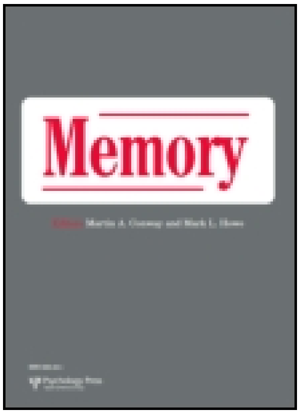


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# Dissociating the two faces of selective memory retrieval

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# Dissociating the two faces of selective memory retrieval

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Research in the past four decades has repeatedly shown that selective retrieval of some (non-target) memories can impair subsequent retrieval of other (target) information, a finding known as retrieval-induced forgetting. More recently, however, there is evidence that selective retrieval can both impair and enhance recall of related memories (K-H. T. Bäuml & Samenieh, 2010). To identify possible experimental dissociations between the detrimental and the beneficial effects of memory retrieval, we examined retrieval dynamics in listwise directed forgetting, varying the delay between preceding non-target and subsequent target recall. When target recall immediately followed non-target recall, we replicated the prior work and found detrimental effects of memory retrieval on to-be-remembered items but beneficial effects on to-be-forgotten items. In contrast, when a delay was introduced between non-target and target recall, the detrimental effects were present but the beneficial effects were absent. The results demonstrate a first experimental dissociation between the two effects of memory retrieval. They are consistent with a recent two-factor account of the two faces of selective memory retrieval.

***Keywords:*** Retrieval; Enhancement; Forgetting; Context; Inhibition.



During the past four decades researchers have repeatedly argued that retrieval is a self-limiting process (Roediger, 1978). This view assumes that selective retrieval of some memories impairs retrieval of related information (for reviews, see Anderson, 2003; Bäuml, Pastötter, & Hanslmayr, 2010; Roediger & Neely, 1982). Evidence for this self-limiting property of memory retrieval has arisen mainly from two experimental paradigms: the output-interference paradigm and the retrieval-practice paradigm. The output-interference paradigm examines how the recall of studied items varies as a function of the items' serial position in the testing sequence. The general result is that an item's recall chances decline with its testing position, suggesting that the preceding recall of other list items can impair recall of target information (e.g., Roediger, 1974; Smith, 1971). In the retrieval-practice paradigm participants study a list of items, practise retrieval of a subset of the items, and then are tested on all originally studied items. The typical result is that, relative to an appropriate control condition, recall of the practised items is enhanced but recall of the unpractised items is impaired, suggesting that repeated retrieval of some list items can impair later recall of the other items (e.g., Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 1995). Since Anderson et al. (1994), the latter finding is termed retrieval-induced forgetting (RIF).

However, as Bäuml and Samenieh (2010) recently showed, selective memory retrieval is not always self-limiting but can also be self-propagating. Using the listwise directed forgetting task (e.g., Bjork, 1970), Bäuml and Samenieh asked participants to study a list of items and then provided the participants with a cue either to

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forget or to continue remembering the previously studied list. After study of a second list, participants' memory for predefined target items from the first list was tested. Testing differed in whether participants were asked to retrieve 0, 4, 8, or 12 of the list's remaining (non-target) items before they recalled the list's target items. The results showed that, as more and more of the non-target items were previously retrieved, target recall decreased linearly in the remember condition but increased linearly in the forget condition, indicating that selective memory retrieval can both impair and improve recall of related memories. Bäuml and Samenieh (2012a) replicated the basic finding and extended it by also demonstrating the self-propagating property of memory retrieval for memories that are subject to context-dependent forgetting (for an extension of the results from selective memory retrieval to part-list cueing, see Bäuml & Samenieh, 2012b).

