Amount of Postcue Encoding Predicts Amount of Directed Forgetting

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In list-method directed forgetting, participants are cued to intentionally forget a previously studied list (List 1) before encoding a subsequently presented list (List 2). Compared with remember-cued participants, forget-cued participants typically show impaired recall of List 1 and improved recall of List 2, referred to as List 1 forgetting and List 2 enhancement. In 3 experiments, we examined how amount of postcue encoding influences directed forgetting. Two results emerged dissociating List 1 forgetting from List 2 enhancement. First, an increase in amount of postcue encoding led to an increase in List 1 forgetting but did not affect List 2 enhancement. Second, the forget cue influenced all List 1 items but affected only early List 2 items. A 2-mechanism account of directed forgetting is suggested, according to which List 1 forgetting reflects reduced accessibility of List 1 items, and List 2 enhancement arises from a reset of encoding processes.

Keywords: episodic memory, directed forgetting, intentional forgetting, encoding, inhibition

List-method directed forgetting is the demonstration that people can intentionally forget previously studied material if, after study, a forget cue is provided and new material is learned. In this paradigm, participants study two lists of items and, after study of List 1, receive a cue to either forget or continue remembering this list. After subsequent study of List 2, a recall test is conducted in which participants are asked to recall all of the previously presented items, including those they were originally cued to forget. Compared with remember-cued participants, forget-cued participants typically show impaired recall of List 1 and improved recall of List 2, referred to as List 1 forgetting and List 2 enhancement (for reviews, see Bäuml, 2008, or MacLeod, 1998).[1]

Theoretical Accounts of Directed Forgetting

Directed forgetting has mostly been attributed to a single mechanism, regarded as responsible for both effects of the forget cue—that is, List 2 enhancement and List 1 forgetting. The selective rehearsal account, for instance, assumes that during List 2 encoding remember-cued participants rehearse both List 2 and List 1 items, whereas forget-cued participants selectively rehearse List 2 items, thus improving later recall of List 2 at the expense of List 1 (Bjork, 1970). The retrieval inhibition account assumes that forget-cued participants engage in active inhibitory processes that reduce access to List 1 items and, due to the resulting decrease in these items' interference potential, facilitate memory for List 2 items (Geiselman, Bjork, & Fishman, 1983). Finally, the context-change account claims that the forget cue induces a change in participants' internal context, which then impairs List 1 recall due

to a mismatch between the context at encoding and the context at retrieval and improves later List 2 recall due to a reduction in proactive interference (Sahakyan & Kelley, 2002). As alternatives to one-mechanism accounts, which attribute List 1 forgetting and List 2 enhancement to the same (inhibitory or noninhibitory) mechanism, two-mechanism accounts have recently been suggested, relying on a retrieval-based mechanism to explain List 1 forgetting and an encoding-based mechanism to explain List 2 enhancement (Bäuml, Hanslmayr, Pastötter, & Klimesch, 2008; Sahakyan & Delaney, 2003; for details, see General Discussion).

The Crucial Role of Postcue Encoding

The presentation of the forget cue is not sufficient to create List 1 forgetting. Rather, postcue encoding of further items is necessary to induce the forgetting. Corresponding evidence comes from experiments by Gelfand and Bjork (1985; described in Bjork, 1989) and Pastötter and Bäuml (2007). In these experiments, after study of List 1, participants received a cue to either forget or continue remembering the list. Then, either a second list was presented for study or an unrelated distractor task was carried out. At test, participants were asked to recall List 1 items regardless of initial cuing. List 1 forgetting was observed only when study of the second list was interpolated between cuing and test, suggesting that the forget cue is not sufficient and postcue encoding of new material is necessary for the forgetting effect.

The finding that directed forgetting depends on the learning of new material suggests that the mechanism (or mechanisms) mediating directed forgetting operate during List 2 encoding. Support

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[1] In the literature, two different directed forgetting tasks have been employed: the list-method task and the item-method task. In contrast to the list-method task, in the item-method task participants study a list of items and the exposure of each single item is followed closely by the cue to either remember it or forget it. On a later memory task, to-be-remembered items are typically better recalled than to-be-forgotten items (for reviews, see MacLeod, 1998, or Bäuml, 2008).

for this suggestion comes from studies in which different facets of postcue encoding were manipulated. Bjork (1970), for instance, showed that directed forgetting is observed only if the forget cue is presented before List 2 encoding, but not if it is presented afterward. Conway, Harries, Noyes, Racsma'ny, and Frankish (2000) demonstrated that List 1 forgetting can be reduced or even eliminated if a secondary task is performed during List 2 encoding. Bäuml and Kuhbandner (2009) found that when positive, but not negative, moods were induced immediately before List 2 encoding, directed forgetting could be eliminated. In addition, measuring participants' electrophysiological brain activities during List 2 encoding, Bäuml et al. (2008) identified (separate) neural correlates of List 1 forgetting and List 2 enhancement, consistent with the view that directed forgetting is caused by mechanisms operating during List 2 encoding.

If directed forgetting is caused during postcue encoding, the question arises of how List 1 forgetting and List 2 enhancement vary with amount of encoded postcue information. It is surprising that to date no studies have been published that address this very basic issue. A priori, at least two possibilities arise regarding the relationship between amount of postcue encoding and directed forgetting. One possibility is that the directed forgetting effects arise more or less instantaneously as a direct consequence of starting the learning process over again, meaning that the presence of only a few List 2 items, or even a single item, would already be sufficient to induce the effects; if so, directed forgetting would depend on postcue encoding but would be largely unaffected by amount of encoded postcue information. The other possibility is that the directed forgetting effects arise more continuously during List 2 encoding, leading to a gradual increase in directed forgetting as more and more List 2 items are encoded; if so, amount of directed forgetting should increase with amount of encoded postcue information.

The Present Experiments

In this study we report the results of three list-method directed forgetting experiments, designed to examine how directed forgetting depends on amount of List 2 encoding. In these experiments, either a relatively low number (three or five) or a relatively high number (eight or 15) of List 2 items were encoded; the number of encoded List 1 items was held constant (15). Mean recall rates as well as serial position data of List 1 and List 2 were analyzed to examine whether all or only a subgroup of the two lists' items were affected by the forget cue and amount of postcue encoding. The results of the experiments will shed further light on the role of postcue encoding in directed forgetting. In addition, they may offer new insights into the mechanisms mediating directed forgetting.

Experiment 1

We had two goals with Experiment 1. The first goal was to replicate the previous finding that List 1 forgetting requires encoding of postcue information (Gelfand & Bjork, 1985; Pastötter & Bäuml, 2007). The second goal was to examine whether amount of List 2 encoding predicts amount of directed forgetting. After studying 15 List 1 items, participants received a cue to either forget or continue remembering the list. Then either a second list (List 2) of three, eight, or 15 items was presented for study, or no List 2

encoding took place. At test, participants were asked to recall the items from the first list, followed by List 2 recall when a second list of items had been studied.

Method

Participants.   Two hundred fifty-six students (101 men, 155 women) at Regensburg University were tested individually, with 32 participants in each of eight experimental conditions.

Material.   Thirty unrelated German nouns of medium frequency were drawn from the CELEX database (Duyck, Desmet, Verbeke, & Brysbaert, 2004). Initially, two sets of 15 words each were created. Across the two sets, words were matched on frequency and word length. Within a set, subsets of three and eight words were prepared by sampling without replacement from the whole set of 15 items. The assignment of words to sets and subsets was constant throughout the experiment. List 1 always consisted of one of the two sets of 15 words. In the conditions in which participants learned a second list, List 2 consisted of items from the other set, the whole 15-item set, the 8-item subset, or the 3-item subset. Sets were counterbalanced across List 1 and List 2 encoding. Lists were used equally often in the remember and the forget conditions.

