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Directed Forgetting of Recently Recalled Autobiographical Memories

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In 6 experiments, the authors investigated list-method directed forgetting of recently recalled autobiographical memories. Reliable directed forgetting effects were observed across all experiments. In 4 experiments, the authors examined the impact of memory valence on directed forgetting. The forget instruction impaired recall of negative, positive, and neutral memories equally, although overall, participants recalled fewer unemotional memories than emotional memories. The preexisting organization of memories enhanced the directed forgetting effect, and a release from forgetting occurred only when the forgotten memories were directly cued. The authors discuss the roles of emotion, retrieval dynamics, and organization in these effects and suggest that the directed forgetting of recently recalled autobiographical memories may reflect the inhibition of recently formed memories of remembering, that is, episodic inhibition. The authors consider the implications of these findings for the control of autobiographical remembering in everyday life.

Keywords: directed forgetting, autobiographical memory, retrieval inhibition, emotional memories, personal forgetting

A fundamental problem for any memory system is how to make appropriate information available when it is required, especially when similar, associated items compete for retrieval. As R. A. Bjork (1989; see also Abra, 1972) pointed out, a driver needs to remember where he or she parked his or her car today, not yesterday or the day before, or even where he or she habitually parks it. This problem may partly be solved by goal-directed, or intentional, forgetting, which has been studied in the laboratory with a variety of relatively simple procedures, including directed forgetting (E. L. Bjork, Bjork, & Anderson, 1998; MacLeod, 1998; Sahakyan & Delaney, 2005; Sahakyan & Kelley, 2002), retrieval-induced forgetting (Anderson, 2004; Anderson, Bjork, & Bjork, 1994; Barnier, Hung, & Conway, 2004), and the recent think/no-think task (Anderson & Green, 2001). Here, we focused on the directed forgetting task and examined its effectiveness in the management of a particularly important form of human long-term knowledge: autobiographical memory.

The intentional forgetting of recently acquired, relatively simple information, as opposed to the intentional forgetting of more complicated representations of autobiographical memories (cf., Conway, 2005; Conway & Pleydell-Pearce, 2000), has been demonstrated repeatedly with the directed forgetting procedure. List-method directed forgetting measures individuals' recall of material that they learn first but are then instructed to intentionally forget relative to their recall of items that they learn second and are instructed to intentionally remember (for review, see E. L. Bjork et al., 1998; MacLeod, 1998). In the standard procedure, participants are presented with two lists of items to study (List 1 and List 2). After List 1, but before List 2, half the participants are told to forget List 1 items (forget group), and half are told to remember the items (remember group). Both groups are told to remember List 2 items, which then follow.[1] Later, participants try to recall all items from both lists. Participants in the forget group typically

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[1] The directed forgetting paradigm can also be implemented with an item method, which involves a cue to forget or remember after each item (rather than only one interlist forget or remember cue). Basden and Basden (1998) argued that whereas item-method directed forgetting indexes encoding failures, list-method directed forgetting indexes retrieval failures.

recall fewer (to-be-forgotten) List 1 items than have participants in the remember group. For instance, Conway, Harries, Noyes, Racsmány, and Frankish (2000; Experiment 1) used two 10-item word lists (that named common, unrelated objects and locations) and reported a List 1 recall of 32% for the forget group and 67% for the remember group; that is, the forget instruction impaired the recall of the forget group to approximately 50% below the baseline performance of the group instructed to remember (see also Basden & Basden, 1998; MacLeod, 1998).

This directed forgetting effect has been interpreted as evidence of retrieval inhibition, whereby the instruction to forget triggers inhibitory mechanisms that temporarily reduce the accessibility, rather than the availability, of List 1 information in memory. Memories that are available and accessible can be consciously brought to awareness (as indexed by explicit memory tests), memories that are available but not currently accessible remain outside of awareness but may influence ongoing experience (as indexed by implicit memory tests; Schacter, 1987), and memories that are neither available nor accessible influence neither conscious processes nor unconscious processes (Tulving & Pearlstone, 1966; see also R. A. Bjork, 1989; Johnson, 1994; Kihlstrom & Barnhardt, 1993; for comments on procedures that may inhibit availability, see Anderson & Green, 2001; Anderson & Spellman, 1995; Barnier, Hung, & Conway, 2004). The impact of directed forgetting on accessibility, and not on availability, has been demonstrated by findings that the forget instruction influences explicit, but not implicit, memory tests (Basden, Basden, & Gargano, 1993; E. L. Bjork & Bjork, 1996; Perfect, Moulin, Conway, & Perry, 2002; Racsmány & Conway, 2006) and that re-presenting specific cues related to the targeted items in, for example, a recognition test can abolish the effect (E. L. Bjork & Bjork, 1996; Conway et al., 2000).