Bäuml and Samenieh (2012a) suggested a two-factor account to explain why selective memory retrieval is detrimental in some cases but beneficial in others. According to this account, selective memory retrieval generally triggers two processes, inhibition of interfering memories and reactivation of the retrieved items' original encoding context. Which of the two processes dominates in an experimental situation is assumed to depend on whether the to-be-retrieved memories are subject to impaired context access or not. If, at test, the encoding context of the to-be-retrieved memories is still active and the memories still show a high level of activation, not much room is supposed to be left for context reactivation but much room may be left for inhibition; the target items may interfere during preceding retrieval of the non-target items and may get inhibited to make selection of the non-target material easier (e.g., Anderson et al., 1994; Anderson & Spellman, 1995). As a net result, target recall may be impaired. In contrast, if access to the original encoding context is impaired and the activation level of the to-be-retrieved memories is reduced—as, for instance, may be the case in listwise directed forgetting and context-dependent forgetting (e.g., Bjork & Bjork, 1996; Geiselman, Bjork, & Fishman, 1983; Sahakyan & Kelley, 2002)—not much room is supposed to be left for interference and inhibition (e.g., Anderson et al., 1994; Storm, Bjork, & Bjork, 2007) but much room may be left for context reactivation; preceding retrieval of the non-target items may result in reactivation of the retrieved items' encoding context (e.g., Howard & Kahana, 1999, 2002), and this reactivated context may then serve as a retrieval cue for the target items. As a net result, target recall may be enhanced.

The two-factor account of selective memory retrieval suggests that quite different processes underlie the two opposing effects of selective memory retrieval, thus indicating that the beneficial and detrimental effects of memory retrieval should be dissociable from one another. One possible factor dissociating the two faces of memory retrieval might be the delay between preceding non-target and subsequent target recall. By using both the output-interference and the retrieval-practice paradigm, numerous studies have shown that the detrimental effects of memory retrieval are not restricted to cases in which target recall follows non-target recall immediately but generalise to situations in which a delay is introduced between retrieval practice and test; in fact several studies reported robust RIF if retrieval practice and test were separated by a delay of 5 to 20 minutes (e.g., Anderson et al., 1994; Chan, 2009; MacLeod & Macrae, 2001), suggesting that the detrimental effect of memory retrieval lasts for quite a while. In contrast, to date beneficial effects of selective memory retrieval have been demonstrated mainly by using the output-interference paradigm (Bäuml & Samenieh, 2010, in press-a). Because, in this paradigm, target recall immediately follows non-target recall, these results are silent on whether the existence of beneficial effects generalises to situations in which target recall is delayed.

On the basis of the view that the beneficial effects arise because preceding non-target recall reactivates the retrieved items' original encoding context (e.g., Bäuml & Samenieh, 2012a; Howard & Kahana, 2002), the expectation may arise that the beneficial effects will not generalise to situations in which target recall is delayed. Indeed, although reactivation of the retrieved items' original encoding context may make this context a potentially powerful retrieval cue for target recall, the reactivated context cue may be effective only if the retrieval process was not interrupted, for instance, by means of an interpolated distractor task. Such disruption might reduce the context's activation level and thus reduce the cue's effectiveness in reactivating the target items. If so, the beneficial effect of selective retrieval might be present primarily when target recall follows non-target recall immediately, and be reduced, if not eliminated, when target recall is delayed.

The results of an experiment reported designed to examine whether the delay between preceding non-target and subsequent target recall influences the beneficial and detrimental effects of selective memory retrieval differently. We used the retrieval-practice paradigm to examine the effects of selective memory retrieval. To study the effects of selective retrieval both when access to the original encoding context is impaired and when no such impairment arises, we employed the listwise directed forgetting task (e.g., Bäuml & Samenieh, 2010). Participants took part in a three-phase experiment. In the first phase they studied a first list of items, consisting of predefined target and non-target items, then received a cue to either forget or remember the list for an upcoming test, and subsequently studied a second list of items. In the second phase participants either repeatedly retrieved the first list's non-target items, or they completed an unrelated distractor task. In the third phase participants were asked to recall the first list's target items. Participants differed in the delay that separated the second and third phase of the experiment, which was 1 minute or 10 minutes. In addition, a 0-minute delay condition was included to serve as a replication of the prior work.

Following Bäuml and Samenieh (2010, in press-a) we expected that, if target recall immediately followed non-target recall, repeated retrieval of the non-target items would impair target recall in the remember condition but improve target recall in the forget condition. Following the prior work that found the detrimental effects of memory retrieval to be still present after a delay of 5 to 20 minutes between non-target and target recall (e.g., Anderson et al., 1994; MacLeod & Macrae, 2001), we expected impaired target recall across all three delay conditions of the remember condition. Following the two-factor account of selective memory retrieval and the view that preceding non-target recall reactivates the retrieved items' original encoding context in the forget condition (e.g., Bäuml & Samenieh, 2012a; Howard & Kahana, 2002), we expected the beneficial effects to be present with undelayed recall, but to be reduced, or even eliminated, when target recall was delayed.