Design.   The experiment had a 2 × 4 design with the between-participants factors of cue (remember, forget) and amount (0 items, 3 items, 8 items, 15 items). Conditions differed on which cue was provided after List 1 encoding. In the remember condition, List 1 was followed by a cue to remember the words; in the forget condition, List 1 was followed by a cue to forget the words. Conditions also differed as to how many List 2 items were studied. In the three-item, the eight-item, and the 15-item condition, an additional second list was presented with three, eight, or 15 to-be-encoded words; in the zero-item condition, no List 2 encoding took place.

List 1 and List 2 mean recall rates were used as dependent variables. Serial position curves were calculated and, for each position n, smoothed by averaging original data from three adjacent points, $x_s(n) = [x(n-1) + x(n) + x(n+1)]/3$, except for the first and the last positions of the curve, for which the averaging was based on two adjacent points, $x_s(1) = [x(1) + x(2)]/2$ and $x_s(\text{last}) = [x(\text{last}-1) + x(\text{last})]/2$ (e.g., Roediger & McDermott, 1995). In all three experiments, data were analyzed with and without smoothing of the serial position curves. As it turned out, the conclusions were the same for the two analysis methods.

Procedure.   In accordance with the multiple-cue version of list-method directed forgetting (e.g., Bäuml et al., 2008; Pastötter & Bäuml, 2007), participants were told from the outset that they would be presented with lists of words to learn but that following each list they would be given a cue to remember or forget the previous list. The forget cue specified that there was no need to remember List 1 items.

The experiment consisted of four main phases: a List 1 encoding phase, a cuing phase, a List 2 encoding/distractor phase, and a test phase. In the initial List 1 encoding phase, in all conditions, 15 List 1 items were presented auditorily with a presentation rate of 2 s. Conditions differed as to what happened in the subsequent cuing phase. In the remember condition, List 1 was followed by the cue to remember the list; in the forget condition, List 1 was followed by the cue to forget the list.

Next, in the List 2 encoding phase, conditions differed in amount of postcue encoding. In the 15-item condition, 15 List 2 items were presented auditorily with a presentation rate of 2 s and participants were instructed to remember these items. Participants then counted backward from a three-digit number in steps of threes for 30 s as a recency control. In the eight-item and three-item conditions, eight or three items were presented auditorily with a presentation rate of 2 s; the distractor was prolonged to match the duration of the encoding/distractor phase between conditions. In the zero-item condition, no List 2 encoding took place and participants counted backward in a prolonged distractor phase instead.

In the fourth phase of the experiment, a free recall test was carried out in which all participants in all conditions were first asked to recall as many of the List 1 items as possible. In the conditions in which participants studied a second list, participants were subsequently asked to recall as many of the List 2 items as possible. The recall time for each list was 1 min. If a participant indicated that he or she would need additional time to recall a list's items, the recall period was prolonged.

Results

List 1 recall. Figure 1 shows proportion of List 1 recall as a function of cue (remember vs. forget) and amount (15 items vs. 8 items vs. 3 items vs. 0 items). A 2×4 analysis of variance (ANOVA) with the factors of cue and amount revealed a main effect of cue, $F(1, 248) = 17.7$, $MSE = 0.018$, $p < .001$, partial $\eta^2 = .07$; a main effect of amount, $F(3, 248) = 18.3$, $MSE = 0.018$, $p < .001$, partial $\eta^2 = .18$; and an interaction between the two factors, $F(3, 248) = 5.0$, $MSE = 0.018$, $p < .01$, $\eta^2 = .06$. These results indicate that forget-cued participants showed lower List 1 recall than remember-cued participants and that List 1 recall decreased with amount of postcue encoding. In particular, the results reveal that List 1 forgetting increased with number of encoded postcue items. Consistently, post hoc t tests showed an effect of cue in the 15-item condition, $t(62) = 4.9$, $p < .001$, Cohen's $d = 1.22$, and in the eight-item condition, $t(62) = 2.8$, $p < .01$, $d = 0.70$, but not in the three-item condition, $t(62) = 1.3$, $p = .20$, $d = 0.32$, or in the zero-item condition, $t(62) < 1.0$. Also, when a second list of items was studied, List 1 recall in the

forget condition decreased with number of List 2 items, $F(2, 93) = 4.7$, $MSE = 0.017$, $p < .01$, partial $\eta^2 = .09$, whereas List 1 recall in the remember condition was unaffected by amount of postcue encoding, $F(2, 93) < 1.0$.

Figure 2 shows serial position curves of List 1 items for each of the four postcue encoding conditions. Separately for each encoding condition, mean List 1 recall data were analyzed with the additional factor of serial position with a 2×15 ANOVA on proportion of List 1 recall with the factors of cue (remember vs. forget) and serial position (1–15). In all four conditions, analyses revealed a main effect of serial position, all $Fs(14, 868) > 11.0$, all $ps < .001$, all partial $\eta^2 s > .15$, which was due to outstanding primacy effects reflecting improved recall of the list's first items. A main effect of cue was found in the 15-item condition, $F(1, 62) = 23.0$, $MSE = 0.250$, $p < .001$, partial $\eta^2 = .27$, and in the eight-item condition, $F(1, 62) = 7.2$, $MSE = 0.312$, $p < .01$, partial $\eta^2 = .10$, but there was no effect of cue in the three-item and zero-item conditions, $Fs < 1.2$. In the 15-item condition, an interaction between the factors of cue and serial position arose, $F(14, 868) = 2.3$, $MSE = 0.061$, $p < .01$, partial $\eta^2 = .04$, which was due to more forgetting of primacy items than of middle and late list items. In all other conditions, no such interaction was found, all $Fs < 1.5$. Middle and late List 1 items (Positions 4–15) in the 15-item condition also showed a main effect of cue, $F(1, 62) = 13.3$, $MSE = 0.183$, $p < .001$, partial $\eta^2 = .18$, but no interaction between cue and serial position, $F(11, 682) < 1.0$, indicating that reliable forgetting arose for all list items.

List 2 recall. Figure 1 shows proportion of List 2 recall as a function of cue (remember vs. forget) and amount (three items vs. eight items vs. 15 items). A 2×3 ANOVA with the factors of cue and amount revealed a main effect of cue, $F(1, 186) = 12.3$, $MSE = 0.063$, $p < .001$, partial $\eta^2 = .06$; a main effect of amount, $F(2, 186) = 25.9$, $MSE = 0.063$, $p < .001$, partial $\eta^2 = .22$; and an interaction between the two factors, $F(2, 186) = 3.9$, $MSE = 0.063$, $p < .05$, partial $\eta^2 = .04$. These results indicate that forget-cued participants showed enhanced List 2 recall compared with remember-cued participants and that List 2 recall decreased with increasing amount of postcue items. In particular, List 2 enhancement decreased with increasing amount of
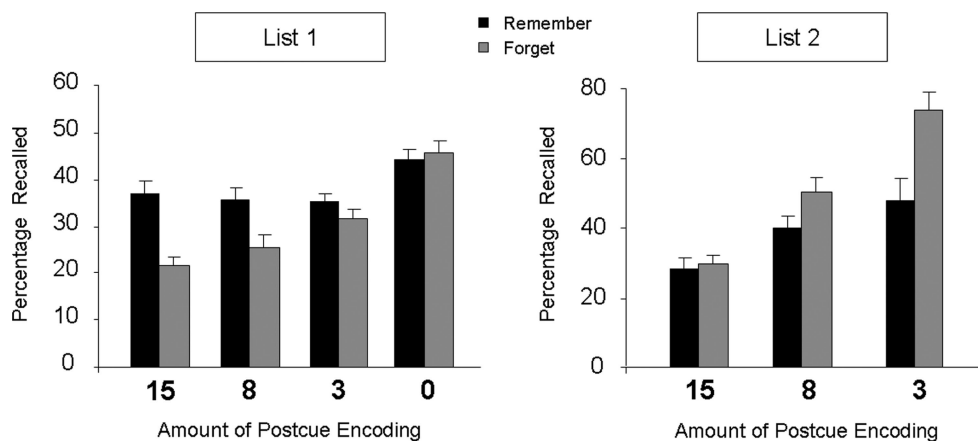