Recall of the to-be-remembered List 2 items is sometimes enhanced after the forget instruction, arguably because the inhibition of List 1 items releases List 2 items from proactive interference (Anderson, 2005; E. L. Bjork et al., 1998). Sahakyan and Delaney (2005) referred to the impaired recall of List 1 items as the costs of directed forgetting, to the enhanced recall of List 2 items as the benefits of directed forgetting, and to the costs and benefits together as the directed forgetting effect. According to inhibitory accounts, the costs and benefits of directed forgetting are due to the operation of a single factor, retrieval inhibition, which is initiated by an intention to forget (in response to the forget instruction) and by two sets of information, List 1 and List 2, which have the potential to compete in later recall (Anderson, 2005; Anderson & McCulloch, 1999; E. L. Bjork et al., 1998; Conway et al., 2000). According to alternative, two-factor accounts, the costs of directed forgetting are due to context change, and the benefits are due to strategy shift (Sahakyan, 2004; Sahakyan & Delaney, 2003, 2005; Sahakyan, Delaney, & Kelley, 2004; Sahakyan & Kelley, 2002; see also, MacLeod, Dodd, Sheard, Wilson, & Bibi, 2003). In these two-factor accounts, researchers attempt to explain why enhanced recall of List 2 memories following the forget instruction (List 2 benefits) are not always observed (Conway et al., 2000; MacLeod, 1998).

Laying aside these explanations, the directed forgetting effect, particularly with word lists, is sufficiently robust (albeit with certain boundary conditions; Conway et al., 2000) that the procedure has been used to investigate intentional forgetting and memory control across a range of areas (e.g., E. L. Bjork & Bjork, 2003; Conway & Fthenaki, 2003; Elzinga, Phaf, Ardon, & van Dyck, 2003; Kimball & Bjork, 2002; Moulds & Bryant, 2002). In particular, directed forgetting has been promoted as one way to investigate the relationship between traumatic life events and disrupted personal memory (Anderson & Green, 2001; E. L. Bjork et al., 1998; Koutstaal & Schacter, 1997; Levy & Anderson, 2002; Wessel & Merckelbach, 2006). There is evidence that individuals are motivated to avoid or forget upsetting memories from their past, and some clinical disorders suggest that there is an extreme avoidance of, and amnesia for, such material (Brewin, 2001; Conway & Pleydell-Pearce, 2000; Kihlstrom & Schacter, 1995; Wenzlaff & Wegner, 2000; but for alternative explanations, see McNally, 2003; Pope, Hudson, Bodkin, & Olivia, 1998; Spanos, 1996). If directed forgetting in the laboratory is similar to the everyday forgetting and/or pathological forgetting that occurs outside the laboratory, then this procedure offers a powerful analogue to researchers. Currently, however, there is little evidence that the standard directed forgetting procedure can be used to attenuate autobiographical remembering in the same way that it can be used to attenuate simple verbal materials.

Almost all research to date in which the standard procedure was used has involved recently acquired, simple verbal information, such as lists of unemotional words. In contrast, autobiographical memories are long-term, complex memory representations, which are not only highly organized in an associative network but often highly emotional and strongly related to the self (Conway, 2005; Conway & Pleydell-Pearce, 2000; McAdams, 2001). A directed forgetting instruction may or may not create genuine and significant disruptions of such complex, emotional, and personal material. Conway (2001a) argued that if laboratory paradigms can generate a powerful inhibition of low self-relevant stimuli, such as word pairs, then this will perhaps extend to personally relevant and emotional information and memories (for discussion of the link between autobiographical memory and emotion; see, for instance, Christianson, 1992; McNally, 2003; Waldvogel, 1948). Recent research by Wessel and Merckelbach (2006) and Joslyn and Oakes (2005) has suggested that list-method directed forgetting of emotional autobiographical memories might be possible.

