



The importance of context: Evidence that contextual representations increase intrusive memories

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ABSTRACT

Background and objectives: Intrusive memories appear to enter consciousness via involuntary rather than deliberate recollection. Some clinical accounts of PTSD seek to explain this phenomenon by making a clear distinction between the encoding of sensory-based and contextual representations. Contextual representations have been claimed to actively reduce intrusions by anchoring encoded perceptual data for an event in memory. The current analogue trauma study examined this hypothesis by manipulating contextual information independently from encoded sensory-perceptual information.

Method: Participants viewed images selected from the International Affective Picture System that depicted scenes of violence and bodily injury. Images were viewed either under neutral conditions or paired with contextual information.

Results: Two experiments revealed a significant increase in memory intrusions for images paired with contextual information in comparison to the same images viewed under neutral conditions. In contrast to the observed increase in intrusion frequency there was no effect of contextual representations on voluntary memory for the images. The vividness and emotionality of memory intrusions were also unaffected.

Limitations: The analogue trauma paradigm may fail to replicate the effect of extreme stress on encoding postulated to occur during PTSD.

Conclusions: These findings question the assertion that intrusive memories develop from a lack of integration between sensory-based and contextual representations in memory. Instead it is argued contextual representations play a causal role in increasing the frequency of intrusions by increasing the sensitivity of memory to involuntary retrieval by associated internal and external cues.

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1. Introduction

Intrusive memories appear to enter consciousness via a spontaneous and involuntary process in contrast to memories that result from deliberate and voluntary recollection (Brewin & Saunders, 2001; Davies & Clark, 1998). Such intrusions feature as part of both pathological conditions such as post-traumatic stress disorder (van der Kolk & Fisman, 1995) and during healthy autobiographical memory (Bernsten, 2007). Many contemporary explanations for intrusive recollections have tended to draw a distinction between the encoding of sensory-based data from experienced events and the formation of more abstract conceptual representations. In the dual-representation theory of post-traumatic stress disorder (PTSD) proposed by Brewin, Dalgleish, and Joseph (1996)

experienced events are encoded by two parallel memory systems: Situationally Accessible Memory (SAM) and Verbally Accessible Memory (VAM). The SAM system contains detailed sensory and perceptual information that can be involuntarily triggered by matching internal or external cues, particularly when the cues match low-level sensory features of the stored representations. In contrast, VAMs result from the conscious conceptual processing of an event and consist of abstract declarative representations that support the integration of information within autobiographical memory. Brewin, Gregory, Lipton, and Burgess (2010) have recently revised and expanded the original dual-representation theory in order to place it within the context of a neurobiological model of healthy memory and imagery proposed by Byrne, Becker, and Burgess (2007). VAMs are updated within a broader classification of abstract *contextualized representations* (C-reps) and SAMs are included as part of inflexible *sensory-bound representations* (S-reps). Involuntary recollections are argued to primarily result from activation within the S-rep system, particularly under circumstances in which the parallel formation of related

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C-reps during encoding of an event into memory becomes impaired. A similar distinction between sensory-based and conceptual representations in memory also forms part of a cognitive model of intrusive memories in PTSD proposed by Ehlers and Clark (2000), in which persistent involuntary recollections are a consequence of heightened perceptual priming and poor contextualisation within autobiographical memory. In dual-representation accounts of PTSD intrusive memories are seen to arise as a consequence of abnormal *peri-traumatic processing*; i.e., information processing that occurs as the trauma is experienced. Such accounts predict that extreme emotional reaction to traumatic events produces a shift from conceptual processing towards more sensory-perceptual processing that increases intrusion frequency (Bourne, Frasquilho, Roth, & Holmes, 2010).