Figure 1. Mean recall rates as a function of cue (remember, forget) and postcue amount (15 items, 8 items, 3 items, 0 items) in Experiment 1. Error bars represent standard errors of the mean.
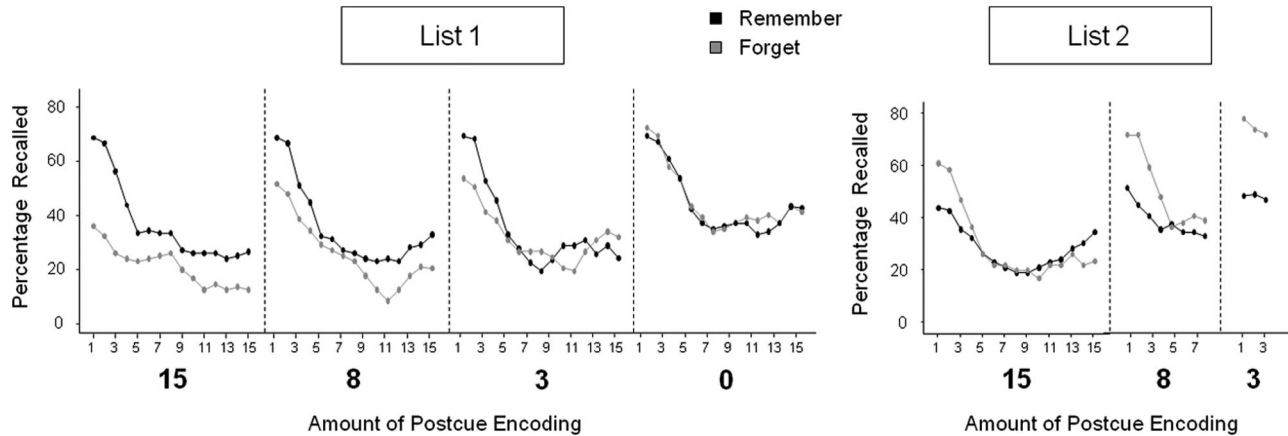
Figure 2. Mean recall rates as a function of cue (remember, forget), postcue amount (15 items, 8 items, 3 items, 0 items), and serial position in Experiment 1.

postcue items. Consistently, whereas List 2 enhancement was not reliable in the 15-item condition, $t(62) < 1.0$, significant List 2 enhancement arose in both the eight-item condition, $t(62) = 2.0$, $p < .05$, $d = 0.50$, and the three-item condition, $t(62) = 3.1$, $p < .01$, $d = 0.78$.

Figure 2 shows serial position curves of List 2 items for each of the three encoding conditions. In the first step, early List 2 items (Positions 1–3), which were part of all three encoding conditions, were analyzed. A $2 \times 3 \times 3$ ANOVA on proportion of recall of early List 2 items with the factors cue (remember vs. forget), amount (three items vs. eight items vs. 15 items), and serial position (1–3) revealed a main effect of cue, $F(1, 186) = 20.2$, $MSE = 0.319$, $p < .001$, partial $\eta^2 = .10$; a marginally significant main effect of amount, $F(2, 186) = 2.8$, $MSE = 0.319$, $p = .06$, partial $\eta^2 = .03$; and a main effect of serial position, $F(2, 372) = 15.0$, $MSE = 0.027$, $p < .001$, partial $\eta^2 = .07$. There were no significant interactions between factors, $Fs < 1.0$. Thus, cue-induced enhancement of early List 2 items was present irrespective of amount of postcue encoding.

In the second step, we analyzed early and middle List 2 items (Positions 1–8), which were part of the eight-item and the 15-item conditions. A $2 \times 2 \times 8$ ANOVA on proportion of recall of early and middle List 2 items with the factors cue (remember vs. forget), amount (eight items vs. 15 items), and serial position (1–8) revealed a main effect of cue, $F(1, 124) = 6.3$, $MSE = 0.358$, $p < .05$, partial $\eta^2 = .05$; a main effect of amount, $F(1, 124) = 9.9$, $MSE = 0.358$, $p < .01$, partial $\eta^2 = .07$; a main effect of serial position, $F(7, 868) = 24.6$, $MSE = 0.070$, $p < .001$, partial $\eta^2 = .16$; and an interaction between cue and serial position, $F(7, 868) = 2.9$, $MSE = 0.070$, $p < .01$, partial $\eta^2 = .02$. No other interactions were found, $Fs < 1.0$. These results indicate that List 2 enhancement declined along the serial position curve irrespective of amount of postcue encoding. Consistently, for middle List 2 items (Positions 4–8), no significant main effect of cue arose, $F(1, 124) < 1.0$. Similarly, in the 15-item condition, no significant effect of cue was found for late List 2 items (Positions 9–15), $F(1, 62) < 1.0$, indicating that the effect of cue was indeed restricted to early List 2 items.

Discussion

We replicated prior work by showing that postcue encoding is necessary to induce List 1 forgetting (Gelfand & Bjork, 1985; Pastötter & Bäuml, 2007). Going beyond the prior work, the results of Experiment 1 show that the amount of postcue encoding affects directed forgetting; the more List 2 items were studied, the more List 1 items were intentionally forgotten. This effect was found irrespective of List 1 items' serial list positions, indicating that the effect was not restricted to certain list positions but generalized to all positions.

When serial position data were disregarded, the results seemed to suggest that amount of postcue encoding affects List 2 enhancement as well, with List 2 enhancement decreasing the more List 2 items were encoded. Analysis of serial position data, however, provided a more appropriate view. Such analysis showed that List 2 enhancement was present for early list items but was absent for middle and late List 2 items. In particular, List 2 enhancement of the early list items was unaffected by amount of postcue encoding. Thus, obviously the decrease in List 2 enhancement with increasing amount of postcue encoding was caused by the smaller relative contribution of early list items to mean recall rates in the 15-item condition compared with the eight-item and three-item conditions. When we controlled for this factor, the results suggested that List 2 enhancement is restricted to early items and is unaffected by amount of postcue encoding. Thus, amount of postcue encoding affects List 1 forgetting but does not affect List 2 enhancement.

Experiment 2

The results of Experiment 1 suggest that the more List 2 items are encoded, the more List 1 items are intentionally forgotten, indicating that the number of encoded List 2 items determines the amount of List 1 forgetting. Such a proposal might be premature, however, because not only number of encoded postcue items but also processing time of postcue encoding differed across encoding conditions. Indeed, because presentation time of the single items was constant across encoding conditions in Experiment 1, higher numbers of encoded items led to higher postcue processing times.

Therefore, both amount of postcue encoding and postcue processing time could have determined the forgetting in Experiment 1.

In Experiment 2, we resolved this confound by varying both the amount and the presentation rate of postcue items. We included four encoding conditions, in which participants studied either five or 15 List 2 items (amount manipulation) with a postcue presentation rate of either 2 or 6 s (presentation-rate manipulation). If the processing time of List 2 items determined the amount of List 1 forgetting, the number of encoded items should not affect List 1 forgetting as long as the cumulated List 2 processing time was held constant. Accordingly, the forgetting should not differ between the five items at 6 s condition and the 15 items at 2 s condition. Besides, the forgetting should be highest in the 15 items at 6 s condition and lowest in the five items at 2 s condition. In contrast, if the number of encoded List 2 items determined the amount of List 1 forgetting, the presentation rate of List 2 items should not affect List 1 forgetting. Accordingly, the forgetting in both the five-item and the 15-item conditions should be unaffected by the items' presentation rate. In particular, the forgetting in the 15 items at 2 s condition should be higher than in the five items at 6 s condition. The results will show whether amount or processing time of postcue encoding determines List 1 forgetting.

Method

Participants. Two hundred eighty-eight students (133 men, 155 women) at Regensburg University were tested individually, with 36 participants in each of eight experimental conditions.

