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Memory awareness following episodic inhibition

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Short article

Memory awareness following episodic inhibition

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Three experiments used directed forgetting (DF) and retrieval practice (RP) to investigate the relation of inhibited items to states of memory awareness occurring at test. In Experiment 1 using list DF robust inhibitory effects were present in cued recall, but in a recognition test these effects were only present in responses accompanied by recollective experience. In Experiments 2 and 3 using RP reliable effects of inhibition were found but these did not relate systematically to states of memory awareness. It is suggested that in DF the to-be-forgotten items are tagged at study as *not to be recollectively experienced* and so have a specific, inhibitory, relation to states of recollective experience occurring during test. In RP no tagging takes place, and inhibition is automatic or nonintentional and consequently does not have a specific relation to states of memory awareness at test.

Keywords: Directed forgetting; Selective practice; Episodic memory; Recollective experience; Retrieval inhibition.

A remarkable finding in the study of human memory is that many of the major memory effects established in laboratory and field studies over the past 30 years are only present when rememberers consciously recollect recently acquired materials (see Gardiner & Richardson-Klavehn, 2000, for a review). If remembering is not accompanied by the experience of recollection (Tulving, 1985; see too Conway, 2005) but instead by some other state of memory awareness, for instance a feeling of familiarity, then standard effects such as level of processing, generation effects, picture superiority

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effects, and many others are not observed. Thus, the state of consciousness termed by Tulving (1985) as *autonoetic consciousness* or *recollective experience* would seem to be integral to many variables known to determine memory performance.

In the present research we investigate whether this requirement for recollective experience is also integral to manipulations that impair memory performance by inducing inhibition of recently studied items. Memory inhibition procedures take essentially two forms: those that feature a conscious intention to forget and those that do not. Our conjecture is that inhibitory manipulations that contain a conscious intention to forget may have a specific relation to later states of memory awareness in remembering. In particular, it may be that episodic memories that are formed under intentional conditions to forget may be marked in some way as *not to be recollectively experienced* (NTBRE). In contrast, episodic memories formed under conditions of inhibition that do not feature a conscious intention to forget may not be marked in this way. It follows then that intentional inhibitory procedures that give rise to episodic memories, or episodic memory content, that are tagged NTBRE should lead to attenuated recollective experience in remembering. Memory inhibitory procedures that do not entail a conscious intention to forget should not result in NTBRE-tagged memories and as a consequence should not vary in any systematic way with recollection.

Here we examine two states of memory awareness operationally referred to as *remember* and *familiarity* or R and F responses. Recollective experience (R) is known to involve the recall of highly specific details, usually in the form of visual or other modes of imagery (Gardner, Richardson-Klavehn, & Ramponi, 1998). It features a strong sense of the self in the past, and attention turns inwards to focus on the memory construction (Conway, 2005; Tulving, 2002). Familiarity (F) on the other hand is a distinct state of conscious memory awareness that does not have these features and instead is characterized by a strong feeling that some item in the current environment has been encountered recently. We hypothesize that tasks that intentionally induce memory inhibition will impair or reduce R responses but leave F responses unaffected. We also further conjecture that intentionality of remembering may be important here too and that inhibition will be greater in voluntary than in involuntary remembering. This may in part be because the aim of voluntary remembering is to recollectively experience the past.

EXPERIMENT 1

In this experiment we used *directed forgetting* (DF) to induce inhibition of a recently learned list of words (see E. L. Bjork & Bjork, 1996, and R. A. Bjork, 1989, for a review of the DF procedure and MacLeod, 1998, for a more general review of DF). The specific procedure used was DF by lists. In the DF by lists procedure two lists are studied for later recall, and a surprise midlists instruction designates the first list as to be forgotten (TBF) or to be remembered (TBR). The exact procedure followed here is that of Conway, Harries, Noyes, Racsmány, and Frankish, (2000). However, one change to the procedure of Conway et al., is that we use a within-subjects design and refer to the two memory instruction manipulations as the directed forgetting or DF condition and the directed remembering or DR condition. In order to examine memory awareness during remembering three different memory tests were conducted: list cued recall, word stem completion, and a recognition test.