# METHOD

## Participants

A total of 144 undergraduates participated in the experiment (mean age = 22.65 years, range 19–30 years), all of them speaking German as native language. They took part on a voluntary basis, were tested individually, and received monetary reward for participation.

## Materials

Four study lists (A-D) were constructed, each containing 15 unrelated concrete German nouns (e.g., Bäuml & Samenieh, 2010). Lists A and B were designated to be used as List 1, whereas Lists C and D were designated to be used as List 2. Lists A and B consisted of 5 target and 10 non-target items each. Among all items, each target item began with a unique initial letter and each non-target item had a unique word stem.

## Design

The experiment had a $2 \times 2 \times 3$ mixed factorial design. CUE (remember vs forget) was manipulated within participants, whereas PRIOR SELECTIVE RETRIEVAL (absent vs present) and DELAY (0 min vs 1 min vs 10 min) were varied between participants. In the remember condition List 1 was followed by a cue to remember the list for an upcoming test. In the forget condition List 1 was followed by a cue to forget the list; a software crash was simulated, and participants were told that the wrong data file was opened and the preceding items should be forgotten. Order of conditions as well as assignment of lists to conditions were counterbalanced (e.g., Bäuml & Samenieh, 2010, 2012a). Selective retrieval conditions differed in whether participants were asked to repeatedly retrieve the 10 non-targets during the practice phase, or whether they completed a distractor task instead. Between non-target and target recall participants were either distracted for 0 minute, 1 minute, or 10 minutes.

## Procedure

In the study phase, for each of the two cueing conditions, the items of the two lists were presented individually and in random order for 4 seconds each. After study of the two lists, there was a 30-second backward counting task as a recency control. In the retrieval-practice phase participants either retrieved the first list's non-target items, or they solved arithmetic problems as a distractor task. Each of the non-target items was cued with its word stem to increase recall chances and thus boost possible detrimental or enhancing effects of non-target recall on subsequent target recall. The cues were presented individually and in random order for 6 seconds. Each item was practised twice. Then participants were asked either to immediately recall the first list's target items (0-minute delay condition), or to solve arithmetical problems for 1 minute (1-minute delay condition) respectively complete several distractor tasks (e.g. arithmetical problems) for a period of 10 minutes (10-minute delay condition), before attending the test of the target items. Recall order of target items was controlled through presentation of the items' unique initial letter. The item cues were presented successively and in random order, for 6 seconds each. Responses were given orally. Finally, participants were asked to recall the first list's non-target items. Conditions were identical to the testing of the list's target items with the only difference that the non-target items' unique word stems were provided as retrieval cues. List 2 items were tested as well, but the results are not reported (see Bäuml & Samenieh, 2012a). Participants completed the two cue conditions successively, with a 10-minute break between conditions.

# RESULTS

## Zero-minute delay condition

Non-target recall in the retrieval-practice phase was high and did not vary with cue condition (remember: 86.3%, forget: 82.9%), $t(23) = 1.138$, $p = .267$. Figure 1A shows the results for target recall. A 2 × 2 ANOVA with the within-participants factor of CUE (remember vs forget) and the between-participants factor of PRIOR SELECTIVE RETRIEVAL (absent vs present) revealed a significant interaction between CUE and PRIOR SELECTIVE RETRIEVAL, $F(1, 46) = 51.370$, $MSE = 0.019$, $p < .001$, partial $\eta^2 = .528$; no main effects of CUE, $F(1, 46) < 1$, or PRIOR SELECTIVE RETRIEVAL, $F(1, 46) < 1$, arose. Planned comparisons revealed that, if no prior selective retrieval took place, target recall was higher in the remember condition than in the forget condition (43.3% vs 24.2%), $t(23) = 5.468$, $p < .001$, $d = 1.12$, thus showing the standard directed forgetting effect for the target items. Prior selective retrieval also affected recall rates, although with opposing effects in the two cueing conditions. In the remember condition, prior selective retrieval impaired recall of the target items (43.3% vs 26.7%), $t(46) = 3.325$, $p = .002$, $d = .961$, thus showing RIF, whereas in the forget condition, prior selective retrieval improved recall of the target items (24.2% vs 48.3%), $t(46) = 4.618$, $p < .001$, $d = 1.337$.