Material. The same two sets of words were used as in Experiment 1. Within each of the two sets, a subset of five words was prepared. As in Experiment 1, List 1 always consisted of one of the two sets of 15 words. List 2 consisted of items from the other set, the whole 15-item set, or the five-item subset.

Design. The experiment had a $2 \times 2 \times 2$ design with the between-participants factors of cue (remember, forget), amount (five items, 15 items), and presentation rate (2 s, 6 s). Conditions differed as to which cue was provided after List 1 encoding. In the remember condition, List 1 was followed by a cue to remember the words; in the forget condition, List 1 was followed by a cue to forget the words. Conditions also differed as to how many List 2

items were studied; in the five-item condition, five List 2 words were studied; in the 15-item condition, 15 List 2 words were studied. To resolve the confound between amount and processing time of postcue encoding that was present in Experiment 1, encoding conditions also differed in presentation rate of List 2 items: In the 2-s condition, presentation rate of List 2 items was 2 s; in the 6-s condition, presentation rate was 6 s.

List 1 and List 2 mean recall rates were used as dependent variables. Items were counted as correctly recalled if they were recalled with the correct list. Analysis of serial position data was identical to Experiment 1.

Procedure. The procedure was identical to Experiment 1 with the exception of the List 2 encoding/distractor phase. In this phase, List 2 processing time was 10 s (five items at 2 s), 30 s (five items at 6 s or 15 items at 2 s), or 90 s (15 items at 6 s). In the latter condition, participants had to count backward from a three-digit number in steps of threes for 30 s as a recency control. In all other conditions, the distractor was prolonged to match duration of the List 2 encoding/distractor phase.

Results

List 1 recall. Figure 3 shows proportion of List 1 recall as a function of cue (remember vs. forget), amount (15 items vs. five items), and presentation rate (2 s vs. 6 s). A $2 \times 2 \times 2$ ANOVA on List 1 recall rates with the factors of cue, amount, and presentation rate revealed a main effect of cue, $F(1, 280) = 26.3$, $MSE = 0.020$, $p < .001$, partial $\eta^2 = .09$; a main effect of amount, $F(1, 280) = 29.8$, $MSE = 0.020$, $p < .001$, partial $\eta^2 = .10$; and an interaction between cue and amount, $F(1, 280) = 5.7$, $MSE = 0.020$, $p < .01$, partial $\eta^2 = .02$. There were no other main effects or interactions (all Fs < 1.0). These results indicate that forget-cued participants showed lower List 1 recall than remember-cued participants, and List 1 recall decreased with amount of postcue encoding. In particular, the results suggest that List 1 forgetting was unaffected by postcue presentation time but increased with amount of postcue encoding. Consistently, post hoc t tests showed a significant effect of cue in the 15-item conditions, $t(142) = 5.8$, $p < .001$, $d = 0.97$, but only a marginally significant effect in the five-item conditions, $t(142) = 1.8$, $p = .07$, $d = 0.31$. Similar to
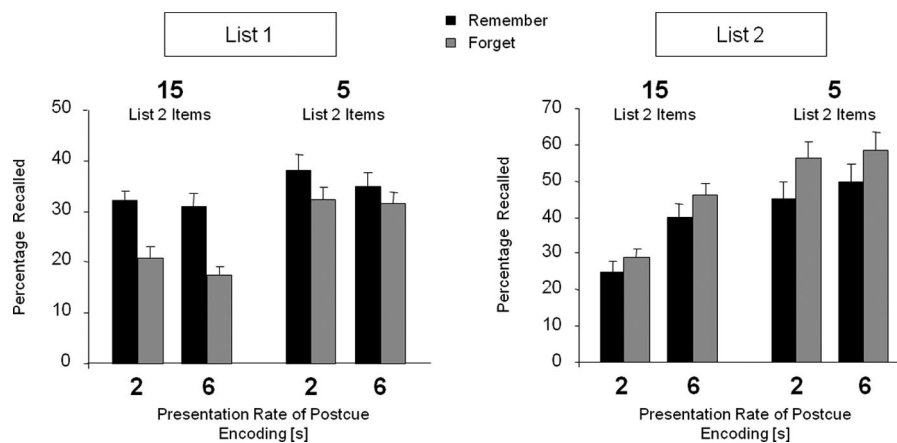

Figure 3. Mean recall rates as a function of cue (remember, forget), postcue amount (15 items, 5 items), and List 2 presentation rate (2 s, 6 s) in Experiment 2. Error bars represent standard errors of the mean.

Experiment 1, List 1 recall in the forget condition decreased with number of encoded List 2 items, $F(1, 140) = 37.8$, $MSE = 0.016$, $p < .001$, partial $\eta^2 = .21$, whereas List 1 recall in the remember condition was only slightly affected by amount of postcue encoding, $F(1, 140) = 3.5$, $MSE = 0.023$, $p = .07$, partial $\eta^2 = .03$.

Figure 4 shows serial position curves of List 1 items for each of the four encoding conditions. Separately for each combination of amount and presentation rate, mean List 1 recall data with the additional factor of serial position were analyzed. In addition, 2×15 ANOVAs on proportion of List 1 recall with the factors of cue (remember vs. forget) and serial position (1–15) were calculated. In all conditions, analyses revealed a main effect of serial position, all Fs$(14, 980) > 20.0$, all ps $< .001$, all partial η^2s $> .22$, which was due to outstanding primacy effects. A main effect of cue was found in the 15-item at 2-s condition, $F(1, 70) = 12.7$, $MSE = 0.246$, $p < .001$, partial $\eta^2 = .15$, and the 15-item at 6-s condition, $F(1, 70) = 19.9$, $MSE = 0.260$, $p < .001$, partial $\eta^2 = .22$. There were no other main effects or interactions (all Fs < 1.8). Thus, List 1 items were intentionally forgotten when 15 List 2 items were studied, but not when five List 2 items were studied. The forgetting was found irrespective of the items' serial position.

List 2 recall. Figure 3 shows proportion of List 2 recall as a function of cue (remember vs. forget), amount (five items vs. 15 items), and presentation rate (2 s vs. 6 s). A $2 \times 2 \times 2$ ANOVA on proportion of List 2 recall with the factors of cue, amount, and presentation rate revealed a main effect of cue, $F(1, 280) = 7.0$, $MSE = 0.057$, $p < .01$, partial $\eta^2 = .02$; a main effect of amount, $F(1, 280) = 37.8$, $MSE = 0.057$, $p < .001$, partial $\eta^2 = .12$; a main effect of presentation rate, $F(1, 280) = 12.0$, $MSE = 0.057$, $p < .001$, partial $\eta^2 = .04$; and an interaction between amount and presentation rate, $F(1, 280) = 5.2$, $MSE = 0.057$, $p < .05$, partial $\eta^2 = .02$. There were no other interactions (all Fs < 1.0). These results indicate that forget-cued participants showed enhanced List 2 recall compared with remember-cued participants, and List 2 recall decreased with amount of postcue encoding but increased with presentation rate; the decrease of List 2 recall with an increasing amount of postcue encoding was more pronounced in the 2-s condition than in the 6-s condition. In particular, List 2 enhancement was unaffected by amount and presentation rate of List 2 items.

Figure 4 shows serial position curves of List 2 items for each of the four encoding conditions. In the first step, early List 2 items (Positions 1–5), which were part of all four encoding conditions, were analyzed. A $2 \times 2 \times 2 \times 5$ ANOVA on proportion of recall of early List 2 items with the factors of cue (remember vs. forget), amount (five items vs. 15 items), presentation rate (2 s vs. 6 s), and serial position (1–5) revealed a main effect of cue, $F(1, 280) = 9.5$, $MSE = 0.383$, $p < .01$, partial $\eta^2 = .03$; a main effect of amount, $F(1, 280) = 4.2$, $MSE = 0.383$, $p < .05$, partial $\eta^2 = .02$; a main effect of presentation rate, $F(1, 280) = 8.1$, $MSE = 0.383$, $p < .01$, partial $\eta^2 = .03$; a main effect of serial position, $F(4, 1120) = 56.9$, $MSE = 0.050$, $p < .001$, partial $\eta^2 = .17$; and a marginally significant interaction between amount and presentation rate, $F(1, 280) = 3.0$, $MSE = 0.383$, $p = .09$, partial $\eta^2 = .01$. There were no other reliable interactions (all Fs < 1.9). Thus, cue-induced enhancement of early List 2 items was found irrespective of amount and presentation rate of postcue encoding.