In a recent experiment on directed forgetting of emotional and unemotional words, Wessel and Merckelbach (2006) asked participants to learn either a list of 15 negative words such as *murder* or a list of 15 neutral words such as *circle*. After List 1 presentation, the participants were instructed either to forget the first list and to concentrate on learning a second list or to try to remember both lists. The experimenter then presented List 2, which consisted of either 15 negative words or 15 neutral words. Wessel and Merckelbach reported a List 1 recall of 40% for both the forget-negative and forget-neutral groups, compared with a List 1 recall of 53% for the remember-negative group and 58% for the remember-neutral group. That is, the forget instruction impaired recall of both negative and neutral words to approximately 25%–31% below the baseline performance of the group instructed to remember. Importantly for our present research, the forget instruction was equally successful for emotional and unemotional material.

In the only published experiment on directed forgetting of autobiographical material, albeit within a diary paradigm outside the laboratory, Joslyn and Oakes (2005) asked participants to keep a daily diary of memorable events for 2 weeks. After the 1st week of keeping the diary, participants returned to the laboratory and were instructed either to forget or to remember the last week's (Week 1) events and to remember the upcoming week's (Week 2) events. After the 2nd week of keeping the diary, participants returned and were asked to recall both Week 1 and Week 2 events. Participants in the forget group recalled fewer events from Week 1 than participants in the remember group recalled. This experiment suggests that autobiographical events may be intentionally forgotten. However, Joslyn and Oakes's (2005) diary methodology offered less control than that offered by standard laboratory procedures for the investigation of the parameters and mechanism of a directed forgetting effect.

Thus, the following question is at the center of the research reported here: Can directed forgetting, indexed by the standard list-method laboratory procedure, be extended to autobiographical memories in general and to emotional memories in particular? To answer this, we adapted the list-method of directed forgetting to recently recalled autobiographical memories. We based our adaptation on Barnier, Hung, and Conway's (2004) successful adaptation of the retrieval-induced forgetting procedure. In the standard retrieval-induced forgetting procedure, participants study a series of category cue–exemplar word pairs (e.g., *fruit–orange*, *fruit–banana*), and during the critical phase, they practice retrieving half the exemplars from half the categories (e.g., *fruit–orange*). Later, they try to recall all exemplars associated with each category cue (Anderson, 2004; Anderson et al., 1994; Anderson & Spellman, 1995; Perfect et al., 2002). To modify retrieval-induced forgetting for autobiographical memories, Barnier, Hung, and Conway (2004) added Crovitz and Schiffman's (1974) cued recall technique to the standard procedure. Rather than learn category cue–exemplar word pairs, participants recalled specific emotional or unemotional memories from their past in response to negative, positive, and neutral cues presented by the experimenter. As in the standard retrieval-induced forgetting procedure, each cue was associated with a number of memories. During the critical phase, participants practiced retrieving some, but not all, of the autobiographical memories they generated earlier. On the final recall test, participants tried to recall all of their original memories. Barnier, Hung, and Conway's (2004) adaptation was successful: They reported a standard retrieval-induced forgetting effect for recently recalled autobiographical memories.

In the same way that Barnier, Hung, and Conway (2004) adapted the retrieval-induced forgetting paradigm to autobiographical memories, we adapted the standard list-method directed forgetting procedure to autobiographical memories. Using this adapted paradigm, we conducted a series of six experiments involving list-method directed forgetting, in which we aimed to induce forgetting of recently recalled autobiographical memories. Experiment 1 focused on the basic effect of directed forgetting for recently recalled neutral memories. In Experiments 2–6, we built on this foundation by examining theoretically important issues, including the following: (a) the magnitude of directed forgetting across emotional and unemotional memories, in Experiments 3–6; (b) the conditions under which forgetting is released, in Experiment 4; (c) the impact of memory organization on the level of forgetting, in Experiments 2, 5, and 6; and (d) the role of output interference in our effects, in Experiments 1–3.

Experiment 1

In Experiment 1, the basic directed forgetting effect was investigated: Would participants show the standard costs and benefits of an instruction to forget for neutral autobiographical memories? We asked participants to generate 24 specific autobiographical memories in response to two lists of 12 neutral cues, List 1 and List 2. After the participants generated one set of memories to List 1 cues, but before they generated a second set to List 2 cues, we instructed half the participants to forget the memories recalled so far and the other half to keep the memories in mind for later recall. We instructed all participants to remember the List 2 memories. On a final free recall test, immediately after List 2, participants tried to recall all the memories they generated in the elicitation phase, regardless of midlist instruction. Half the participants recalled List 1 memories and then List 2 memories; half recalled List 2 memories and then List 1 memories. We expected a standard directed forgetting effect, where critically, the forget group would recall fewer List 1 memories than the remember group would recall.