In the cued-recall test List 1 was always recalled first. This test assesses the effect of the forget instruction, by comparing TBF List 1 with TBR List 1 memory performance, while minimizing any potential output interference from memory for List 2 (Conway et al., 2000; Racsmány & Conway, 2006). The word stem completion test was based on a similar test used by Richardson-Klavehn and Gardiner (1996). In this test word stems were completed with words studied on the earlier lists (voluntary or intentional condition). If a stem could not be completed in this way it was completed with any appropriate word that could be generated. When this word was in fact a word from the earlier lists then this constituted involuntary recall. Finally, a recognition test for the two lists was undertaken, and for every word judged to be "old" the state of memory awareness, R or F, accompanying that judgement was recorded.

Method

Participants

A total of 27 undergraduate Hungarian students from the Technical University of Budapest participated in return for partial credit in an introductory psychology course. Their ages varied between 19 and 25 years, and there were 16 females and 11 males.

Procedure

Participants were tested individually and were informed that they were taking part in a memory experiment and that their memory for the studied items would be tested later. The order of the mid-lists forget/remember instructions was counterbalanced between individuals. In the study phase the TBR words were presented visually on a computer screen. Each word was displayed for 2 s with a 2-s interitem interval. After the first 12 words had been presented, the participants were instructed to stop. At this point participants in the DF condition were given the following forget instruction: "The list you have just studied was a practice list to familiarize you with the experimental procedure. You should now forget these words, try to put them out of your mind. The experimental list will be presented now." In the DR condition the same procedure was followed but the midlists instruction was: "That is the end of List 1. You must try to keep those words in mind while you learn the second list which will be presented now."

After all words had been studied participants were given a 5-minute arithmetic distractor task. The distractor task was followed by the cued recall test. Participants were given a sheet of paper and were instructed to try to recall as many words as they could from both lists. They were asked to start at the top of the page and write each recalled word under the previous word. In order to reduce the role of output interference effect in recall performance we followed the recall instruction of Conway et al. (2000, Exp. 7): Participants had to recall List 1 words first and then List 2 words. Every participant took part in both the DF and the DR conditions, and the order of conditions was counterbalanced among participants. We used four experimental learning lists consisting of words of moderate to high frequency. The order of presentation of the lists was random for each participant. Each study list contained 12 items.

After free recall participants completed the word stem test (based on David & Brown, 2003). This test consisted of 24 word stems, e.g., "ta__" for *table*, and each word stem could be completed with at least two different Hungarian words. The order of presentation of the stems was randomized for each participant. Participants were instructed to complete the stems with words that they had previously studied. If able to do so, participants were then asked to provide a second word stem completion, thus indicating that their first completion was based on recall—that is, voluntary conscious memory. If they were unable to complete the stem with a studied word, participants were asked to complete the stem with the first word that came to mind. Some participants might complete the stem with the first word item coming to mind and then recognize that completion as a studied word. To indicate such occurrence, participants were instructed to place an asterisk next to the completed item. The recognition test consisted of 48 items with 24 studied (old) and 24 unstudied (new) items (every new word had a first syllable that corresponded to a syllable in one of the studied items). For every item judged to be "old" participants also indicated the basis of their judgement, R or F, following standard instructions (see Gardiner et al., 1998).