We also analyzed middle and late List 2 items (Positions 6–15) in the two 15-item conditions. A $2 \times 2 \times 10$ ANOVA on proportion of List 2 recall with the factors of cue (remember vs. forget), presentation rate (2 s vs. 6 s), and serial position (6–15) revealed a main effect of presentation rate, $F(1, 140) = 26.0$, $MSE = 0.430$, $p < .001$, partial $\eta^2 = .16$, and a main effect of serial position, $F(9, 1260) = 2.1$, $MSE = 0.058$, $p < .05$, partial $\eta^2 = .02$, but no other main effect or interactions (all Fs < 1.2). Thus, in contrast to early List 2 items, middle and late List 2 items were not enhanced in response to the forget cue.

Discussion

We replicated the results of Experiment 1 by showing that List 1 forgetting increases with amount of postcue encoding. Although Experiment 1 was silent on whether this result was due to differences in number of encoded List 2 items or differences in postcue processing time, the results of Experiment 2 clarify that it is number of encoded List 2 items and not List 2 processing time that determines List 1 forgetting. Again, this result holds irrespective of List 1 items' serial positions, suggesting that amount of postcue encoding affects the forgetting of all List 1 items about equally.
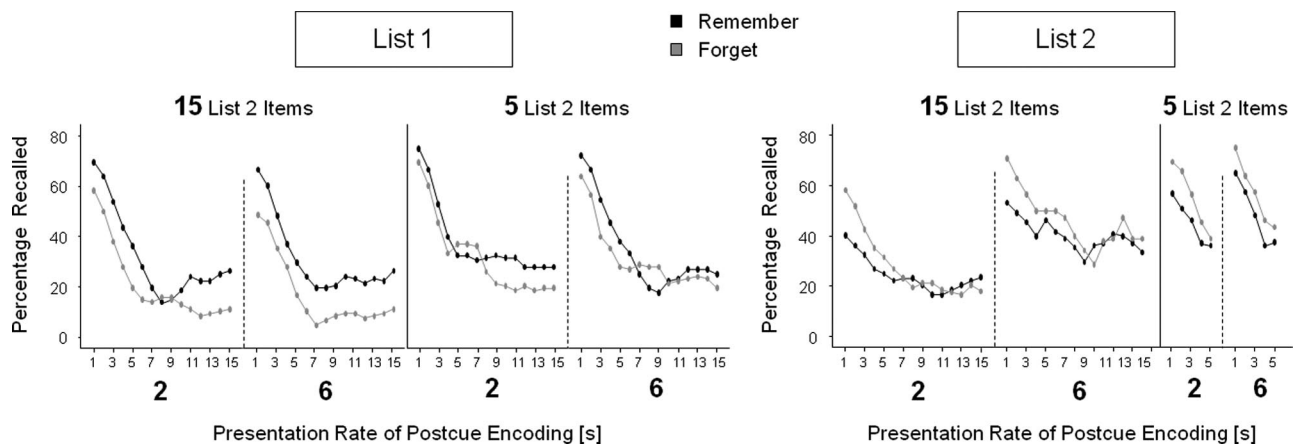

Figure 4. Mean recall rates as a function of cue (remember, forget), postcue amount (15 items, 5 items), List 2 presentation rate (2 s, 6 s), and serial position in Experiment 2.

The results also indicate that List 2 enhancement is unaffected by both amount and processing time of encoded postcue information. This held both when recall rates were averaged across the items' serial positions and when recall rates were analyzed as a function of the items' serial list position. As in Experiment 1, the results from the serial position analysis demonstrate that only recall of the early list items is enhanced in response to the forget cue, whereas recall of middle and late List 2 items does not differ between cuing conditions.

Experiment 3

The selective rehearsal account of directed forgetting assumes that during List 2 encoding remember-cued participants rehearse both List 2 and List 1 items, whereas forget-cued participants selectively rehearse List 2 items, thus improving later recall of List 2 at the expense of List 1 (Bjork, 1970). Selective rehearsal provides a straightforward explanation of the result that List 1 forgetting increases with amount of postcue encoding. According to selective rehearsal, the longer List 2, the more rehearsal of List 1 should take place, which might elevate List 1 recall in the remember condition and yield more forgetting with a high amount than a low amount of postcue encoding—which is exactly what was found in Experiments 1 and 2. The goal of Experiment 3, therefore, was to examine more directly whether rehearsal borrowing during List 2 encoding might have affected the results of Experiments 1 and 2.

Following Sheard and MacLeod (2005), in Experiment 3 we included a stop-rehearsal condition in addition to the standard remember and forget conditions. In this condition, after study of List 1, participants were encouraged to remember the list but to stop rehearsal of List 1 items during List 2 encoding. Thus, after study of 15 List 1 items, participants received a cue to forget the list, remember the list, or remember the list but stop rehearsal of List 1 items. List 2 consisted of either 15 or five items. If the effects of amount of postcue encoding on directed forgetting were due to rehearsal borrowing, manipulations of amount of postcue encoding should have similar effects on recall performance in the stop-rehearsal and the forget conditions. In contrast, if the effects of amount of postcue encoding

were not due to rehearsal borrowing, recall should be the same in the stop-rehearsal and remember conditions.

Method

Participants. Two hundred sixteen students (90 men, 126 women) at Regensburg University were tested individually, with 36 participants in each of six experimental conditions.

Material. The same two sets of words were used as in Experiment 1. Within each of the two sets, a subset of five words was prepared. As in Experiment 1, List 1 always consisted of one of the two sets of 15 words. List 2 consisted of items from the other set, the whole 15-item set or the five-item subset.

Design. The experiment had a 3 × 2 design with the between-participants factors of cue (remember, stop rehearsal, forget) and amount (five items, 15 items). Conditions differed as to which cue was provided after List 1 encoding. In the remember condition, List 1 was followed by a cue to remember the words; in the forget condition, List 1 was followed by a cue to forget the words; in the stop-rehearsal condition, List 1 was followed by a cue to remember the words and participants were told that they should stop rehearsing the first list and focus on learning the upcoming list (see Sheard & MacLeod, 2005). Conditions also differed as to how many List 2 items were studied; in the five-item condition, five List 2 words were studied; in the 15-item condition, 15 List 2 words were studied.

List 1 and List 2 mean recall rates were used as dependent variables. Items were counted as correctly recalled if they were recalled with the correct list. Analysis of serial position data was identical to Experiment 1.

Procedure. The procedure was identical to Experiment 2 with the exception that items of both lists were visually presented with a presentation rate of 5 s.

