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Quality trumps quantity at reducing memory errors: Implications for retrieval monitoring and mirror effects

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ABSTRACT

Memories have qualitative properties (e.g., the different kinds of features or details that can be retrieved) and quantitative properties (e.g., the frequency and/or strength of retrieval). Here we investigated the relative contribution of these two properties to the retrieval monitoring process. Participants studied a list of words, and memory for these words was enhanced either by studying an associated picture or by word repetition. Subsequent memory tests required participants to selectively monitor retrieval for these different kinds of stimuli. Compared to words that were studied only once, test words associated with either pictures or repetitions were more likely to be correctly recognized, but critically, false recognition was reduced only when monitoring memory for picture recollections. Subjective judgments and speeded tests indicated that study repetition increased the number of test words that elicited recollection and familiarity (a quantitative difference), but studying pictures maximized the recollection of unique or distinctive details (a qualitative difference). These results indicate that memory quality is more critical than quantity for retrieval monitoring accuracy.

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Introduction

In a seminal review, Koriat, Goldsmith, and Pansky (2000) drew a distinction between quantity-oriented and quality-oriented approaches to understanding memory. Quantity-oriented approaches are concerned with factors that affect the amount of remembered information, whereas quality-oriented approaches are concerned with factors that affect the accuracy of remembered information. They further argued that research on memory accuracy and distortion in the late 20th century represented a historical shift from quantity to quality-oriented approaches, and that metacognitive monitoring processes should play a central role in quality-oriented approaches.

Metacognitive monitoring processes are involved in consciously controlled aspects of memory reconstruction, such as selecting the appropriate retrieval strategies and decision criteria.

Along these lines, a goal of recent research has been to understand the role that monitoring processes play in avoiding false memory effects at retrieval (Gallo, 2010; Mitchell & Johnson, 2009). Much of this research has focused on false recognition, or the incorrect acceptance of nontarget information on a recognition memory test. A major challenge has been to explain why some encoding manipulations on target information reduce the size of false recognition effects, even though the items that are used to measure false recognition effects (lures) are not themselves encoded in the same way as the target information. As described below, both quantitative and qualitative approaches have been used to explain these sorts of effects, but there has been little attempt to directly compare the potential contributions of both quantitative factors and qualitative factors to the retrieval monitoring process.

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Quantitative factors

Signal detection models of recognition memory are a classic example of theories that emphasize quantitative factors. These models assume that memories can be mapped along a single continuum at retrieval, which is often described as memory strength or familiarity (Lockhart & Murdock, 1970). In these theories the main role of monitoring or decision processes is to set a response criterion along the retrieval continuum. More recently, multi-dimensional signal detection theories have been developed to allow for qualitative differences in memory retrieval (Banks, 2000; Rotello, Macmillan, & Reder, 2004; see also Wixted & Mickes, 2010). However, exactly how qualitatively different types of retrieved information are combined in a memory decision has not been extensively investigated within this approach, and most applications of signal detection models tend to be restricted to situations where a single continuum of retrieval strength may provide an adequate description (e.g., recognition memory for word lists, cf. Wixted, 2007). This theoretical framework has primarily been used to advance a quantitative approach to understanding memory.

With respect to false recognition effects, a quantitative approach has been extensively applied to the mirror effect (Glanzer & Adams, 1985; Greene, 2007), or the finding that some encoding manipulations simultaneously increase the correct recognition of targets (hits) and decrease the false recognition of lures (false alarms). In this context much attention has been paid to strength-based manipulations whereby items receive more study time either through repetition or presentation duration (e.g., Cary & Reder, 2003; Hirshman, 1995; Hockley & Niewiadomski, 2007; Kim & Glanzer, 1993). For example, Stretch and Wixted (1998) had some participants study a list of items three times and had others study a list of items once. Study repetition not only increased hits to repeated items, ostensibly by enhancing their memory strength, but also decreased false alarms to nonstudied items in some conditions. The target repetition effect on false alarms was attributed to the use of a more conservative response criterion along the strength continuum at retrieval, corresponding to the quantitative differences in target strength. Such false recognition effects are not always obtained in repetition studies (e.g., Bruno, Higham, & Perfect, 2009; Verde & Rotello, 2007), but the significant effect in some conditions is theoretically important (for recent discussion, see Starns, White, & Ratcliff, 2010). To the extent that these false recognition effects are driven by strength-based criterion shifts, they suggest that quantitative memory differences can affect the retrieval monitoring process.¹

More qualitative approaches also have been applied to mirror effects, in the form of dual process theories. These theories make a qualitative distinction between recollection, or the retrieval of specific details from the study

phase that are associated with a test item, and familiarity, or a decontextualized feeling of oldness towards the test item itself (Mandler, 1980; Yonelinas, 2002). Cary and Reder (2003) analyzed subjective judgments of recollection and familiarity (e.g., Rajaram, 1993; Tulving, 1985) with respect to the strength-based mirror effect. They found that repetition increased recollection judgments for studied items, but decreased familiarity judgments associated with nonstudied items. These findings suggest that participants were less reliant on familiarity when recollection was high, thereby decreasing false recognition (also see Joordens & Hockley, 2000).

Dual process theories make a qualitative distinction between recollection and familiarity, but many applications of dual process theories to false recognition effects focus on quantitative factors. From this perspective, the false recognition portion of the mirror effect may be attributed either to a qualitative shift away from familiarity-based responding and towards recollection-based responding, or to a quantitative shift in one's response criterion along the familiarity dimension. Sometimes it is attributed to both (see Cary & Reder, 2003; Gallo, Weiss, & Schacter, 2004). More generally, dual process theories emphasize the role of recollection in controlling or overriding the influences of familiarity (e.g., Brainerd, Reyna, Wright, & Mojardin, 2003; Hintzman & Curran, 1994; Jacoby, 1991), thereby associating recollection with more accurate retrieval monitoring. These theories tend to focus on the relative level or amount of recollection compared to familiarity (e.g., how many test items elicit the experience of recollection), again emphasizing quantitative differences. Most dual-processes are mute with respect to how the recollection of qualitatively different kinds of details could affect retrieval monitoring accuracy, such as those details originating from different kinds of stimuli or different sources of studied information.

Qualitative factors

Relative to these other frameworks, the source-monitoring framework more heavily emphasizes qualitative memory differences across different types or sources of information (Johnson, Hashtroudi, & Lindsay, 1993). According to this framework, memory decisions often rely on metacognitive expectations. When making these decisions, people rely not only on the quantitative properties of memories (e.g., the frequency and/or strength of retrieval), but also on the qualitative properties of memories that they expect to vary across different sources of information (e.g., the recollection of different kinds of details or features). The extent that different quantitative and qualitative properties will contribute to a memory decision is assumed to depend, in part, on the perceived usefulness of those properties to accurate responding (Bink, Marsh, & Hicks, 1999). Within this framework, retrieval monitoring involves the selecting of memory sources (or dimensions) that may be appropriate for a decision, and the setting of corresponding decision criteria along each of these dimensions.

With respect to false recognition effects, this more qualitative approach has been extensively applied in the

¹ Study repetitions also can reduce false recognition in list-based exclusion tasks (Jacoby, 1999), but these effects may be due to the use of a recall-to-reject process that is qualitatively different than the criterion-setting processes of interest in the present paper (i.e., disqualifying vs. diagnostic monitoring, see Gallo, 2010).

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