	3
Very often	2
Sometimes	1
Not at all	0
I get a sort of frightened feeling like 'butterflies in the stomach':	**A**

Not at all	0
Occasionally	1
Quite often	2
Very often	3

I have lost interest in my appearance:	**D**
Definitely	3
I don’t take as much care as I should	2
I may not take quite as much care	1
I take just as much care as ever	0

I feel restless as if I have to be on the move:	**A**
Very much indeed	3
Quite a lot	2
Not very much	1
Not at all	0

I look forward with enjoyment to things:	**D**
A much as I ever did	0
Rather less than I used to	1
Definitely less than I used to	2
Hardly at all	3

I get sudden feelings of panic:	**A**
Very often indeed	3
Quite often	2
Not very often	1
Not at all	0

I can enjoy a good book or radio or TV programme:	**D**
Often	0
Sometimes	1
Not often	2
Very seldom	3

Appendix XII: The Primary Care PTSD Screen (PC-PTSD)

Description

The PC-PTSD is a 4-item screen that was designed for use in primary care and other medical settings and is currently used to screen for PTSD in veterans at the VA. The screen includes an introductory sentence to cue respondents to traumatic events. The authors suggest that in most circumstances the results of the PC-PTSD should be considered "positive" if a patient answers "yes" to any 3 items. Those screening positive should then be assessed with a structured interview for PTSD. The screen does not include a list of potentially traumatic events.

Scale

Instructions:

In your life, have you ever had any experience that was so frightening, horrible, or upsetting that, in the past month, you:

1. Have had nightmares about it or thought about it when you did not want to?
   YES / NO
2. Tried hard not to think about it or went out of your way to avoid situations that reminded you of it?
   YES / NO
3. Were constantly on guard, watchful, or easily startled?
   YES / NO
4. Felt numb or detached from others, activities, or your surroundings?
   YES / NO

Current research suggests that the results of the PC-PTSD should be considered "positive" if a patient answers "yes" to any three items.

Appendix XIII: Spontaneous Use of Imagery Scale (SUIS)

Please read each of the following descriptions and indicate the degree to which each is appropriate for you. Do not spend a lot of time thinking about each one, but respond based on your thoughts about how you do or do not perform each activity. If a description is always completely appropriate, please write "5"; if it is never appropriate, write "1"; if it is appropriate about half of the time, write "3"; and use the other numbers accordingly.

_____ a. When going to a new place, I prefer directions that include detailed descriptions of landmarks (such as the size, shape and color of a gas station) in addition to their names.

_____ b. If I catch a glance of a car that is partially hidden behind bushes, I automatically "complete it," seeing the entire car in my mind's eye.

_____ c. If I am looking for new furniture in a store, I always visualize what the furniture would look like in particular places in my home.

_____ d. I prefer to read novels that lead me easily to visualize where the characters are and what they are doing instead of novels that are difficult to visualize.

_____ e. When I think about visiting a relative, I almost always have a clear mental picture of him or her.

_____ f. When relatively easy technical material is described clearly in a text, I find illustrations distracting because they interfere with my ability to visualize the material.

_____ g. If someone were to tell me two-digit numbers to add (e.g., 24 and 31), I would visualize them in order to add them.

_____ h. Before I get dressed to go out, I first visualize what I will look like if I wear different combinations of clothes.

_____ i. When I think about a series of errands I must do, I visualize the stores I will visit.

_____ j. When I first hear a friend's voice, a visual image of him or her almost always springs to mind.

_____ k. When I hear a radio announcer or DJ I've never actually seen, I usually find myself picturing what they might look like.

_____ l. If I saw a car accident, I would visualize what had happened when later trying to recall the details.

Appendix XIV: Vividness of Visual Imagery Questionnaire (VVIQ)

For items 1-4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye.

Item:

1) The exact contour of face, head, shoulders and body. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

2) characteristic poses of head, attitudes of body, etc. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

3) The precise carriage, length of step, etc., in walking. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

4) The different colours worn in some familiar cloths. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

Visualize a rising sun. consider carefully the picture that comes before your mind's eye.

