Journal of Memory and Language 68 (2013) 39–53

Contents lists available at SciVerse ScienceDirect

Journal of Memory and Language

journal homepage: www.elsevier.com/locate/jml

The critical role of retrieval processes in release from proactive interference

Karl-Heinz T. Bäuml *, Oliver Kliegl

Department of Experimental Psychology, Regensburg University, 93040 Regensburg, Germany

ARTICLE INFO

Article history:
Received 14 February 2012
revision received 18 June 2012
Available online 7 September 2012

Keywords:
Interference
Directed forgetting
Context change
Interpolated testing
Latency

ABSTRACT

Proactive interference (PI) refers to the finding that memory for recently studied (target) information can be vastly impaired by the previous study of other (nontarget) information. PI can be reduced in a number of ways, for instance, by directed forgetting of the prior nontarget information, the testing of the prior nontarget information, or an internal context change before study of the target information. Here we report the results of four experiments, in which we demonstrate that all three forms of release from PI are accompanied by a decrease in participants' response latencies. Because response latency is a sensitive index of the size of participants' mental search set, the results suggest that release from PI can reflect more focused memory search, with the previously studied nontarget items being largely eliminated from the search process. Our results thus provide direct evidence for a critical role of retrieval processes in PI release.

Introduction

Proactive interference (PI) refers to the finding that memory for recently studied information can be vastly impaired by the previous study of further information (e.g., Underwood, 1957). In a typical PI experiment, participants study a (target) list of items and are later tested on it. In the PI condition, participants study further (nontarget) lists that precede encoding of the target information, whereas in the no-PI condition participants engage in an unrelated distractor task. Typically, recall of the target list is worse in the PI condition than the no-PI condition, which reflects the PI finding. PI has been extensively studied in the past century, has proven to be a very robust finding, and has been suggested to be one of the major causes of forgetting in everyday life (e.g., Underwood, 1957; for reviews, see Anderson & Neely, 1996; Crowder, 1976).

Over the years, a number of theories have been put forward to account for PI, most of them suggesting a critical role of retrieval processes in this form of forgetting. For instance, temporal discrimination theory suggests that buildup of PI is caused by a failure to distinguish items from the most recent target list from items that appeared on the earlier nontarget lists. Specifically, the theory assumes that at test participants are unable to restrict their memory search to the target list and instead search the entire set of items that have previously been exposed (Baddeley, 1990; Crowder, 1976; Wixted & Rohrer, 1993). Another retrieval account attributes PI to a generation failure. Here, reduced recall levels of the target items are thought to be due to the impaired ability to access the material's correct memory representation (Dillon & Thomas, 1975). In contrast to these retrieval explanations of PI, some theories also suggested a role of encoding factors in PI, assuming that the prior study of other lists impairs subsequent encoding of the target list. For instance, attentional resources may deteriorate across item lists and cause the target material to be less well processed in the presence than the absence of the preceding lists (e.g., Crowder, 1976).

Release from PI

As aggravating PI may be in many situations, experimental results from the past decades have convincingly shown that there are numerous ways in which PI can be reduced. Among these techniques are list-method directed

* Corresponding author. Fax: +49 941 943 3872.
E-mail address: karl-heinz.baeuml@psychologie.uni-regensburg.de (K.-H.T. Bäuml).

0749-596X/$ - see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jml.2012.07.006

forgetting, context change, and interpolated testing. In directed forgetting studies, it has been demonstrated that a cue to forget a previously studied nontarget list can lead to a release from PI and thus to better memory for a subsequently studied target list, relative to a control condition in which participants are asked to remember both lists (e.g., Bjork, 1970, 1989). In context-change studies, it has been shown that an internal context change between the prior study of a nontarget list and the subsequent study of a target list can reduce PI, relative to a control condition without such context change (e.g., Pastötter & Bäuml, 2007; Sahakyan & Kelley, 2002). Studies on interpolated testing have demonstrated that testing previously studied nontarget lists before subsequent encoding of the target list can result in better memory for the target information, relative to a control condition without such testing of the prior information (e.g., Szpunar, McDermott, & Roediger, 2008; Tulving & Watkins, 1974; for further demonstrations of PI release, see Jacoby, Wahlheim, Rhodes, Daniels, & Rogers, 2010; Wixted & Rohrer, 1993).

