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On the relationship between repetition priming and recognition memory: Insights from a computational model ☆

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Abstract

A single-system model of repetition priming and recognition memory is presented, which is conceptually similar to signal-detection theory. Key assumptions of the model are (a) that the same memory source contributes to both priming and recognition performance and (b) that variance of the noise associated with priming measures is greater than recognition. To test the model, four experiments were conducted examining the effects of a manipulation of attention at study on priming and recognition performance. The model predicted that (1) effects of attention will be observed on priming and recognition, albeit larger for recognition, (2) the magnitude of priming will not exceed recognition in any condition, and (3) priming and recognition performance will be weakly correlated. Predictions (1) and (2) were confirmed by the experiments, and some evidence for (3) was obtained, providing support for the model.

Keywords: Repetition priming; Recognition; Attention; Implicit; Computational model

Introduction

The relationship between repetition priming and recognition memory has played an important role in the development of theories of memory. Repetition priming refers to a change in identification, detection or production of an item (e.g., a word) as a result of prior exposure to the same or a similar item. For example, in a perceptual identification task, items are presented extremely briefly and priming can be shown if a greater proportion of old (previously studied) items are identified relative to new (non-studied) items (e.g., Jacoby & Dallas, 1981). Priming is often compared with performance in recognition tasks in which participants attempt to discriminate between old and new items.

An influential view is that priming and recognition are mediated by functionally independent and neurally distinct implicit/procedural and explicit/declarative memory systems respectively (Gabrieli, 1998; Squire, 1994). Consistent with this view, many dissociations between priming and recognition have been reported. For example, priming can be spared in amnesic individuals despite severely impaired recognition performance relative to normal adults (e.g., Graf, Squire, & Mandler, 1984; Hamann & Squire, 1997a, 1997b). The reciprocal dissociation of intact recognition memory and impaired priming has also been reported in

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individuals with occipital lobe damage (Gabrieli, Fleischman, Keane, Reminger, & Morrell, 1995; Keane, Gabrieli, Mapstone, Johnson, & Corkin, 1995), constituting a double dissociation between priming and recognition in these individuals and amnesics. Furthermore, functional dissociations have also been reported in controls, for example, deeper levels of processing of study items can effect recognition memory but have little or no effect on priming (e.g., Jacoby & Dallas, 1981; for reviews see Richardson-Klavehn & Bjork, 1988; Roediger & McDermott, 1993).

Contrary to the multiple-systems view, single-system accounts of priming and recognition explain dissociations such as these in terms of the unique ways in which different memory tasks make demands on a common underlying system (Buchner & Wippich, 2000; Kinder & Shanks, 2001, 2003; Shanks & Perruchet, 2002). For example the simple recurrent network (SRN) model, a single-system connectionist model of priming and recognition (Kinder & Shanks, 2001, 2003), has been shown to account for the double dissociation shown in amnesics and occipital-lobe-damaged individuals. Kinder and Shanks (2003) assumed that amnesics have a generalised learning deficit and that occipital lobe damaged individuals have a deficit of visual processing. The presentation of items in the perceptual identification task was simulated by inputting them to the SRN in degraded form relative to recognition. A double dissociation emerged from the SRN through the way that these factors interacted with the encoded memory representation. Similarly, in normal adults, other single-system models have been successful in accounting for functional dissociations (see Shanks, 2005; Shanks & Perruchet, 2002; Shanks, Wilkinson, & Channon, 2003; Zaki, Nosofsky, Jessup, & Unverzagt, 2003).

In this article, we add to the single-system account of priming and recognition by considering whether the effects of an attentional manipulation at study on priming and recognition can be accounted for by a single-system computational model. In the past, manipulations of attention at study have produced patterns of priming and recognition performance that may be challenging for a single-system account and we now briefly review some of this evidence.

Effects of attention on priming and recognition

Recognition performance for less-attended study items is typically impaired compared to attended items. For example, if participants must perform a concurrent task during the study phase, if attention is diverted away from a target to a different spatial location, or if working memory is loaded during the study phase, then recognition performance is typically impaired relative to non-divided attention conditions. The evidence regarding the influence that attentional manipulations at study have on priming, however, is mixed. Some studies have dissociated priming and recognition with attentional manipulations, finding effects on recognition but none on priming (Jacoby, Woloshyn, & Kelley, 1989; Kellogg, Newcombe, Kammer, & Schmitt, 1996; Mulligan & Hartman, 1996; Parkin, Reid, & Russo, 1990; Parkin & Russo, 1990; Russo & Parkin, 1993; Schmitter-Edgecombe, 1996a, 1996b; Szymanski & MacLeod, 1996; Wolters & Prinsen, 1997). Many of these studies have used dual-task manipulations at study (see below). In contrast, studies that have found effects on priming (Bentin, Moscovitch, & Nirhod, 1998; Berry, Shanks, & Henson, 2006; Crabb & Dark, 1999; Crabb & Dark, 2003; Eich, 1984; Hawley & Johnston, 1991; Johnston & Dark, 1985; MacDonald & MacLeod, 1998; Mulligan, 2002, 2003; Phaf, Mul, & Wolters, 1994; Rajaram, Srinivas, & Travers, 2001; Stone, Ladd, Vaidya, & Gabrieli, 1998; Stone, Ladd, & Gabrieli, 2000) often use selective attention manipulations at study. But despite this inconsistency, it is fairly clear that attentional effects are weaker on priming than on recognition.

Considering dual-task manipulations, Parkin et al. (1990), for example, required participants to carry out a sentence verification task (decide whether visually presented sentences made sense) under full- or divided-attention conditions at study. In the full attention condition, participants simply carried out the verification task. In the divided attention condition, participants carried out the verification task but also monitored a series of tones, occurring randomly every 3–7 s, and indicated for each one whether it was high, medium or low in pitch. Recognition performance was impaired by the manipulation, whereas priming in a word-fragment completion task was significant and unaffected by the study manipulation. This dissociation was interpreted by Parkin et al. (1990) within the implicit-explicit memory distinction to suggest that priming (a form of implicit memory) does not depend on attention at encoding, but recognition (a form of explicit memory) does. Similar conclusions from dissociations such as this have been drawn by other researchers (e.g., Kellogg et al., 1996; Parkin & Russo, 1990; Szymanski & MacLeod, 1996; Wolters & Prinsen, 1997).

This finding is typical of studies that manipulate attention at study by requiring participants to perform some concurrent task (e.g., tone-monitoring, digit-monitoring, performing addition sums, or maintaining a string of digits in working memory). Under these types of study conditions, priming has been found to be unaffected relative to full-attention conditions as measured in perceptual priming tasks such as word-fragment-completion (Mulligan, 1998; Mulligan & Hartman, 1996),