Results

List 1 recall. Figure 5 shows proportion of List 1 recall as a function of cue (remember vs. stop rehearsal vs. forget) and amount (15 items vs. five items). A 3 × 2 ANOVA on List 1 recall
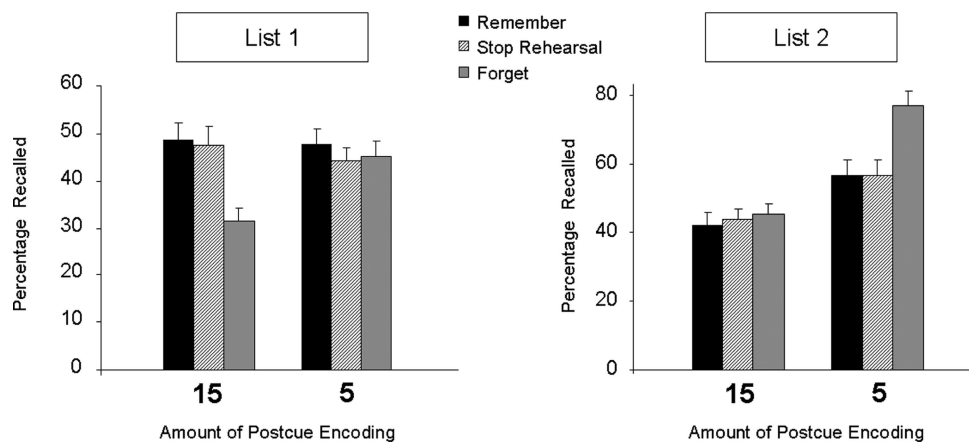

Figure 5. Mean recall rates as a function of cue (remember, stop rehearsal, forget) and postcue amount (15 items, 5 items) in Experiment 3. Error bars represent standard errors of the mean.

rates with the factors of cue and amount revealed a main effect of cue, $F(2, 210) = 4.8$, $MSE = 0.039$, $p < .01$, partial $\eta^2 = .04$, and a significant interaction, $F(2, 210) = 3.9$, $MSE = 0.039$, $p < .05$, partial $\eta^2 = .04$, but no main effect of amount, $F(1, 210) = 1.3$. In the 15-item condition, a one-way ANOVA showed a significant effect of cue, $F(2, 105) = 7.5$, $MSE = 0.044$, $p < .001$, partial $\eta^2 = .12$, which was due to lower List 1 recall in the forget condition compared with both the remember condition, $t(70) = 3.6$, $p < .001$, $d = 0.89$, and the stop-rehearsal condition, $t(70) = 3.4$, $p < .001$, $d = 0.79$; List 1 recall in the latter conditions did not differ, $t(70) < 1.0$. In the five-item condition, no difference in List 1 recall between cuing conditions was observed, $F(2, 105) < 1.0$. Also, List 1 recall in the forget condition decreased with number of List 2 items, $t(70) = 3.2$, $p < .01$, $d = 0.75$, whereas List 1 recall in the remember and stop-rehearsal conditions was unaffected by amount of postcue encoding, $ts(70) < 1.0$. The results thus indicate that List 1 recall in the stop-rehearsal condition is identical to List 1 recall in the remember condition and that List 1 forgetting is restricted to the forget condition.

Figure 6 shows serial position curves of List 1 items. Separately for encoding conditions, mean List 1 recall data with the additional factor of serial position were analyzed with a 3×15 ANOVA on proportion of List 1 recall with the factors of cue (remember vs. stop rehearsal vs. forget) and serial position (1–15). In both encoding conditions, analyses revealed a main effect of serial position, $Fs(14, 1470) > 24.0$, $ps < .001$, partial $\eta^2 s > .18$, which was due to outstanding primacy effects. A main effect of cue was found in the 15-item condition, $F(2, 105) = 7.1$, $MSE = 0.665$, $p < .001$, partial $\eta^2 = .12$, but not in the five-item condition, $F(2, 105) < 1.0$. In both conditions, there was no interaction between factors, $Fs(28, 1470) < 1.0$. Consistently, in a 2×15 ANOVA with the factors of cue (remember vs. forget) and serial position (1 to 15), direct comparison of the remember and forget conditions showed no interaction of cue and serial position in the 15-item condition, $F(14, 980) < 1.0$, indicating that reliable forgetting arose irrespective of List 1 items' serial positions.

List 2 recall. Figure 5 shows proportion of List 2 recall as a function of cue (remember vs. stop rehearsal vs. forget) and

amount (five items vs. 15 items). A 3×2 ANOVA on List 2 recall rates with the factors of cue and amount revealed a main effect of cue, $F(2, 210) = 5.6$, $MSE = 0.057$, $p < .01$, partial $\eta^2 = .05$; a main effect of amount, $F(1, 210) = 36.9$, $MSE = 0.057$, $p < .001$, partial $\eta^2 = .15$; and a significant interaction between the two factors, $F(2, 210) = 3.5$, $MSE = 0.057$, $p < .05$, partial $\eta^2 = .03$. In the 15-item condition, no difference in List 2 recall between cuing conditions was observed, $F(2, 105) < 1.0$. In the five-item condition, a significant effect of cue arose, $F(2, 105) = 7.0$, $MSE = 0.072$, $p < .001$, partial $\eta^2 = .12$, which was due to higher List 2 recall in the forget condition compared with both the remember condition, $t(70) = 3.2$, $p < .01$, $d = 0.76$, and the stop-rehearsal condition, $t(70) = 3.3$, $p < .001$, $d = 0.78$; List 2 recall in the latter conditions did not differ, $t(70) < 1.0$. The results thus indicate that List 2 recall in the stop-rehearsal condition is identical to List 2 recall in the remember condition, and that List 2 enhancement is restricted to the forget condition.

Figure 6 shows serial position curves of List 2 items. In the first step, early List 2 items (Positions 1–5), which were part of both encoding conditions, were analyzed. A $3 \times 2 \times 5$ ANOVA on proportion of recall of early List 2 items with the factors of cue (remember vs. stop rehearsal vs. forget), amount (five items vs. 15 items), and serial position (1–5) revealed a main effect of cue, $F(2, 210) = 9.4$, $MSE = 0.346$, $p < .001$, partial $\eta^2 = .08$; a main effect of amount, $F(1, 210) = 9.2$, $MSE = 0.346$, $p < .05$, partial $\eta^2 = .04$; a main effect of serial position, $F(4, 840) = 24.3$, $MSE = 0.057$, $p < .001$, partial $\eta^2 = .10$; but no reliable interactions (all $Fs < 1.0$). Consistently, direct comparison of the forget and remember conditions showed no reliable interactions (all $Fs < 1.0$). Thus, the forget cue induced the same amount of enhancement of early List 2 items in the two encoding conditions.

Next, we analyzed middle and late List 2 items (Positions 6–15) in the 15-item condition. A 3×10 ANOVA on proportion of List 2 recall with the factors of cue (remember vs. stop rehearsal vs. forget) and serial position (6–15) revealed a main effect of serial position, $F(9, 945) = 2.2$, $MSE = 0.058$, $p < .05$, partial $\eta^2 = .02$, but no other main effect or interactions ($Fs < 1.0$). Consistently, direct comparison of the forget and remember conditions showed
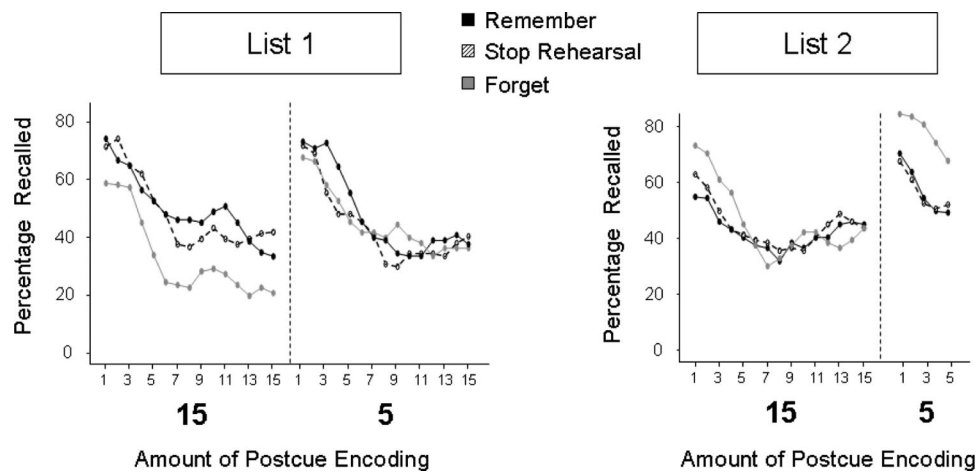

Figure 6. Mean recall rates as a function of cue (remember, stop rehearsal, forget), postcue amount (15 items, 5 items), and serial position in Experiment 3.

no reliable interaction between the two factors, $F(9, 630) < 1.0$. Thus, in contrast to early List 2 items, middle and late List 2 items were not enhanced in response to the forget cue.