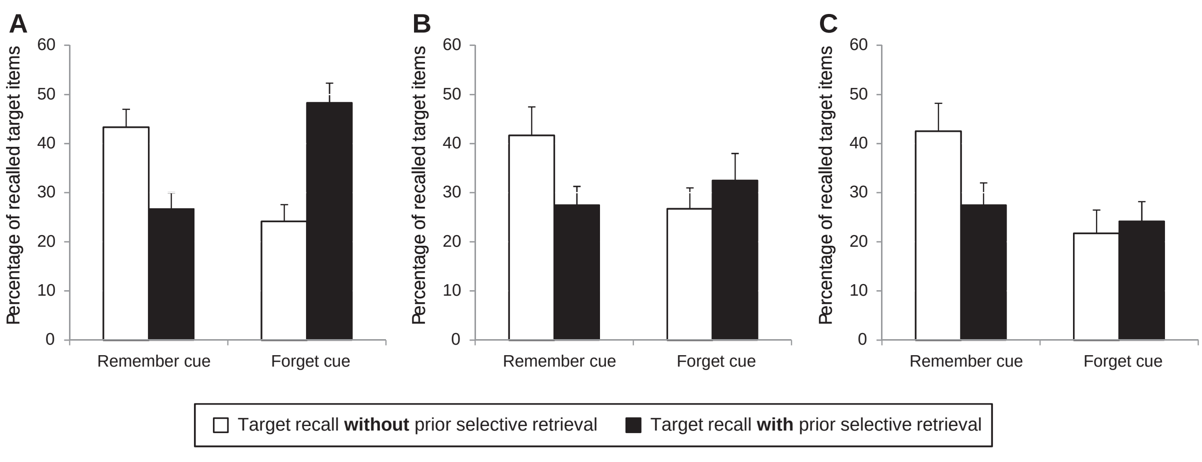


**Figure 1.** Results of the three delay conditions. (A) *0-minute delay condition*: Prior non-target recall impaired memory for to-be-remembered targets, but improved memory for to-be-forgotten targets. (B) *1-minute delay condition*: Prior non-target recall impaired memory for to-be-remembered targets, but left memory for to-be-forgotten targets unaffected. (C) *10-minutes delay condition:* Prior non-target recall impaired memory for to-be-remembered targets, but left memory for to-be-forgotten targets unaffected.

## One-minute delay condition

Non-target recall in the retrieval-practice phase was again high and unaffected by cue condition (remember: 83.3%, forget: 78.8%), $t(23) = 1.44$, $p = .163$. Figure 1B shows the results for target recall. A $2 \times 2$ ANOVA with the within-participants factor of CUE (remember vs forget), and the between-participants factor of PRIOR SELECTIVE RETRIEVAL (absent vs present) showed a significant interaction between the two factors, $F(1,\ 46) = 5.465$, $MSE = 0.044$, $p = .024$, partial $\eta^2 = .106$; no main effects of CUE, $F(1,\ 46) = 1.366$, $MSE = 0.044$, $p = .248$, or PRIOR SELECTIVE RETRIEVAL, $F(1,\ 46) < 1$, were found. Planned comparisons revealed that, if no prior selective retrieval took place, target recall was higher in the remember condition than in the forget condition (41.7% vs 26.7%), $t(23) = 2.584$, $p = .017$, $d = .540$, thus again showing standard directed forgetting. Again, prior selective retrieval affected recall rates differently in the two cueing conditions. In the remember condition, prior selective retrieval impaired recall of the target items, (41.7% vs 27.5%), $t(46) = 2.057$, $p = .046$, $d = .607$, thus showing RIF, whereas in the forget condition, it did not affect target recall (26.7% vs 32.5%), $t(46) < 1$.