Item:

5) The sun is rising above the horizon into a hazy sky. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

6) The sky clears and surrounds the sun with blueness. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

7) Clouds. A storm blow up, with flashes of lightning. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

8) A rainbow appears. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

Think of the front of a shop which you often go to. Consider the picture that comes before your mind's eye.

Item:

9) The overall appearance of the shop from the opposite side of the road. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

10) A window display including colours, shapes and details of individual items for sale. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

11) You are near the entrance. The colour, shape and details of the door. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

12) you enter the shop and go to the counter. The counter assistant serves you. Money changes hands. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.

5 - No image at all, you only "know" that you are thinking of the object

Finally, think of a country scene which involves trees, mountains and a lake. consider the picture that comes before your mind's eye.

Item:

13) The colour of the landscape. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

14)The colour and shape of the trees. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

15) The colour and shape of the lake. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

16) A strong wind blows on the trees and on the lake causing waves. Circle appropriate answer
1 - Perfectly clear and as vivid as normal vision.
2 - Clear and reasonably vivid.
3 - Moderately clear and vivid.
4 - Vague and dim.
5 - No image at all, you only "know" that you are thinking of the object

Appendix XV: Diary of film-related IMs (Study 5, Chapter 6)

1. When did you have the memory of the film clip? **Time**:_____ **Date**:_____
2. When did you record it? **Time**:_____ **Date**:_____
3. Please describe in detail the film scene that came into your mind.

4. Was the memory triggered by something, for example… (circle as appropriate)
   (g) in your thoughts
   (h) in your environment
   (i) there was no trigger – **if so move to Question 6**

5. What triggered this memory?

6. When the memory was triggered in your mind, ***where*** were you, and ***what*** were you doing?

7. How much were you concentrating on this activity? (Circle as appropriate.)

1	2	3	4	5
Not at all				Fully concentrating

8. How vivid was this memory? (Circle as appropriate.)

1	2	3	4	5	6	7
Not vivid/vague						Extremely vivid

9. What was your mood before experiencing this memory? (Circle as appropriate. In this scale 4 is 'neutral.')

1	2	3	4	5	6	7
Extremely negative			Neutral			Extremely positive

10. How distressing was this memory? (Circle as appropriate. In this scale 4 is 'moderately distressing.')

1	2	3	4	5	6	7
Not distressing			Moderately			Extremely distressing

11. What effect, if any, did the intrusion of the film have on your mood? (Circle as appropriate. In this scale 4 is 'moderately worse.')

1	2	3	4	5	6	7
No effect			Moderately			Made me feel a lot worse

Appendix XVI: Diary of Involuntary Autobiographical Memories (Study 5, Chapter 6)

1. (a) When did you have the memory? **Date**:_____ **Time**:_____AM/PM
   (b) When did you record it? **Date**:_____ **Time**:_____ AM/PM

2. Describe your memory. What was it about?

3. How vivid was this memory? (circle as appropriate)

Very vague, almost no image 1 2 3 4 5 6 7 Extremely vivid, almost like normal vision

4. Was the memory triggered by something… (circle as appropriate)
   (a) in your thoughts
   (b) in your environment
   (c) there was no trigger – (**if c, then skip to Question 6)**

5. If you circle (a) or (b) above, please describe what was the trigger.

6. What were you doing when the memory came to mind? (please describe)

7. How much were you concentrating on this activity? (circle as appropriate)

Not at all 1 2 3 4 5 Fully concentrating

8. What was your mood before experiencing this memory?

1 2 3 4 5 6 7
Extremely negative Neutral Extremely positive

9. How pleasant or unpleasant is the memory that you experienced?

1 2 3 4 5 6 7
Very unpleasant Neutral Very Pleasant

10. What effect, if any, did the intrusion of the film have on your mood? (Circle as appropriate)

1 2 3 4 5 6 7
Made me feel a lot worse Had no effect Made me feel a lot better

11. Is the memory of a general or specific event? (circle as appropriate)
   (a) General event
   (b) Specific event

12. When did the original event occur? (please be as specific as possible).

13. Have you ever had a memory of this event before? (circle as appropriate)

Never Once or twice A few times Several times Many times