For each of the three techniques – directed forgetting, context change, and interpolated testing – often retrieval explanations have been put forward to account for the release from PI. Such retrieval explanations center on the view that directed forgetting of nontarget material, a change in internal context between prior nontarget and subsequent target encoding, and the interpolated testing of the prior nontarget material can reduce interference of the prior nontarget information at test and thus improve recall of the target items. Such interference reduction has been suggested to be mediated by inhibitory processes that reduce accessibility of the nontarget items (directed forgetting; e.g., Geiselman, Bjork, & Fishman, 1983), by the induced mismatch between encoding and test context for the nontarget items (directed forgetting; context-dependent forgetting; e.g., Sahakyan & Kelley, 2002), or by enhanced list segregation as caused by the preceding retrieval practice on the nontarget items (interpolated testing; Szpunar et al., 2008).

In contrast, more recent accounts in the three paradigms have favored encoding explanations of release from PI. These explanations center on the view that each of the techniques improves subsequent encoding of the target list. Such improvement has been suggested to be mediated by a change in people's encoding strategy, with more elaborate encoding of the target list if the nontarget material was intentionally forgotten or subject to a context change (directed forgetting; context change; e.g., Sahakyan & Delaney, 2003, 2005), or by a reset of the encoding process supposed to make the encoding of the later target list as effective as the encoding of earlier nontarget lists; such reset processes have been suggested to be triggered in response to a forget cue (Pastötter & Bäuml, 2010), a context change (Pastötter, Bäuml, & Hanslmayr, 2008), and interpolated testing (Pastötter, Schicker, Niedernhuber, & Bäuml, 2011).

The possible role of search set size in PI and release from PI

The finding that encoding processes can influence PI release challenges the view of a critical role of retrieval processes in PI release. Indeed, although previous retrieval accounts of PI release have repeatedly argued that PI release may result from reduced interference of the prior nontarget information when the target items are recalled (e.g., Bjork, 1989; Sahakyan & Kelley, 2002; Szpunar et al., 2008), this proposal has never been tested directly. This study comes up with such a test by examining directly whether, with release from PI, participants are able to restrict their memory search to the target list, rather than searching the entire set of target and nontarget items that have previously been exposed. The suggestion that participants' search set size may play a role in release from PI is also motivated by a previous PI study.

In this previous PI study, Wixted and Rohrer (1993) exposed participants to a short target list, with or without prior study of further nontarget lists. As expected, after study of the nontarget lists, PI built up for the most recent list, as reflected in the reduced percentage of correctly recalled items. Analyzing participants' response latencies, the authors additionally found an increase in response latency for the target list when preceding lists were studied. Because response latency is a sensitive index of the size of participants' mental search set (see below), the slowing of the retrieval process points to an increase in participants' search set size when PI arises. This increase was interpreted as evidence that PI builds up as a result of a growing inability to distinguish items that appeared on the target list from items that appeared on the preceding nontarget lists, which supports temporal discrimination theory.

The present study extends Wixted and Rohrer's (1993) prior PI work to release from PI by examining (i) whether retrieval processes play a critical role not only in buildup of PI but also in release from PI, and (ii) whether changes in participants' search set size mediate both build up of PI and release from PI. The first goal of the present study was to replicate Wixted and Rohrer's (1993) finding by showing that response latency of target information increases when PI is built up, suggesting that the size of participants' search set increases with PI. The second goal was to examine whether release from PI is accompanied by a decrease in response latency and thus by a reduction in participants' search set size. Such a pattern of results would indicate that retrieval processes play a critical role in both buildup of PI and release from PI, and that both effects can be mediated through modulations in participants' search set size. We used directed forgetting, interpolated testing, and context change techniques to induce a release from PI. To examine participants' latencies we used response latency analysis.

Response latency analysis

Typically, studies of episodic forgetting focus on response total – i.e., the percentage of recalled items within a certain period of time – as the dependent measure, whereas response latency – i.e., the speed of recall – is ignored. Such proceeding may be justified if the two measures capture largely the same underlying processes. However, there is evidence that response total and response latency do not always covary but rather are independent. For instance, Rohrer and Wixted (1994) demonstrated that a reduction in list length increases response totals and