Results and discussion

In the list cued recall the critical interaction of List × Cue was present, $F(1, 26) = 26.47$, *MSE* equals; 1.48, $p < .01$. DF List 1 recall was found to be reliably poorer than DR List 1, $t(1, 26) = 11.2$, $p < .01$ (Table 1). Together this pattern shows a strong and reliable DF effect. There were no reliable effects of voluntary versus involuntary

Table 1. *Mean percentages of memory performances in Experiment 1*

	DF		*DR*	
	List 1	*List 2*	*List 1*	*List 2*
Cued recall	*29.7* (12.3)	40 (19.1)	42.3 (19.6)	28.4 (20.1)
Voluntary recall	36.3 (17.6)	37.7 (18.1)	43.4 (13)	39.9 (18.6)
Involuntary recall	6.1 (4.6)	8.1 (5.1)	7.8 (6.1)	9.7 (7.4)
Recognition hits	83 (16.5)	83.9 (11.4)	86.7 (13.2)	82.4 (14.2)
"Remember" responses	*58.4* (25.8)	68 (22.4)	74.4 (28)	63.1 (29.9)
"Familiarity" responses	39.5 (26.1)	31 (23.3)	25.6 (28)	36.9 (29.9)

Note: Standard deviations are presented in parentheses. DF refers to the directed forgetting condition; DR refers to the directed remembering condition. Figures in italics reflect significant to-be-forgotten memory impairment compared to control and to-be-remembered scores.

recall for List 1 compared to List 2 in either condition, $F(1, 26) = 1.7$, $MSE = 0.32$, $p > 0.1$, and $F(1, 26) = 2.8$, $MSE = 0.2$, $p > 0.1$, respectively (Table 1). Similarly, there was no overall effect of DF in recognition, $F(1, 26) = 1.14$, $MSE = 1.1$, $p > 0.1$. A post hoc analysis of power for the critical contrast of List 1 performance in DF and DR conditions showed that with an alpha at .05 the calculated power is 0.66, indicating that the lack of difference in the recognition task was not due to low power (Erdfelder, Faul, & Buchner, 1996).

More interesting was that a powerful DF effect was found in recognition accompanied by recollective experience, R responses, $F(1, 26) = 21.78$, $MSE = 1.45$, $p < .01$. For R responses, DF List 1 recall was found to be reliably poorer than DR List 1. An inversed DF effect was observed in F responses, $F(1, 26) = 19.65$, $MSE = 0.33$, $p < .01$ (see Table 1). These findings quite clearly demonstrate a strong DF effect when remembering is accompanied by recollective experience, but not when it is accompanied by feelings of familiarity. The voluntary/involuntary dimension appeared to be orthogonal to the DF effect and was dominated by a powerful recency effect in both DF and DR groups.

In the directed forgetting paradigm the standard finding with free recall is that the forget instruction decreases the level of first-list items and increases recall of second-list items compared to the condition in which only the remember instruction was used. Another usual finding in this procedure is that the effect of the forget instruction generally observed in free recall is abolished in recognition. This pattern was observed in Experiment 1 where significant and standard directed forgetting effect was found in free recall but not in recognition. In a further analysis of recognition performance it was found that the specific effect of forget instruction was present in "R" items and reversed for "F" items.

EXPERIMENT 2

This second experiment uses the retrieval practice procedure of Anderson, Bjork, and Bjork (1994). In this procedure participants practise selectively recalling items from a previously studied list. The effects of this selective practice are to induce inhibition of closely associated items in a memory of the original study list (Racsmány & Conway, 2006). Memory for these unpractised items is reliably poorer than memory for baseline items. Our question is: Will this effect only be presented in R responses as was the case with DF?

Method

Participants

A total of 48 undergraduate Hungarian students from the Technical University of Budapest participated in return for partial credit in an introductory psychology course. Their ages varied between 18 and 29 years, and there were 27 females.

Procedure and materials

Following Anderson et al. (1994) we constructed 10 categories, 2 of which were used as fillers. Each category consisted of 12 exemplars from each of 8 target categories forming two subsets (6 items) with moderate-to-high-frequency words drawn from two published Hungarian frequency norms (Füredi & Kelemen, 1989; Kónya & Pintér, 1985). The categories chosen were: animals, fruits, sports, cooking utensils, clothes, musical instruments, professions, and reading materials (fillers: flowers, nations). For each category, two counterbalancing sets of 6 items were each created and used an equal number of times as targets versus lures on recognition task. Each item in the first subset had a first syllable that corresponded to a syllable of an item in the other subset. We created two subsets from the 8 target categories and designated them an equal number of times as practised and nonpractised categories. The practised and nonpractised exemplars were counterbalanced as well. There were four phases to the experiment.