Method

Participants and design. We tested 36 members (19 male participants, 17 female participants) of the University of Bristol Volunteer Panel, Bristol, England, in a 2 (group) $\times$ 2 (output order) $\times$ 2 (list) mixed-model design. They participated in return for an honorarium of £5 ($10) per hour, and they ranged in age from 21 to 57 years (M = 34.53 years, SD = 10.09).

Materials. Two 12-item word lists were used to elicit memories. The 24 cues were from a large pool of words used in previous autobiographical memory research in Martin A. Conway's laboratory. The cues named common objects and locations, were of moderate-to-high frequency and high imageability, and more important, they had been found to successfully elicit autobiographical memories from the majority of volunteers who participated in previous memory retrieval experiments. List 1 included the following words: *seaside, garden, countryside, tennis, train, theatre, museum, newspaper, bank, trousers, house,* and *dog.* List 2 included the following words: *cinema, supermarket, library, pub, gym, forest, kitchen, door, airport, university, telephone,* and *television.* Cues were presented visually, and the order of presentation of the word lists was counterbalanced within groups. Within each list, words were randomly intermixed, and serial position was not controlled.

Procedure. Participants were told that they were taking part in a memory experiment that would examine the speed with which people retrieve memories to cues and how well the elicited memories are later recalled. They were tested in small groups (either the forget group or the remember group, but not a mixed group), and each person was seated at a separate computer console. The experimenter explained that the cues would be presented one at a time on the computer screen, and the participants' task was to generate specific memories in response to these words as quickly as possible. Participants were instructed to think of specific memories of experiences, from any area of their life, that occurred at least 1 month ago, and they were encouraged to sample widely from their life. They were also required to give different, unique memories to each cue. A specific memory was defined as a memory "of an event that you directly experienced and that lasted over a period of seconds, minutes, or hours but no longer than 1 day." Participants were told that the cues would be presented in two lists (List 1 and List 2), with a break between the presentations, and that they would be required to recall the cues and memories later in the experiment.

Participants were instructed that following the presentation of each cue, they should indicate when they had a specific, relevant memory in mind by pressing the space bar on the keyboard. They should then turn from the computer to a separate booklet provided by the experimenter and write, next to the printed cue, a brief title for the memory.[2] Participants were instructed to provide a title that, if they read it again later in the experiment, would remind them of the particular memory that they recalled for that cue. They then wrote, in a box provided below the memory title, a short description of who and what the memory involved and where it took place. Next, participants rated each memory (on a 5-point scale) in terms of importance ("How personally important is the recalled event to you?"; from 1 = *not important* to 5 = *amongst the most important experiences I have ever had*), clarity ("How detailed and clear is your memory?"; from 1 = *no images, vague memory* to 5 = *extremely vivid, amongst the most vivid memories I can recollect*), intensity ("What is the degree of emotional intensity of the experience?"; from 1 = *no emotion* to 5 = *extremely intense, amongst the most intensely emotional experiences I have ever had*), and frequency of rehearsal ("How many times have you thought and talked about this memory?"; from 1 = *rarely thought or talked about previously* to 5 = *one of the memories I most frequently think and/or talk about*). They also dated the memory to the nearest year and month. Memory generation latency for each event was measured from the presentation of the cue until participants pressed the keyboard space bar. See the Appendix for a summary of the memory accessibility and memory quality data for Experiment 1 (as well as for Experiments 2–6; see below).

After these instructions, participants pressed the keyboard space bar for the 1st cue from List 1 and engaged in the memory generation, description, rating, and dating cycle until the 12 cues from this list had been presented. Participants were then treated according to their (randomly) allocated directed forgetting groups. Participants in the forget group (n = 17) were informed that List 1 cues were a practice list designed to give them a feel for the experiment and that they "must now put the cue words and memories retrieved to List 1 out of mind and not let them interfere with [their] performance on List 2. In short—forget them and instead concentrate on the upcoming experimental list." Further, they were told that "memory for the second experimental list will be assessed shortly after completion of this phase of the experiment." Individuals in the remember group (n = 19) were informed that they had just completed List 1 and that they would now be shown a second experimental list that would be followed by the recall phase of the experiment, in which they would have to recall all memories and cues from both lists. All participants then pressed the space bar for the 1st cue from List 2 and engaged in the memory generation, description, rating and dating cycle until the 12 words from this list had been presented. Note that once a memory had been recalled, described, and rated, participants turned the page of the response booklet over, face down, and this booklet was not viewed again in the experiment.