Pooled data. Analysis of serial position data in Experiments 1–3 suggests that List 1 items are forgotten irrespective of the items' serial positions, whereas List 2 enhancement is restricted to early List 2 items. To increase statistical power in these analyses, in the final step we combined serial recall data across experiments. Pooling was conducted separately for List 1 and List 2 and separately in the remember and forget conditions. Pooling was restricted to those encoding conditions in which List 2 contained 15 items. Pooling was feasible because neither presentation time (Experiment 2) nor modality (Experiment 3) seemed to influence effects of cuing. Recall data of 280 participants went into the combined data analysis. Figure 7 shows the results.

A 2×15 ANOVA on proportion of List 1 recall with the factors of cue (remember vs. forget) and serial position (1–15) revealed a main effect of cue, $F(1, 278) = 53.6$, $MSE = 0.395$, $p < .001$, partial $\eta^2 = .16$; a main effect of serial position, $F(14, 3892) = 84.0$, $MSE = 0.061$, $p < .001$, partial $\eta^2 = .23$; but no significant interaction between the two factors, $F(14, 3892) < 1.0$. Thus, consistent with the results from the separate analyses, combined data analysis indicates that List 1 items are forgotten irrespective of the items' serial positions.

A 2×15 ANOVA on proportion of List 2 recall with the factors of cue (remember vs. forget) and serial position (1–15) revealed a main effect of serial position, $F(14, 3892) = 35.0$, $MSE = 0.071$, $p < .001$, partial $\eta^2 = .11$; a significant interaction between factors, $F(14, 3892) = 4.1$, $MSE = 0.071$, $p < .001$, partial $\eta^2 = .02$; but no reliable main effect of cue, $F(1, 278) = 2.4$, $MSE = 0.590$, $p = .12$, partial $\eta^2 = .01$. Post hoc analyses showed that List 2 enhancement was found for Serial Positions 1 to 4, $ts(278) > 2.3$, $ps < .05$, $ds > 0.28$, but not for later serial positions, all $ts(278) < 1.0$. Thus, consistent with the results from the separate analyses, combined data analysis indicates that List 2 enhancement is restricted to early serial list positions.

Discussion

We replicated the results of Experiment 1 and Experiment 2 by showing that List 1 forgetting increases with amount of postcue

Figure 7. Mean recall rates as a function of cue (remember, forget) and serial position for pooled data combined over the 15-item conditions of Experiments 1–3.

encoding. Again, we found List 1 forgetting for all serial positions, suggesting that amount of postcue encoding affects the forgetting of the whole list. Analysis of recall data in the stop-rehearsal condition showed that encouraging participants to stop rehearsal of List 1 items during List 2 encoding did not induce List 1 forgetting. Rather, List 1 recall data in the stop-rehearsal condition were indistinguishable from those in the remember condition. This finding suggests that rehearsal borrowing during List 2 encoding should not have affected List 1 forgetting and should not have affected the observed increase in List 1 forgetting with amount of postcue encoding.

Like the results of Experiment 3, portions of the results of Experiment 2 are also inconsistent with the rehearsal borrowing view. First, selective rehearsal not only predicts that rehearsal borrowing should increase with increasing List 2 list length but it should also increase with higher presentation rates of List 2 items. If so, larger List 1 forgetting should arise with longer (List 2) presentation rates than with shorter rates. However, in Experiment 2, we did not find any effect of presentation rate on List 1 forgetting.

Second, selective rehearsal predicts that when the filler interval and processing time of List 2 items are held constant, and when a 15 item $\times$ 2 s List 2 encoding condition is compared with a 5 item $\times$ 6 s List 2 encoding condition, then more rehearsal borrowing of List 1 items should occur with the longer presentation rate (5 $\times$ 6 condition) than with the shorter presentation rate (15 $\times$ 2 condition). However, in Experiment 2, the amount of forgetting was higher in the 15 $\times$ 2 condition than in the 5 $\times$ 6 condition, which is the opposite of what the selective rehearsal view predicts. Thus, together, the results of Experiments 2 and 3 clearly reject rehearsal borrowing.

In Experiment 3, we also replicated the result of Experiments 1 and 2 that List 2 enhancement is restricted to early List 2 items and is unaffected by amount of postcue encoding. Again, the results from the serial position analysis demonstrate that only recall of the early list items is enhanced in response to the forget cue, whereas recall of middle and late List 2 items does not differ between the forget and remember conditions. List 2 recall data in the stop-rehearsal condition were indistinguishable from those in the remember condition. Thus, just like List 1 forgetting, List 2 enhancement was restricted to the forget condition.

General Discussion

Across three experiments, we examined how amount of postcue encoding influences list-method directed forgetting. In all experiments, amount of postcue encoding affected List 1 forgetting; the forgetting increased as the number of encoded List 2 items increased. Unlike number of encoded List 2 items, presentation rate of List 2 items did not affect the forgetting. Neither postcue presentation rate nor number of encoded List 2 items influenced List 2 enhancement. Amount of postcue encoding thus affected List 1 forgetting but not List 2 enhancement, suggesting a first dissociation between List 1 forgetting and List 2 enhancement that arose from the present experiments.

Across experiments, the forget cue reduced recall at all serial positions of List 1. In contrast, the forget cue enhanced recall of early List 2 items only but did not affect recall of middle and late list items. These findings suggest that the forget cue affects only a
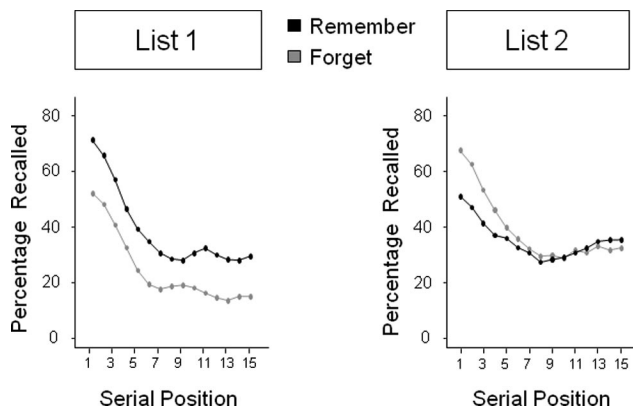
subset of List 2 items but influences all List 1 items. This result points to a second dissociation between List 1 forgetting and List 2 enhancement that arose from the present experiments.

List 1 Forgetting

The present results demonstrate that postcue encoding plays a crucial role for List 1 forgetting. In Experiment 1, we replicated the finding that the presence of the forget cue is not sufficient to induce List 1 forgetting and requires additional encoding of post-cue information (Gelfand & Bjork, 1985; Pastötter & Bäuml, 2007). The results of the present experiments go beyond the prior work and show that number of encoded List 2 items influences List 1 forgetting. In all of the experiments, the pattern arose that the more List 2 items had been encoded, the more List 1 items were intentionally forgotten. This held, whereas presentation rate of the List 2 items did not affect List 1 forgetting, indicating that it is number of encoded postcue items and not processing time that determines List 1 forgetting.

Analysis of serial position data indicates that all List 1 items were subject to forgetting. This finding is in line with previous studies, suggesting that List 1 forgetting is not restricted to any subgroup of the list's items (Geiselman et al., 1983; Kimball & Bjork, 2002; Lehman & Malmberg, 2009; Sahakyan & Foster, 2009). In addition, the present results indicate that amount of List 1 forgetting is about equal for all List 1 items. Whereas in the 15-item condition of Experiment 1 more forgetting of List 1 primacy items than of middle- and late-list items was found, no such interaction arose in either the eight-item condition of Experiment 1 or the 15-item conditions of Experiment 2 and Experiment 3. In fact, analysis of pooled data showed the same amount of List 1 forgetting for all serial positions. Thus, an item's serial List 1 position does not predict its amount of forgetting.

