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Direct and generative retrieval of autobiographical memories: The roles of visual imagery and executive processes

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ABSTRACT

Two experiments used a dual task methodology to investigate the role of visual imagery and executive resources in the retrieval of specific autobiographical memories. In Experiment 1, dynamic visual noise led to a reduction in the number of specific memories retrieved in response to both high and low imageability cues, but did not affect retrieval times. In Experiment 2, irrelevant pictures reduced the number of specific memories but only in response to low imageability cues. Irrelevant pictures also increased response times to both high and low imageability cues. The findings are in line with previous work suggesting that disrupting executive resources may impair generative, but not direct, retrieval of autobiographical memories. In contrast, visual distractor tasks appear to impair access to specific autobiographical memories via both the direct and generative retrieval routes, thereby highlighting the potential role of visual imagery in both pathways.

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1. Introduction

Autobiographical memory contains “facts and events that have been interpreted and integrated into a consistent story about one’s self” (Buckner & Fivush, 1998, p.407). According to Conway and Pleydell-Pearce (2000), autobiographical memories are organised hierarchically and can be retrieved at different levels of specificity. For instance, memories can relate to personal semantic information (e.g., references to “my family”) or general events, which comprise repeated experiences (e.g., when I go to the hairdressers: categic memory) or events lasting longer than one day (e.g., a holiday in Spain: extended memory). Alternatively, one can remember a specific event that happened on one particular day (e.g., a day-trip to the zoo). These specific memories are thought to be particularly useful because they serve as analogies when planning and problem-solving (e.g. Williams et al., 2006). The ability to retrieve specific memories also acts as a protective factor against mood disorders such as depression (Williams et al., 2007) and dysphoria (Anderson, Goddard, & Powell, 2010).

According to Conway and Pleydell-Pearce’s (2000) hierarchical model, specific autobiographical memories can be retrieved through two mechanisms. Generative retrieval involves a controlled and effortful memory construction, beginning with more abstract personal semantic information, moving through to general memories and, finally, to event specific knowledge. In contrast, direct retrieval is a non-effortful process involving spontaneous activation of event specific knowledge. Support for this distinction comes from findings that the manner in which autobiographical memories are retrieved depends on the nature of the retrieval cues. For example, Addis, Knapp, Roberts, and Schacter (2012) found that participants

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relied mainly on generative retrieval when asked to retrieve autobiographical memories in response to generic verbal cues. However, when the cues were personalised to match specific autobiographical memories collected in a pre-test, participants were more likely to exhibit direct retrieval. Addis et al. also found differences in neural activity in response to generic and personalised cues, whereby generic cues recruited brain regions associated with search processes and the retrieval of generic autobiographical information.

A defining characteristic of specific autobiographical memories is the presence of sensory-perceptual details, usually in the form of visual images. For example, using an image generation task, Conway (1988) found that autobiographical memories were rated as more vivid than semantic facts. More recently, Rubin, Schrauf, and Greenberg (2003) found that ratings of visual imagery were the strongest predictor of the sense of *reliving* an AM. In a behavioural study, Kavanagh, Freese, Andrade, and May (2001) demonstrated that concurrent eye movements reduce the vividness and emotionality of emotionally negative memories. Damage to brain regions involved in the processing of visual imagery has also been shown to impair autobiographical memory retrieval (Conway & Fthenaki, 2000; Greenberg & Rubin, 2003). More generally, in the source monitoring framework (see Johnson, Hashtroudi, & Lindsay, 1993), the presence of perceptual detail is one of the cues that allows an individual to distinguish real from imagined events.

The role of visual imagery in autobiographical memory is further illustrated by findings that the imageability of retrieval cues influences the manner in which autobiographical memories are retrieved. For instance, Williams, Healy, and Ellis (1999) found that high imageability cues led to faster retrieval and more specific memories than low imageability cues or cues related to other sensory modalities. They concluded from this that high imageability cues facilitate the direct retrieval route by automatically activating multimodal representations of past events. In contrast, low imageability cues do not activate such representations and instead lead to a generative and effortful search. More recently, Uzer, Lee, and Brown (2012) found that object cues (e.g., *pencil, radio*) were associated with faster retrieval times than emotion cues (e.g., *bored, happy*). Based on findings from three experiments, Uzer et al. concluded that direct retrieval is faster than generative retrieval and that object cues are more likely than emotion cues to initiate direct retrieval.

The studies discussed above suggest that high imageability and low imageability cues elicit direct and generative retrieval, respectively. However, if sensory-perceptual information is a key feature of specific memories then it is likely that such memories will feature visual imagery regardless of how they are retrieved. For instance, when abstract or non-visual cues evoke a generative search, a key part of this process may be the effortful generation of visual images that subsequently form part of a specific memory. The current studies aim to explicitly test the assertion that visual imagery plays an important role within both direct and generative retrieval of specific autobiographical memories. In the two experiments reported below, we investigated the role of visual working memory (Baddeley & Hitch, 1974; Logie, 1995) on the direct and generative retrieval of specific autobiographical memories. In order to achieve this, we used a dual task paradigm in which participants retrieved autobiographical memories either with full attention or whilst completing a secondary task chosen to recruit imagery-based processes.

Two previous studies have used a dual task paradigm to investigate the relationship between working memory and the retrieval of specific autobiographical memories. Williams et al. (2006) found that retrieval of specific memories was impaired by a concurrent task of random button pressing when cues were low imageability, but not when cues were high imageability. More recently, Anderson, Dewhurst, and Nash (2012) found similar interference effects using the concurrent task of random number generation (RNG). In terms of the hierarchical model of autobiographical memory proposed by Conway and Pleydell-Pearce (2000), these findings suggest that concurrent tasks interfere with the generative retrieval but not direct retrieval. However, the tasks used in these studies were ones that typically recruit executive resources. It is impossible to determine whether the effects observed were due to interference with imagery or with more general executive processes. The question addressed in the current studies, therefore, is whether visual working memory processes are important for the retrieval of specific autobiographical memories via both direct and generative retrieval pathways. Akin to previous research (Anderson et al., 2012; Williams et al., 2006), we used a dual task paradigm that required participants to retrieve specific autobiographical memories in response to high imageability and low imageability word cues whilst performing a secondary task. However, in contrast to the previous dual task studies, we used secondary tasks known to interfere with visual working memory processes; irrelevant pictures and dynamic visual noise (DVN).

The irrelevant pictures task was developed by Logie (1986) and involves the presentation of line drawings of common objects. Logie found that the concurrent presentation of such drawings interfered with the use of a visual mnemonic to learn lists of concrete words. Based on these findings, Logie proposed that pictures have obligatory access to the visual-spatial sketchpad component of working memory and interfere with performance in a manner analogous to the interference of verbal processes by irrelevant speech (Salame & Baddeley, 1982). A problem acknowledged by Logie, however, was that irrelevant pictures may also interfere with executive processes. In order to overcome this problem, Quinn and McConnell (1996) developed DVN as a purely visual interference task. DVN consists of an array of small black and white squares that randomly switch colour over time. Previous research has shown that DVN interferes with tasks that involve the generation and manipulation of visual images, such as use of visual mnemonics (Quinn & McConnell) and memory for visual textures that cannot be verbally recoded (Dean, Dewhurst, & Whittaker, 2008). The claim that DVN interferes selectively with visual processes, rather than executive processes, was also supported by the findings of Dean, Dewhurst, Morris, and Whittaker (2005) that DVN interfered with symbolic distance judgements involving visual comparisons, such as animal size, but not judgements involving semantic comparisons, such as animal ferocity or the relative “goodness” of words (see Friedman, 1978).

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