## Ten-minute delay condition

Non-target recall in the retrieval-practice phase was again high and did not vary with cue condition (remember: 84.2%, forget: 78.8%), $t(23) = 1.701$, $p = .102$. Figure 1C shows the results for target recall. A $2 \times 2$ ANOVA with the within-participants factor of CUE (remember vs forget) and the between-participants factor of PRIOR SELECTIVE RETRIEVAL (absent vs present) revealed a significant main effect of CUE, $F(1,\ 46) = 8.036$, $MSE = 0.044$, $p = .007$, partial $\eta^2 = .149$, indicating that target recall was higher in the remember than in the forget condition, and a significant interaction between the two factors, $F(1,46) = 4.214$, $MSE = 0.044$, $p = .046$, partial $\eta^2 = .084$; no main effect of PRIOR SELECTIVE RETRIEVAL arose, $F(1,\ 46) = 1.421$, $MSE = 0.066$, $p = .239$. Planned comparisons showed that, if no prior selective retrieval took place, target recall in the remember condition exceeded target recall in the forget condition, (42.5% vs 21.7%), $t(23) = 3.037$, $p = .006$, $d = .623$, thus showing directed forgetting. Once again prior selective retrieval affected recall rates in the two cueing conditions differently. In the remember condition, prior non-target recall impaired recall of the target items, (42.5% vs 27.5%), $t(46) = 2.073$, $p = .044$, $d = .603$, thus showing RIF, whereas in the forget condition it did not affect subsequent target recall (21.7% vs 24.2%), $t(46) < 1$.

The results shown in Figure 1 suggest that the effect of preceding non-target recall on subsequent target recall varied with delay in the forget condition but did not vary with delay in the remember condition. Indeed, whereas target recall impairment was roughly constant across the three delay conditions in the remember condition (0 minute: 16.7%, 1 minute: 14.2%, 10 minutes: 15.0%), target recall improvement strongly decreased with delay in the forget condition (0 minute: 24.2%, 1 minute: 5.8%, 10 minutes: 2.5%). Additional analysis supported the numerical impression. Analysis of variance with the between-participants factor of PRIOR SELECTIVE RETRIEVAL (absent vs present) and the between-participants factor of DELAY (0 minute vs 1 minute vs 10 minutes) revealed a significant interaction between the two factors in the forget condition, $F(2,\ 138) = 3.554$, $MSE = 0.046$, $p = .031$, partial $\eta^2 = .049$\$, but no such interaction in the remember condition, $F(2,\ 138) < 1$, thus indicating that delay influenced the beneficial but not the detrimental effect of selective memory retrieval. The finding of a significant interaction between PRIOR SELECTIVE RETRIEVAL (absent vs present), DELAY (0 minute vs 1 minute and 10 minutes), and CUE (remember vs forget), $F(1,\ 140) = 5.480$, $MSE = 0.036$, $p = .021$, partial $\eta^2 = .038$, supports the indication.

## Further analyses

Prior work on RIF showed that repeated retrieval of the non-target items in the retrieval-practice phase enhances the items' later recall at test (e.g., Anderson et al., 1994). The present results on non-target recall replicate the finding. In both the remember and the forget condition, an ANOVA with the between-participants factor of PRIOR SELECTIVE RETRIEVAL (absent vs present) and the between-participants factor of DELAY (0 minute vs 1 minute vs 10 minutes) revealed main effects of PRIOR SELECTIVE RETRIEVAL—remember: $F(1, 138) = 20.133$, $MSE = 0.016$, $p < .001$, partial $\eta^2 = .127$; forget: $F(1, 138) = 12.369$, $MSE = 0.027$, $p = .001$, partial $\eta^2 = .082$—but no main effects of DELAY—remember: $F(2, 138) = 1.730$, $MSE = 0.016$, $p = .181$; forget: $F(2, 138) = 2.294$, $MSE = 0.027$, $p = .105$—and no interactions between the two factors; $Fs(2, 138) < 1$. The effect of PRIOR SELECTIVE RETRIEVAL did not vary with cue condition (remember: 76.5% vs\ 86.1%, forget: 70.3% vs 79.9%), $F(1, 142) < 1$, suggesting that repeated retrieval of the non-target items improved the items' later recall regardless of delay and cue condition.