List 2 Enhancement

The present results suggest that, when averaged over List 2 items' serial positions, amount of List 2 encoding can affect List 2 enhancement. It seems that by increasing amount of postcue in-formation List 2 enhancement can decrease and even disappear. This held, whereas presentation rate of the List 2 items did not affect List 2 enhancement, indicating that, analogous to List 1 forgetting, it is the number of encoded postcue items but not the items' processing time that affects List 2 enhancement.

The results from the serial position analyses, however, present a different picture. First, they suggest that it is only recall of the early List 2 items that is enhanced in response to the forget cue but not recall of the middle and late List 2 items. Indeed, when we compared serial position curves between cuing conditions, we found that the two curves converge from early to middle serial positions. Second, neither the amount of encoded List 2 items nor the items' presentation rate affected List 2 enhancement of early list items. Therefore, when we factored items' serial position into the analysis of mean recall data, no difference in List 2 enhance-ment between postcue encoding conditions was found. These results suggest that, when recall performance in the single serial positions is averaged over List 2 items' serial positions, an appar-ent decrease of List 2 enhancement with increasing amount of postcue encoding can arise because of the increasingly smaller

relative contribution of early list items to mean recall rates when list length is increased. Factual, however, List 2 enhancement is restricted to early list items and is unaffected by amount of postcue encoding.

Although the serial position results of List 1 forgetting are consistent with those of prior reports, the serial position results of List 2 enhancement differ slightly from two recent observations (Lehman & Malmberg, 2009; Sahakyan & Foster, 2009). Whereas in the present experiments List 2 enhancement was restricted to the first four items of the list, in the two previous studies, enhancement effects arose for the first six items (Lehman & Malmberg, 2009) or even the first eight items (Sahakyan & Foster, 2009). One reason for the variance in results might be that, in the two recent studies, item lists were broken into bins spanning two (Lehman & Malm-berg, 2009) or even four serial positions (Sahakyan & Foster, 2009), whereas in the present study list positions were not cate-gorized. Another reason for the variance in results could be that, compared with the two prior studies, in Experiments 1 and 2 item presentation time was shorter (2 s) and the items were presented auditorily rather than visually. However, in Experiment 3, item presentation time was longer (5 s) and the items were presented visually, and again List 2 enhancement was restricted to early list items. Further work may help to determine exactly which of the early List 2 items show enhancement and which do not. Apart from that, however, the results from the three studies suggest that serial position curves of cuing conditions converge from early to middle serial positions. This finding imposes a challenge for theoretical accounts of directed forgetting.

In this study, we always asked participants to recall List 1 before List 2. Although this procedure immunized List 1 items against output order effects, it may have created output order effects for the List 2 items. Recent studies have addressed the issue of whether list recall order affects the two directed forgetting effects. In each of these studies, experiments were conducted in which one half of the participants recalled List 1 before List 2, and the other half of the participants recalled List 2 before List 1. Consistent across the studies, recall order affected neither List 1 forgetting nor List 2 enhancement (Barnier et al., 2007; Geiselman et al., 1983; Zellner & Bäuml, 2006). If generalizable to the conditions of the present experiments, the present finding of List 2 enhancement for primacy items only should generalize to the case when List 2 is recalled first.

List 1 Forgetting Versus List 2 Enhancement

The present results reveal two dissociations between the two directed forgetting effects. They identify an effect of amount of postcue encoding on List 1 forgetting but not List 2 enhancement, and they reveal effects of the forget cue on all List 1 items but only on the primacy items of List 2. These two dissociations add to the results of other recent studies, reporting further dissociations be-tween List 1 forgetting and List 2 enhancement (Bäuml et al., 2008; Benjamin, 2006; Sahakyan & Delaney, 2003, 2005; Zellner & Bäuml, 2006). For instance, in recognition testing, List 2 en-hancement was found without List 1 forgetting (Benjamin, 2006); in incidental learning, List 1 forgetting was observed without List 2 enhancement (Sahakyan & Delaney, 2005); measuring partici-pants' electrophysiological brain activities during List 2 encoding, separate neural correlates were found for List 1 forgetting and List

2 enhancement (Bäuml et al., 2008). These dissociations are consistent with a two-mechanism view on directed forgetting, assuming that different mechanisms mediate the two directed forgetting effects.

According to existing two-mechanism accounts of directed forgetting, a retrieval-based mechanism underlies List 1 forgetting and an encoding-based mechanism underlies List 2 enhancement (Bäuml et al., 2008; Sahakyan & Delaney, 2003). Regarding List 2 enhancement, Sahakyan and Delaney (2003) argued that the effect is caused by a change in people's encoding strategy, with more elaborate encoding of List 2 items in the forget condition than in the remember condition. In contrast, we argue that List 2 enhancement arises from a reset of encoding processes. According to this proposal, cuing participants to forget List 1 selectively boosts encoding of early List 2 items with stronger primacy effects in the forget condition than in the remember condition. The assumption is that the forget cue abolishes memory load and inattention that supposedly build up when successive lists are not segregated (Pastötter, Bäuml, & Hanslmayr, 2008) and creates enhanced opportunities to show list primacy effects. In fact, according to the strategy-change view, the beneficial effect of the forget cue should not be restricted to List 2 primacy items but rather should be present for all List 2 items (e.g., Glanzer & Koppenaal, 1977). List 2 enhancement thus does not seem to depend on adaptation of study strategies but rather is the result of a simple reset of the encoding process.

Regarding List 1 forgetting, existing two-mechanism accounts of directed forgetting suggest that the forgetting reflects a retrieval problem. This holds, whereas the accounts differ as to whether List 1 forgetting is assumed to be caused by a change in people's internal context (Sahakyan & Delaney, 2003) or by retrieval inhibition (Bäuml et al., 2008). The present results are silent about the issue, leaving open the question regarding whether the forgetting is caused in an inhibitory or noninhibitory way. At the very least, however, the finding that rehearsal borrowing did not cause the forgetting in the present experiments rejects a rehearsal account of List 1 forgetting (see Discussion section of Experiment 3). Thus, together the present results impose restrictions on both the mechanism (or mechanisms) mediating List 1 forgetting and the mechanism (or mechanisms) mediating List 2 enhancement.

Conclusions

Across three experiments, the present results demonstrate that the amount of postcue encoding predicts the amount of List 1 forgetting and leads to a gradual increase in the forgetting. In contrast, the amount of postcue encoding does not affect List 2 enhancement, suggesting a first dissociation between List 1 forgetting and List 2 enhancement. By showing that the forget cue affects all List 1 items but influences only early List 2 items, the results provide a second dissociation between the two directed forgetting effects. The results are consistent with a two-mechanism view on directed forgetting, according to which List 1 forgetting reflects reduced accessibility of List 1 items and List 2 enhancement arises from a reset of encoding processes.

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PRINT FULL NAME OR KEY NAME OF INSTITUTION

ADDRESS

CITY   STATE/COUNTRY   ZIP

YOUR NAME AND PHONE NUMBER

MEMBER OR CUSTOMER NUMBER (MAY BE FOUND ON ANY PAST ISSUE LABEL)

DATE YOUR ORDER WAS MAILED (OR PHONED)

_____PREPAID _____CHECK _____CHARGE
               CHECK/CARD CLEARED DATE:_____

(If possible, send a copy, front and back, of your cancelled check to help us in our research of your claim.)

ISSUES: _____ MISSING _____ DAMAGED

TITLE	VOLUME OR YEAR	NUMBER OR MONTH

Thank you. Once a claim is received and resolved, delivery of replacement issues routinely takes 4–6 weeks.

━━━━━ (TO BE FILLED OUT BY APA STAFF) ━━━━━

DATE RECEIVED: _____
ACTION TAKEN: _____
STAFF NAME: _____

DATE OF ACTION: _____
INV. NO. & DATE: _____
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