Phase 1: Study. A PC controlled the study phase. The participants saw category–exemplar pairs on the monitor screen, and they were told to try to remember the category examples as best as they could. Each category exemplar pair was presented in uppercase letters at the centre of the screen for 5 seconds.

Phase 2: Retrieval practice. When participants had completed the study phase, the experimenter distributed retrieval practice booklets. Each page in the booklet contained one of the category names studied previously and the first two letters of one member of that category also studied previously. Participants were instructed to complete the exemplar fragment with one of the words they had studied earlier. Participants were told that some of the examples might be tested more than once and that in those cases they should respond with the remembered item.

Phase 3: Filled retention interval. After the retrieval practice phase had been completed, booklets were collected, and participants were given an unrelated mathematical task for 5 minutes.

Phase 4: Recall phase. Participants were given recall booklets with the name of one of the previously studied categories on the top of each page. Participants were instructed to recall as many examples as they could in the 10-minute period allocated for this test. They were constrained to keep the order of categories as they were presented in the recall booklet. Order of presentation of category cues was counterbalanced over participants.

As in Experiment 1, category cued recall was followed by a test list consisting of 48 category label–word stem pairs. Each word stem could be completed with at least two different Hungarian words within the same categories. Order of the presentation of category-plus-stems was random with a different random order for each participant. Using these items voluntary and involuntary memory was assessed in the same way as in Experiment 1.

Phase 5: Recognition phase. Finally, participants took a 96-item recognition test. The target stimuli consisted of 12 exemplars from each of eight target categories with moderate-to-high-frequency words drawn from two published Hungarian frequency norms (Füredi & Kelemen, 1989; Kónya & Pintér, 1985). We created two subsets from the eight target categories and designated each an equal number of times as practised and nonpractised categories. In the recognition list old category exemplar pairs from the study list were mixed with an equal number of new pairs. In this task participants were given category–exemplar pairs for an old–new decision. As in Experiment 1, for every item judged to be "old" participants also indicated the basis of their judgement, R or F, following standard instructions (see Gardiner et al., 1998).

Results and discussion

It can be seen from Table 2 that there was a large effect of retrieval practice on category-cued

Table 2. *Mean percentages of memory performances in Experiment 2*

	Rp+ items	*Rp− items*	*Nrp items*
Category-cued recall	76 (17.3)	*46.7* (18.5)	55.7 (13.5)
Voluntary recall	83.5 (17.1)	*57.2* (19.1)	65.2 (17.5)
Involuntary recall	7.7 (8.4)	10.3 (10.9)	12.1 (9.6)
Recognition hits	93.5 (7.1)	*84.1* (15.1)	89.3 (8.4)
False alarms	21.1 (20)	23.8 (16.8)	25.8 (19.6)
"Remember" response	63.7 (27.8)	61.3. (26.3)	61.8 (20.3)
"Familiarity" response	35.9 (28.2)	38.7 (26.3)	37.8 (28.2)

Note: Standard deviations are presented in parentheses. Rp+ = items that received retrieval practice; Rp− = items from practised categories that were themselves not retrieval practised; Nrp = items that were not from categories that contained an item that received retrieval practice. Figures in italics reflect significant to-be-forgotten memory impairment compared to control and to-be-remembered scores.