A major conclusion drawn from dual-representation accounts of PTSD is the belief that events which give rise to intrusive memories are encoded in a radically different manner to the encoding process which underlies voluntary memory. However, a different perspective on involuntary recall has been proposed by the cognitive literature on autobiographical memory. Diary-based studies have suggested that involuntary memories are a frequent consequence of normal autobiographical recollection (Bernsten, 2009; Rubin & Bernsten, 2009). Bernsten (2010, 2009) has argued that involuntary memory represents a basic mode of remembering that operates using the same episodic memory system as voluntary memory. The encoding and maintenance of both types of memory are therefore judged to be the same, with only the processes that occur during retrieval distinguishing the experience of involuntary and voluntary recollection. Mace (2007) has proposed that involuntary recollection can occur in two distinct ways (Mace, Clevinger, & Martin, 2010); either by recollection of a single involuntary memory following cueing by a related sensory or abstract experience, or by a process described as “chained involuntary remembering”, in which the direct cueing of one involuntary memory automatically triggers the involuntary recollection of another. Mace et al. (2010) have claimed that such chained involuntary remembering can account for up to 15% of naturally occurring involuntary memories. Drawing from the cognitive findings on involuntary recollection Rubin, Bernsten, and Bohni (2008) have proposed a memory-based model of PTSD in which the *current* memory for a negative event, rather than the encoding of the original event itself, determines the experience of post-traumatic symptoms. This memory-based model emphasises the dynamic and reconstructive nature of autobiographical memory in relation to the development and maintenance of PTSD. The development of PTSD following trauma is viewed as arising from an interaction between characteristics of the traumatic event and the cognitive processes involved in remembering it. A key feature of the memory-based model that distinguishes it from dual-representation accounts is that trauma memories are judged not to be fixed during encoding but instead change over time as a result of individuals' goals and current concerns (e.g., Conway, 2005; Conway & Pleydell-Pearce, 2000). The model predicts that increased availability of explicit memory for the trauma is linked to PTSD symptoms rather than a peri-traumatic shift in encoding from conceptual to sensory-perceptual processing.

A specific prediction made by clinical dual-representation models is that the presence of abstract contextualized representations in memory should help to actively reduce the incidence of involuntary recollections for traumatic and emotional material. Evidence in support of this has been provided by experimental studies that examine the frequency of memory intrusions in non-clinical samples using a ‘trauma film paradigm’ (Holmes & Bourne, 2008; Krans, Näring, Becker, & Holmes, 2009). For example, it has been shown that asking participants to perform

a concurrent verbal task (backwards counting) while watching a trauma film depicting road accident footage significantly increases the frequency of reported intrusions in comparison to a control group (Bourne et al., 2010; Holmes, Brewin, & Hennessey, 2004). These results have been interpreted as demonstrating that verbal interference disrupts conceptual processing of the film's meaning, which in turn places greater emphasis on the encoding of perceptual sensory-based information into memory. However, conflicting findings have been reported by Krans, Näring, and Becker (2009) and Pearson and Sawyer (2011) who found that concurrent verbal tasks significantly *decreased* rather than increased the frequency of intrusions for emotive material. Existing experimental findings in the literature are therefore inconclusive regarding the role played by peri-traumatic contextual processing in intrusive memories.

A good test of the dual-representation account would be to manipulate abstract contextual information for an event independently of encoded sensory information. However, the traditional trauma film paradigm is limited in the scope it offers for this type of manipulation. The majority of studies reported in the literature create trauma films by using pre-existing material taken from films, documentaries, and news reports (Holmes & Bourne, 2008). This type of material can introduce potentially confounding factors such as lack of realism, or significant differences in dramatization and narrative coherence (Weidmann, Conradi, Groger, Fehm, & Fydrich, 2009). Trauma films also frequently include audio commentaries and soundtracks that present contextual information to participants in a very explicit and artificial manner. For example, a film originally compiled by Steil (1996) commonly used in the analogue trauma literature consists of scenes of road traffic accidents preceded by audio descriptions that provide context for each scene (Bourne et al., 2010; Holmes & Bourne, 2008). The finding that concurrent verbal tasks increase the frequency of intrusive memories for trauma films may result from interference with comprehension of such narrative elements of the film's soundtrack rather than conceptual processing of the visual scenes themselves (Pearson & Sawyer, 2011). The use of dual-task methodology also imposes an overall attentional load during encoding that can make independent manipulation of contextual and sensory-based information difficult to assess (Krans, Näring, & Becker, 2009; Krans, Näring, Becker, et al., 2009; Krans, Näring, Holmes, et al., 2009).

The objective of the present study was to examine the impact on intrusion frequency of manipulating contextual information independently from the visual sensory information encoded by participants. This was accomplished using a paradigm based on presenting images selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1997). The IAPS provides a set of normative emotional visual stimuli that are widely used in research on emotion and cognition, and have been shown by previous studies to be effective in provoking involuntary recollections when presented to a non-clinical sample of participants (Bywaters, Andrade, & Turpin, 2004; Hall & Bernsten, 2008; Pearson & Sawyer, 2011). IAPS images confer a number of advantages as experimental stimuli in comparison to using trauma films. Photographs are able to support a greater range of subjective interpretation than motion pictures (Berger, 2002), and can also be readily presented without an audio commentary or soundtrack that might artificially distort a participant's subjective appraisal of what a stimulus represents (Pearson & Sawyer, 2011). The normative emotional data available for IAPS images also greatly exceeds that typically available for trauma films, and allows for different sets of images with matched valence levels to be created. Another limitation of the trauma film paradigm is that participants' only view a film once, thereby often forcing a reliance on between-participant comparisons. A repeated measures design has been reported by

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