In the present experiment PRIOR SELECTIVE RETRIEVAL and DELAY were manipulated between participants, whereas CUE was manipulated within participants. Importantly, none of the reported statistical effects interacted with participants' testing order, all $ps > .230$, and there was also no main effect of testing order, $ps > .393$, which is consistent with the prior work (e.g., Bäuml & Samenieh, 2010, 2012a).

## DISCUSSION

Prior work reported evidence for the self-limiting property of selective memory retrieval by using the output-interference paradigm, i.e., when target recall followed non-target recall immediately (e.g., Roediger, 1974; Smith, 1971), and by using the retrieval-practice paradigm, i.e., when typically preceding non-target and subsequent target recall were separated by a delay of several minutes (e.g., Anderson et al., 1994; Chan, 2009). The results from the present experiment replicate both lines of work by showing detrimental effects of memory retrieval for to-be-remembered information in the absence and the presence of a delay between non-target and target recall. In addition the results show that the amount of RIF is not reduced when target recall is delayed by several minutes. Thus possible reductions in RIF with delay, as they have been reported repeatedly in the literature when non-target and target recall were separated by 24 hours (e.g., Chan, 2009; MacLeod & Macrae, 2001; but see Garcia-Bajos, Migueles, & Anderson, 2009), should be restricted to longer delay intervals.

To date, evidence for the self-propagating property of selective memory retrieval has arisen mainly in the output-interference paradigm, i.e., when target recall follows non-target recall immediately (Bäuml & Samenieh, 2010, 2012a). Employing the retrieval-practice paradigm and varying the delay between non-target and target recall, the present results replicate the prior finding by showing beneficial effects of selective retrieval on to-be-forgotten information when target recall is undelayed. Going beyond the prior work, the results also show that such beneficial effects do not generalise to conditions in which there is a delay of at least 1 minute between recall of the two types of items. Although numerical evidence for beneficial effects arose in the 1-minute and 10-minutes delay conditions as well, the effects were small and not reliable. These results indicate that the beneficial effects of selective memory retrieval are mainly present if target recall follows non-target recall immediately, and are strongly reduced, if existent at all, if target recall is delayed.

The present results provide a first dissociation between the two faces of selective memory retrieval by showing that delay between retrieved non-target items and still-to-be-retrieved target items influences the two effects of memory retrieval differently. The demonstration of lasting detrimental effects of selective memory retrieval is consistent with the inhibitory view on RIF, according to which retrieval practice can reduce the strength of the non-retrieved items' memory representation and create an effect that lasts for quite a while (e.g., Anderson et al., 1994; Anderson & Spellman, 1995; for a non-inhibitory account of RIF, see Williams & Zacks, 2001). The demonstration that the beneficial effects of selective memory retrieval are primarily observed when target recall immediately follows non-target recall is consistent with the view that selective memory retrieval reactivates the retrieved items' original encoding context (e.g., Howard & Kahana, 1999, 2002). Such reactivation can make the context a potentially powerful retrieval cue for target recall, but the cue should be effective primarily if the retrieval process was not interrupted, for instance, by means of an interpolated distractor task. Such disruption may reduce the context's activation level and thus reduce the cue's effectiveness in reactivating the target items. Thus, beneficial effects of selective retrieval should be present mainly when target recall is undelayed, which is exactly what the results in the forget condition of the present study show.[1]

Altogether the present results are consistent with Bäuml and Samenieh's (2012a) two-factor account of selective memory retrieval, which assumes that selective memory retrieval generally triggers two processes, inhibition of interfering memories and reactivation of the retrieved items' original encoding context. Crucially, the account assumes that whether inhibition or context reactivation dominates in an experimental situation depends on whether the to-be-retrieved memories are subject to impaired context access or not. If access to the original context is still maintained—as should be the case in the remember condition of the present experiment—inhibitory processes should dominate and not much room should be left for context reactivation processes; in contrast, if access to the original context is impaired—as should be the case in the forget condition of the present experiment—context reactivation processes should dominate and not much room should be left for interference and inhibition. By showing the pattern of beneficial and detrimental effects of selective retrieval in the forget and remember conditions of the present experiment when target recall was undelayed, and by showing persisting detrimental effects in the remember condition but transient beneficial effects in the forget condition, the present results support the suggested two-factor account.[2]