Immediately after this task, participants were given a single sheet of paper and asked to start at the top of the page and to recall all the memories they generated earlier. Individuals (randomly) allocated to the *List 1 first* group (n = 18) were instructed to recall as many memories as they could from List 1 first and only when they had completed this, to recall memories from List 2. Individuals (randomly) allocated to the *List 2 first* group (n = 18) were instructed to recall List 2 memories first, followed by List 1 memories. All participants were instructed to write a brief memory description that provided enough information (e.g., who, what, where, and when) so that recall during this phase could be checked against their earlier recall. When they had written a memory description, they were also asked to write the cue that had originally elicited the memory. Participants were told that if they could remember only the memory or only the cue, they should write it but they should try to recall both the memories and their associated cues. Participants continued working until they could recall no more; this part of the experiment typically lasted 15–20 min. Finally, the experimenter debriefed participants, answered their questions, and thanked them for their participation.

A response was scored as correct only if both the cue and the memory description from the free recall test phase were judged to correspond to the cue and memory description from the study phase. Exact correspondences were not required, although only minor variations in cues were accepted as correct, and there had to be a clear relation between the two memory descriptions (i.e., they had to mention at least some of the same information and unambiguously refer to the same event). Thus, recalling a cue as *The Times* when in fact it had been *newspaper* was classified as correct, whereas recalling it as *a magazine* was classified as incorrect. Instances in which the memory description at the test phase did not unambiguously refer to the same event that was described at the study phase were classified as incorrect. The majority of participants in this and the following five experiments recalled both the memory and its associated cue, and differences between the two sets of descriptions and cues were rare (less than 1%). There were few instances (also less than 1%) in which they recalled only one or the other. When participants failed to recall, they generally omitted both the memory and the cue.

Results and Discussion

Table 1 shows the mean proportion of List 1 and List 2 memories recalled correctly in Experiment 1 (as well as in Experiments 2 and 3; see below). For all experiments, recall was a proportion of generated memories. For all experiments, List 1 memories (forget vs. remember) and List 2 memories (forget vs. remember) were analyzed separately. There was no formal within-subjects comparison of List 1 versus List 2 because of the confounding of list order; List 1 presentation always preceded List 2 presentation (Anderson, 2005). It is worth noting, however, that investigators have predicted and reported that the forget group's recall of List 1 memories may be poorer than their recall of List 2 memories (R. A. Bjork, 1989; Conway et al., 2000).

[2] To minimize self-editing during memory generation, we asked participants in all experiments to provide only a very brief description of the events and specifically instructed them not to disclose private, personal details.

Table 1
Proportion of Memories Recalled Correctly by Directed Forgetting Groups

	List 1		List 2	
Group	*M*	*SD*	*M*	*SD*
	Experiment 1			
List 1 first				
Forget	.73	.14	.77	.15
Remember	.86	.09	.78	.18
List 2 first				
Forget	.66	.22	.79	.26
Remember	.76	.15	.75	.15
Overall				
Forget	.70	.18	.78	.20
Remember	.81	.14	.76	.16
	Experiment 2			
List 1 first				
Forget	.72	.15	.50	.18
Remember	.92	.10	.70	.13
List 2 first				
Forget	.80	.21	.55	.29
Remember	.88	.10	.48	.22
Overall				
Forget	.76	.18	.53	.23
Remember	.90	.10	.59	.21
	Experiment 3			
List 1 first				
Forget	.46	.22	.67	.19
Remember	.57	.15	.66	.20
List 2 first				
Forget	.36	.20	.67	.12
Remember	.60	.19	.61	.12
Overall				
Forget	.42	.21	.67	.16
Remember	.58	.17	.63	.15

