

Comparing effects of perceptual and reflective repetition on subjective experience during later recognition memory

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Abstract

Using the Remember/Know procedure, we compared the impact of a reflective repetition by refreshing (i.e., briefly thinking of a just-seen item) and a perceptual repetition (i.e., seeing an item again) on subjective experience during recognition memory. Participants read aloud words as they appeared on a screen. Critical words were presented once (read condition), immediately repeated (repeat condition), or followed by a dot signalling the participants to think of and say the just-previous word (refresh condition). In Experiments 1 and 2, Remember responses benefited from refreshing a word (in comparison with reading it). In Experiment 2, this benefit disappeared when participants had to refresh one of three active items. Perceptual repetition increased Remember responses in Experiment 1, but not in Experiment 2 regardless of whether participants had just previously seen 1- or 3-items. These findings indicate that under some circumstances, reflective and perceptual repetition may have different consequences for later subjective experience during remembering, suggesting differences in their underlying functional mechanisms.

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1. Introduction

Many studies (including the classic work of Ebbinghaus, 1885/1964) show that long-term memory often benefits from repetition. We investigated the nature of the long-term memory benefit from a single repetition of two types—perceptual repetition (perceiving an item again immediately) or reflective repetition (perceiving an item and then mentally thinking of it immediately in its absence). These simple acts of briefly looking again

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at something or immediately thinking of it are interesting because they constitute basic perceptual and reflective attentional processes that contribute to conscious experience. We asked what are the relative effects on long-term memory, especially subjective experience during remembering, of a perceptual repetition vs. a reflective repetition?

This question may be addressed in the framework of the Multiple-Entry, Modular Memory framework (MEM) proposed by Johnson and colleagues (e.g., Johnson, 1992; Johnson, Reeder, Raye, & Mitchell, 2002). MEM is a process-oriented model that distinguishes between perceptual component processes and reflective component processes of cognition. Perceptual processes act in response to external stimuli whereas reflective processes allow one to mentally maintain, revive, or act on the products of prior perception or thought. Reflective processes can be thought of as a part of the executive function of working memory (e.g., Baddeley & Hitch, 1974) in that some are recruited to manipulate and organize active information. One of the simplest reflective processes is *refreshing*, that is, thinking of an item that was just perceived and whose representation is still active. It serves to foreground a representation against a background of other active representations, thus making the item a focus of reflective attention (Raye, Mitchell, Reeder, Greene, & Johnson, in press; see also Cowan, 1999) just as selective perceptual attention to a visual display can foreground one of several external stimuli (e.g., Desimone & Duncan, 1995). Refreshing can be considered as an instance of repetition in that the item is processed twice (e.g., the first time perceptually, the second time reflectively); the second processing of the item occurs when the item is not externally present. It can be distinguished from other types of reflective repetition such as rehearsal of active information in a cyclic manner over several seconds, or reactivating information that is no longer active. It can also be distinguished from generation, in which an item is mentally generated in response to a cue but has not just been previously perceived or thought. Ranganath, Cohen, and Brozinsky (2005) proposed that refreshing may operate during the initial stage of working memory maintenance and contribute to successful long-term memory formation over and above processing that occurs later in the memory delay. Thus, one possibility is that refreshing helps transform a temporary perceptual representation in iconic memory into a stable working memory representation that can be maintained for a longer period. Here we investigate whether a reflective act as simple as refreshing contributes to the conscious experience of remembering on a later occasion and whether its effects are comparable to or different from seeing an item again.

Johnson and colleagues (e.g., Johnson et al., 2005) have investigated refreshing by cueing participants to immediately think of an item they just perceived. For example, in one study (Johnson et al., 2002), participants read aloud unrelated words presented one after another on a computer screen. Critical words were presented once (*read* condition), immediately repeated (*repeat* condition), or followed by a dot signalling the participants to think of the just-previous word and to say it again (*refresh* condition). Verbal response times were compared across conditions. This first phase was followed by a surprise recognition memory test in which previously presented words were randomly mixed with new words. In this study and others using a similar experimental procedure, participants typically show a long-term recognition memory benefit for refreshed items relative to read items (Grillon et al., 2005; Johnson, Mitchell, Raye, & Greene, 2004; Johnson, Raye, Mitchell, Greene, & Anderson, 2003; Johnson et al., 2005, 2002; Raye, Johnson, Mitchell, Greene, & Johnson, 2007; Raye, Johnson, Mitchell, Reeder, & Greene, 2002) and repeated items (Johnson et al., 2002; Raye et al., 2002). They also typically show a recognition benefit from perceptual repetition of an item (*repeat* condition compared to items read once) (Grillon et al., 2005; Johnson et al., 2004, 2005, 2002; Raye et al., 2002; but see Johnson et al., 2003). None of these studies (with the exception of Grillon et al., 2005, discussed below) assessed the subjective experience of the participants during long-term recognition; rather, they focused on recognition accuracy.

Recognition memory sometimes involves the experience of consciously recollecting details of a particular event and sometimes involves only a feeling of familiarity (e.g., Gardiner, 1988; Johnson, Hashtroudi, & Lindsay, 1993; Mandler, 1980; Tulving, 1985). Tulving (1985) proposed the Remember–Know procedure to investigate this difference in subjective experience. Participants are asked to make a Remember response if recognition is accompanied by the conscious recollection of some specific feature of the item's presentation (where it was, what they thought, etc.) and a Know response if recognition is associated with feelings of familiarity in the absence of conscious recollection of the item's presentation.

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