Research on the detrimental effects of selective memory retrieval has demonstrated that RIF is a very general phenomenon and occurs for a wide range of materials and experimental situations (for reviews, see Anderson, 2003; Bäuml et al., 2010). However, this research has also identified a number of boundary conditions of RIF. For instance, detrimental effects of selective retrieval have been shown to be absent when retrieved non-targets and not-yet-retrieved targets show a high degree of inter-item similarity (e.g., Anderson, Green, & McCulloch, 2000; Bäuml & Hartinger, 2002), and when participants are in negative mood (Bäuml & Kuhbandner, 2007), are under stress (Koessler, Engler, Riether, & Kissler, 2009), or perform a divided-attention task during retrieval of the non-target items (Roman, Soriano, Gomez-Ariza, & Bajo, 2009). Boundary conditions of the beneficial effects of memory retrieval have not yet been shown. By demonstrating that the beneficial effects on target recall are restricted to undelayed target recall, the present study suggests a first boundary condition of the beneficial effects of selective memory retrieval.

Using the listwise directed forgetting task, Storm et al. (2007) recently found that semantic generation of related, but not previously presented, items reduces later recall of previously studied to-be-remembered items but leaves recall of to-be-forgotten items unaffected. This finding mimics the present results in the 1-minute and 10-minutes delay conditions. Because in the Storm et al. study target recall was delayed as well, the parallel in results between the two studies is

[1] Chan, McDermott, and Roediger (2006) and Chan (2009) reported beneficial effects of selective memory retrieval when there was a longer delay between non-target and target recall. In contrast to the present study (and most other work in RIF) these studies used integrated study material which typically eliminates RIF if target and non-target recall are separated by short delay (e.g., Bäuml & Hartinger, 2002). Chan (2009) replicated this finding and additionally found recall of the control items to be reduced and recall of the unpractised items to be unaffected by longer delay, which created the facilitation effect for the unpractised items in their study. The results from this prior work and the results from the present study thus seem to be mediated by quite different mechanisms (for a discussion, see Abel & Bäuml, in press).

[2] In the retrieval-practice phase of all three delay conditions of this study, non-target recall in the forget condition was numerically (though not statistically) below non-target recall in the remember condition (on average, 80.1% vs 84.6%). One might ask whether this difference has affected the results. On the one hand there is evidence that RIF does not depend much on retrieval success in the retrieval-practice phase (Storm, Bjork, Bjork, & Nestojko, 2006), indicating that the detrimental effects in this study would have been similar if success rates in the remember condition had been slightly reduced. On the other hand there is evidence that the beneficial effect of selective memory retrieval increases with number of recalled non-target items (Bäuml & Samenieh, 2010), indicating that the beneficial effects might have been slightly enhanced if success rates in the forget condition had been higher.

consistent with the present suggestion that delay can serve as a boundary condition for the beneficial effects of selective memory retrieval. However, using a semantic generation task for preceding recall of the non-target items, the Storm et al. results may also point to a second boundary condition of the beneficial effects of selective retrieval. Indeed, whereas the generation of related, but not previously presented, items can cause forgetting of previously studied material when access to the original encoding context is maintained (see Bäuml, 2002), such generation may not be sufficient to induce enhancement of previously studied items if access to the encoding context is impaired. Rather, intralist but not extralist retrieval may be necessary to reactivate the original list context of the to-be-retrieved target items and thus cause target recall improvement (e.g., Howard & Kahana, 1999, 2002). Future work is needed to examine whether, like delay between preceding non-target and subsequent target recall, usage of a semantic generation task for non-target recall creates a boundary condition for the beneficial effects of selective memory retrieval.

In sum, this is the first study to dissociate beneficial and detrimental effects of selective memory retrieval. The results show detrimental effects of selective memory retrieval regardless of the delay between non-target and subsequent target recall, but show beneficial effects only if target recall is undelayed. The finding is consistent with the two-factor account of selective memory retrieval, according to which quite different mechanisms—inhibition and context reactivation—underlie the two faces of selective memory retrieval.

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