For List 1 memories, a 2 (group) × 2 (output order) factorial analysis of variance (ANOVA) indicated that the forget group recalled fewer List 1 memories than the remember group recalled, $F(1, 32) = 5.06$, $p = .031$, $\eta_p^2 = .137$ (see Table 1).[3] There was no main effect of output order, $F(1, 32) = 2.99$, $p = .094$, and no Group × Output Order interaction, $F(1, 32) = 0.07$, $p = .791$. Directed forgetting of List 1 memories was not due to output order. For List 2 memories, a similar 2 (group) × 2 (output order) ANOVA showed no significant main or interaction effects (Fs $<$ 0.17, ps $>$ .681).[4] The forget and remember groups recalled a similar number of List 2 memories (see Table 1). These findings indicate reliable, albeit modest, List 1 costs of directed forgetting for recently recalled autobiographical memories, similar to that seen for word lists (Conway et al., 2000). Unlike the findings for word lists, however, there were no List 2 benefits. Also, recall levels were somewhat higher in all conditions than those usually observed in directed forgetting experiments involving verbal materials (Conway et al., 2000). This latter difference between memory for recently studied lists of words and memory for recently recalled sets of autobiographical events may be due to deeper levels of processing, memory distinctiveness, memory organization, or self-reference. Word lists and autobiographical memories may also differ in terms of emotional valence. We considered the impact of memory distinctiveness and organization on directed forgetting in Experiments 2, 5, and 6, and the impact of memory valence in Experiments 3–6.

Experiment 2

In Experiment 2, we investigated whether participants showed the costs and benefits of directed forgetting when autobiographical memories were generated to semantically related List 1 and List 2 cues. It has been argued that competition plays an important role in directed forgetting (Conway et al., 2000) as well as in other forms of experimental forgetting (e.g., retrieval-induced forgetting; Anderson & McCulloch, 1999). Competition refers to the potential for related sets of information to compete for retrieval at recall. Inhibition may be activated by, and directed at, unwanted yet competing memories, to reduce their interference with wanted memories. In other words, competition may be a necessary, or boundary, condition for forgetting: Some level of competition is needed to see the effect. Consistent with this, Conway et al. (2000; see also Golding, Long, & MacLeod, 1994) found that directed forgetting was abolished when List 1 and List 2 items were semantically related. According to Conway et al., semantically related lists are represented in memory, not as separate and competing memory representations, but as one integrated list. Thus, List 1 and List 2 memories do not compete during recall and do not trigger inhibitory processes. Another possibility is that the magnitude of directed forgetting may be sensitive to the degree of competition: less competition means less forgetting.

To investigate these possibilities, in Experiment 2, we used a procedure similar to that used in Experiment 1, but each List 1 cue was semantically related to a List 2 cue (e.g., List 1: *lake, cat,* etc.; List 2: *seaside, dog,* etc.). We expected that relatedness of the cues would lead to relatedness of the memories elicited to them and, thus, to less competition. If competition is a boundary condition on forgetting, we expected that related cues would abolish directed forgetting for autobiographical memories. If competition influences the magnitude of forgetting, we expected that related cues would reduce directed forgetting for autobiographical memories.

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[3] We used partial eta squared to estimate the strength of association for each effect in the ANOVA. Tabachnick and Fidell (1996) recommended its use because, unlike eta squared, it is not influenced by the number and significance of other independent variables in the design. This allowed us to compare the strength of association between the same independent and dependent variables (e.g., group and correct recall) across experiments with different factorial designs. Note, however, that partial eta squared may overestimate strength of association (Pierce, Block, & Aguinis, 2004). Thus, we adopted a conservative interpretation of partial eta squared for small, medium, and large effects (cf., Evans, Wei, & Spyridakis, 2004, who suggested effect size conventions for eta squared as follows: small = .01, medium = .06, and large = .14).

[4] For nonsignificant results, we report the highest F value and the lowest p value generated within one analysis; all nonsignificant effects had F values that were less than or equal to this and p values that were greater than or equal to this.

Method

Participants. We tested 24 members (9 male participants, 15 female participants) of the University of Bristol Volunteer Panel in a 2 (group) × 2 (output order) × 2 (list) mixed-model design. They participated in return for an honorarium of £5 ($10) per hour and ranged in age from 18 to 50 years (M = 30.20 years, SD = 9.31).

Materials and procedure. Two 12-item word lists were used to elicit memories. The 24 cues were from the same large pool of cues used in Experiment 1. List 1 included the following words: *lake, field, park, football, ferry, cinema, castle, book, post, coat, hotel,* and *cat.* List 2 included the following words: *seaside, garden, countryside, tennis, train, theatre, museum, newspaper, bank, trousers, house,* and *dog*. Each List 1 cue was semantically associated with a List 2 cue (e.g., *lake–seaside*; *field–garden*). Cues were presented visually, and order of presentation of the word lists was counterbalanced within groups. Within each list, words were randomly intermixed, and serial position was not controlled. Also, semantically related items were not matched for serial position but were presented randomly. The procedure was identical to that used in Experiment 1, with the exception that the recall test was given 5 min after memory generation (and after a 5 min category-generation distraction task).[5] There were 12 participants each in forget and remember groups and 12 participants each in List 1 first and List 2 first output-order groups. See the Appendix for a summary of the memory accessibility and memory quality data for Experiment 2.