recall. This main effect of item type was reliable, $F(2, 94) = 81.4$, $MSE = 0.99$, $p < .01$, and so was the critical contrast of Nrp items (items that were not from categories that contained an item that received retrieval practice) with Rp− items (items from practised categories that were themselves not retrieval practised), $t(1, 47) = 4.18$, $p < .01$. There was then a robust retrieval practice effect similar to that observed in many previous studies (for recent findings showing this effect, see Racsmány & Conway, 2006). In terms of voluntary versus involuntary recall there were no comparable effects of retrieval practice, although the critical contrast of Nrp and Rp− items was significant in voluntary cued recall, $t(47) = 2.04$, $p < .05$, but not in the involuntary recall, $t(47) = 0.1$, $p = .8$. As this manipulation has produced mainly null effects in both experiments we conclude that this task is not sensitive to these manipulations, and, therefore, we do not discuss it further. Although memory performance increased markedly in the recognition test, see Table 2, the effects of retrieval practice observed in recall were maintained in recognition, $F(2, 94) = 8.84$, $MSE = 4.2$, $p < .01$, Finally, and of particular interest to the present study, there were no reliable effects of retrieval practice in R and F responses. Memory performance for items recognized with recollective experience was higher than that of items recognized with familiarity: a difference that did not vary significantly over Rp+ (items that received retrieval practice), Nrp, and Rp items, $F(2, 94) = 0.59$, $MSE = 3.39$, $p > .1$; a post hoc analysis of power for the omnibus ANOVA of recognition data revealed that the lack of significant difference was not due to sample size, partial eta squared = .21, critical $F = 3.64$; power = 0.9 (Erdfelder et al., 1996). Thus, unlike the DF effect, the effects of retrieval practice were only present in overall responses and were not selectively confined to R responses.

In summary it was found that prior retrieval of Rp+ items facilitated later retrieval of those items, but decreased the recall of Rp− items relative to the Nrp baseline items. The same pattern was observed in voluntary cued recall and recognition, but not in involuntary cued recall. Critically there was no interaction between the selective practice effect and the recollective judgement of "R" and "F" items in the recognition test. This pattern of data suggests that previous inhibitory consequence of selective practice influences "F" and "R" items equally.

EXPERIMENT 3

In this third experiment we modified the retrieval practice procedure of Experiment 2 in two ways. In Experiment 3 the recognition task preceded cued recall, and we measured not only hits and false alarm rates but also reaction times of recognition decisions.

Method

Participants

A total of 48 undergraduate Hungarian students from the Technical University of Budapest participated in return for partial credit in an introductory psychology course; 4 participants were later discarded as they misunderstood the instruction and exchanged key presses during the recognition task. Their ages varied between 21 and 28 years, and there were 20 females.

Procedure and materials

As in Experiment 2 we constructed 10 categories, 2 of which were used as fillers. The target stimuli consisted of 12 exemplars from each of 8 target categories with moderate-to-high-frequency words drawn from two published Hungarian frequency norms (Füredi & Kelemen, 1989; Kónya & Pintér, 1985). The categories chosen were: animals, fruits, sports, clothes, musical instruments, professions, flowers, nations, and reading materials (fillers: colours, vehicles). Following the procedure of Hicks and Starns (2004) for each category, two counterbalancing sets of 6 items were created and used an equal number of times as targets versus lures in the recognition test. We created two subsets from the 8 target categories and designated each an equal number of times as practised and nonpractised categories. The practised and nonpractised exemplars were counterbalanced. As in Experiment 2 participants viewed category–exemplar pairs on the monitor screen and were instructed to try to remember the category examples as best as they could. Each category–exemplar pair was presented in uppercase letters at the centre of the screen for 5 seconds. A computer program was used to present the study list, and the same program was used to present the recognition task and to record participant's responses. When participants had completed the study phase, they took part in the practice and unrelated filler tasks used in the previous experiment. Following this they took the recognition test. In this test participants were given individual items for an old–new decision (category cues were not used). Each word remained on the computer screen until the person responded with a maximum response window of 2 seconds. We applied a relatively strict response window to force participants to respond as fast as possible in order to detect minor reaction time differences between conditions. Nevertheless, the 2-s response window is far above the average response time (700–1,200 ms) observed in previous recognition studies (see MacLeod, 1999). If participants responded "old" they also indicated whether the response was based on remembering, knowing, or guessing (R, K, or G) using labelled keys. At the beginning of the test participants were given both written and verbal instructions. They also practised the response keys using the filler exemplars and associated new words. Standard remember–know instructions were used (Gardiner et al., 1998). Finally, after the recognition test participants took part in a category cued recall as in Experiment 2. Order of presentation of category cues was counterbalanced across participants.