Results and Discussion

Table 1 shows the mean proportion of List 1 and List 2 memories recalled correctly in Experiment 2. For List 1 memories, a 2 (group) × 2 (output order) ANOVA indicated that the forget group recalled fewer List 1 memories than the remember group recalled, $F(1, 20) = 5.67$, $p = .027$, $\eta_p^2 = .221$ (see Table 1). There was no main effect of output order, $F(1, 20) = 0.18$, $p = .679$, and no Group × Output Order interaction, $F(1, 20) = 0.96$, $p = .339$. As in Experiment 1, directed forgetting of List 1 memories was not due to output order. For List 2 memories, a similar 2 (group) × 2 (output order) ANOVA showed no significant main or interaction effects (Fs < 2.36, all ps $> .140$). The forget and remember groups recalled a similar number of List 2 memories (see Table 1). These findings indicate reliable List 1 costs of directed forgetting but no List 2 benefits, consistent with Experiment 1. Although individuals who elicited memories to related cues (in Experiment 2) tended to recall more List 1 memories than those who elicited memories to unrelated cues (in Experiment 1), we still found List 1 costs of directed forgetting. In fact, the effect was somewhat larger than the effect in Experiment 1, although it was still modest. Our finding that semantic relatedness of the cues did not reduce directed forgetting—rather, it improved recall—is inconsistent with findings for word lists (Conway et al., 2000; Golding et al., 1994) and may be due to the fact that the related cues did not necessarily lead to related memories. We return to the issue of relatedness and its impact on directed forgetting in Experiments 5 and 6.

Experiment 3

In Experiment 3, the costs and benefits of directed forgetting for emotional and unemotional autobiographical memories were investigated. Autobiographical memories are often associated with strong emotions (Conway & Fthenaki, 2003; Conway & Pleydell-Pearce, 2000; McAdams, 2001; Pillemer, 1998; Singer & Salovey, 1993). Whereas Wessel and Merckelbach's (2006) directed forgetting findings suggested that emotional and unemotional words might be intentionally forgotten at the same rate, other research has suggested that emotional and unemotional events might be remembered and forgotten at different rates (Barnier, Levin, & Maher, 2004; Christianson, 1992; McNally, 2003; Waldvogel, 1948). For instance, in Barnier, Hung, and Conway's (2004) extension of retrieval-induced forgetting to autobiographical memories, independent of the retrieval-induced forgetting effect, participants recalled fewer positive memories than negative memories and fewer negative memories than neutral memories.

In Experiment 3, we used a procedure similar to that used in Experiment 1, but List 1 and List 2 each contained four negative, four positive, and four neutral (unrelated) cues. We expected a directed forgetting effect in the forget group, consistent with Experiments 1 and 2. However, we expected that the emotional valence of the memories might influence final recall in one of (at least) two ways: The size of the directed forgetting effect might differ across negative, positive, and neutral memories (indicated by a Group × Valence interaction) or recall might differ across negative, positive, and neutral memories, independent of directed forgetting instructions (indicated by a valence main effect). Because past research findings are mixed, we did not predict the direction of this influence.

Method

Participants and design. We tested 29 members (14 male participants, 15 female participants) of the University of Bristol Volunteer Panel in a 2 (group) × 2 (output order) × 3 (valence) × 2 (list) mixed-model design. They participated in return for an honorarium of £5 ($10) per hour and ranged in age from 18 to 61 years (M = 35.85 years, SD = 12.70).