Results and discussion

It can be seen from Table 3 that RP had a positive effect on recognition performance of Rp+ items, $F(2, 86) = 38.9$, $MSE = 0.5$, $p < .01$; however, the inhibitory effect of RP on the Rp− hits observed in Experiment 2 was not present in this experiment. The critical contrast of Nrp with Rp− items did not show a reliable difference, $t(1, 43) = 0.22$, $p > .1$. A post hoc analysis of power for the recognition data revealed that the failure to find a significant difference was not due to small sample size, partial eta squared = .64, critical $F = 3.09$; power = 0.9. This finding, which it might be noted runs counter to the findings of Hicks and Starns (2004), is not wholly unexpected as the RP effect is not always observed in recognition memory hits (Koutstaal, Schacter, Johnson, & Galluccio, 1999). The same is also true of DF effects (see MacLeod, 1998). The standard explanation is that the copy cues used in recognition memory tests overcome inhibitory effects (E. L. Bjork & Bjork, 1996). In RP this appears to be case in at least some studies

Table 3. *Mean percentages of recognition accuracy, means of RT medians, and means of cued-recall performance in Experiment 3*

	Rp+ items	*Rp− items*	*Nrp items*
Recognition hits	92.3 (9.1)	73.5 (15.5)	74.1 (13.4)
False alarms	7.9 (7.1)	7.9 (7.1)	8.1 (7.4)
"Remember" responses	70.3 (20.8)	70.7 (21.5)	70.5 (21.2)
"Know" responses	25 (18.8)	21.7 (17.3)	21.6 (18.7)
"Guess" responses	4.7 (7.5)	7.6 (11.9)	7.9 (9.3)
Recognition RTs	1,006.1 (217.1)	*1,131.9* (254.4)	1,012.7 (212.9)
Category-cued recall	76.4 (13.6)	57.5 (16.6)	60.1 (14.2)

Note: Standard deviations are presented in parentheses. RT (reaction time) medians in ms. Figures in italics reflect significant to-be-forgotten memory impairment compared to control and to-be-remembered scores.

although systematic RP effects in recognition have been observed in other series of experiments—see, for example, Racsmány and Conway, (2006). Despite the lack of an RP effect in hits there was a strong effect in reaction times. Table 3 shows the mean RTs of recognition decisions, and it can be seen that these varied over Rp+, Nrp, and Rp− items and that this effect was reliable, $F(2, 86) = 18.4$, $MSE = 2220.5$, $p < .001$. Recognition of Rp− items was a full 100 ms slower than recognition of Nrp items, and this difference was also reliable, Tukey HSD test, $df = 86$, $p < .01$. Thus, it seems that although the copy cues of the recognition test were effective in overcoming the inhibition induced by RP, inhibition was nonetheless still present in access times to inhibited items. This is interesting as it suggests that despite previous inconsistent findings in amount of Rp− items recognized there may be an additional and more consistent effect present in retrieval times. The powerful copy cues present in a recognition test may, then, overcome RP induced inhibition but the inhibitory effect of the RP manipulation remains in access times to memory details (list items).

Crucially, for present concerns, memory performance for items recognized with recollective experience was reliably higher than that of items recognized with familiarity or guess, $F(2, 86) = 295.9$, $MSE = 8.8$, $p < .001$, but this did not vary significantly over Rp+, Nrp, and Rp− conditions, $F(2, 164) = 0.76$, $MSE = 2.2$, $p > .1$. This result replicates the findings of Experiment 2 and further demonstrates that there is no systematic relation between RP and recollective experience at test.

Finally there was no RP effect in category-cued recall: The main effect of item type was reliable, $F(2, 86) = 36.18$, $MSE = 0.46$, $p < .01$, showing elevated recall of Rp+ items relative to the other two conditions, but the critical contrast of Nrp with Rp− items was not significant, $t(1, 47) = 1.18$, $p > .1$. The results in cued recall are highly similar to those in the recognition hits rates and most probably are so because of the effect of the recognition test in releasing RP-induced inhibition.

Changing the sequence of recognition and recall tasks in this experiment yielded significant differences in the pattern of data. This time we found no significant difference between Rp− and Nrp baseline items in recognition hits, but found a strong difference in retrieval times: Recognition of Rp− items was reliably slower then recognition of Nrp baseline items. Another difference relative to the previous results was that we did not find the critical difference of Nrp and Rp− items in cued recall either. However, the most important finding of the present experiment was that retrieval practice had no differential effect on R and K items and in this respect quite clearly differs from directed forgetting.

GENERAL DISCUSSION

In the three experiments we found robust effects of directed forgetting (DF) and retrieval practice (RP). In DF items on a list designated as TBF were poorly recalled compared to baseline. This effect was, however, only present for items associated with recollective experience at recall. In RP items semantically associated with practised items but that were themselves not practised were recalled to reliably lower levels than baseline items (Experiment 2). This was the case in responses overall but, unlike DF, there was no selective effect in items recollectively experienced in the recognition test. As hypothesized earlier this pattern of findings suggests that two tasks may have rather different relations to memory awareness in later recall.

According to *episodic inhibition* (Racsmány & Conway, 2006) recall patterns resulting from both DF and RP are mediated by an episodic memory of the study phase. This memory represents patterns of activation that predominated in conceptual and other knowledge networks during study. In the case of DF the explicit instruction to forget gives rise to a general attempt to inhibit the recently acquired list but this is usually unsuccessful unless followed by second-list learning (R. A. Bjork, 1989). During second-list learning a few items, probably fewer than one or two (Conway et al., 2000), spontaneously come to mind and in so doing trigger further inhibition of List 1 items. A critical point here is that in order for this to occur, TBF List 1 items have to be identifiable, in some way, as TBF. In contrast, in RP there is no explicit instruction to forget, and studied items can, in principle, be brought to mind at any time in the practice phase. Indeed, informal enquires of our participants indicated that this does occur at least occasionally on some trials. We assume, however, that as the practice increases such intrusions become much less frequent, and this is because the repeated recall of the practice items repeatedly induces inhibition of closely associated items represented in the episodic memory of the study phase. The important point then is not that Rp− items may intrude into RP but rather that when they do they are not identified as TBF. They may become TBF in order to reduce interference with Rp + items but this is almost certainly a nonconscious process that does not require an explicit intention to forget.

Our suggestion is, then, that in DF List 1 studied items represented in an episodic memory of the study phase are marked as TBF. In particular, and as argued earlier, we propose that these episodic representations are specifically tagged not to be recollectively experienced—NTBRE. It may be that rather than individual items in the episodic memory being tagged NTBRE the entire memory is tagged, and the contents of the memory inherit the tag. Thus when the episodic memory is accessed in cued recall its contents are more difficult to access than those of a comparable untagged memory (memory for List 1 in the remember group, for example). Interestingly, the contents of a memory tagged NTBRE can still strongly influence performance in tasks that do not require conscious recall—for example, stem completion, lexical decision, and so on (E. L. Bjork & Bjork, 1996; Perfect, Moulin, Conway, & Perry, 2002; Racsmány & Conway, 2006). These findings lend further support to the NTBRE tagging idea because they show that it is the explicit conscious representation of inhibited memories that is affected by intentions to forget.

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