Materials and procedure. Two 12-item word lists were used to elicit memories. The 24 cues were taken from the same large pool of words used in Experiments 1 and 2 except that they were not related across the lists (as in Experiment 2) and they were chosen on the basis of their negative, positive, or neutral valence. The negative, positive, and neutral cues used in this experiment had been found to successfully elicit appropriately valenced autobiographical memories from the majority of volunteers participating in previous memory retrieval research. List 1 words included the following: (negative) *accident, jealousy, sad,* and *embarrassment;*

[5] Across the experiments, we tested recall either immediately after memory generation (Experiment 1), 5 min after memory generation (Experiments 2–3), or 10 min after memory generation (Experiments 4–6). Experiments 2–6 also included distraction tasks between generation and recall. The timing of recall had no impact on the directed forgetting effect, although the immediate test (in Experiment 1) led to higher overall recall than the delayed tests. We increased the interval across the experiments to counter the possibility of a ceiling effect in recall.

(positive) *happy, gift, thrilled,* and *bliss;* and (neutral) *restaurant, cinema, seaside,* and *pub.* List 2 words included the following: (negative) *hate, illness, anger,* and *fear;* (positive) *love, summer, achievement,* and *pleased;* and (neutral) *park, supermarket, school,* and *train.* Cues were presented visually, and order of presentation of the word lists was counterbalanced within groups. Within each list, negative, positive, and neutral words were randomly intermixed, and serial position was not controlled. The procedure was identical to the Experiment 2 procedure. There were 15 participants in the forget group and 14 participants in the remember group; there were 15 participants in the List 1 first output-order group and 14 participants in the List 2 first output-order group. See the Appendix for a summary of the memory accessibility and memory quality data for Experiment 3.

Results and Discussion

Table 1 shows the mean proportion of List 1 and List 2 memories recalled correctly in Experiment 3 (collapsed across memory valence). Table 2 shows the mean proportion of negative, positive, and neutral List 1 and List 2 memories recalled correctly in Experiment 3 (collapsed across output order; in Experiments 4–6 as well; see below). For List 1 memories, a 2 (group) × 2 (output order) × 3 (valence) ANOVA indicated that the forget group recalled fewer List 1 memories than the remember group recalled, $F(1, 25) = 5.57$, $p = .026$, $\eta_p^2 = .182$ (see Table 1). There was no main effect of output order, $F(1, 25) = 0.29$, $p = .596$, and no Group × Output Order interaction, $F(1, 25) = 0.73$, $p = .401$. Directed forgetting of List 1 memories was not due to output order. It is notable that the Group × Valence interaction was significant, $F(2, 50) = 3.60$, $p = .035$, $\eta_p^2 = .126$; the valence main effect and all other interactions, including the Group × Output Order × Valence interaction, were not significant (Fs < 0.59, ps $> .560$). Because we had no specific predictions for the direction of the valence effect, we conducted follow-up interaction contrasts for all possible comparisons: negative versus positive memories, negative versus neutral memories, and positive versus neutral memories. Here, and in the experiments to follow, we chose not to apply a Bonferroni adjustment when conducting follow-up tests for valence, instead we preferred a liberal decision criterion that took account of the relatively small number of memories of each valence. These contrasts indicated that the directed forgetting effect was smaller (if not absent) for negative memories (F vs. R $= -0.02$), than for either positive memories (F vs. R $= 0.23$), $F(1, 25) = 5.09$, $p = .033$, $\eta_p^2 = .169$, or neutral memories (F vs. R $= 0.30$), $F(1, 25) = 6.27$, $p = .019$, $\eta_p^2 = .200$; positive and neutral memories did not differ, $F(1, 25) = 0.18$, $p = .672$ (see Table 2).

For List 2 memories, a similar 2 (group) × 2 (output order) × 3 (valence) ANOVA yielded a near significant Group × Valence

Table 2
Proportion of Negative, Positive, and Neutral Memories Recalled Correctly by Directed Forgetting Groups

	List 1						List 2					
	Negative		Positive		Neutral		Negative		Positive		Neutral	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Experiment 3												
Forget	.54	.26	.35	.30	.36	.26	.71	.22	.72	.23	.59	.26
Remember	.52	.25	.58	.25	.66	.32	.71	.23	.54	.23	.65	.26
Experiment 4												
Free recall												
Forget	.54	.18	.43	.23	.33	.23	.53	.23	.61	.18	.56	.25
Remember	.64	.27	.63	.26	.54	.21	.70	.27	.79	.17	.54	.25
Cued recall												
Forget	.86	.17	.81	.18	.90	.13	.87	.19	.81	.18	.94	.09
Remember	.79	.17	.77	.17	.90	.15	.80	.18	.84	.21	.87	.15
Experiment 5												
Unrelated												
Forget	.52	.27	.44	.22	.34	.25	.60	.22	.66	.23	.50	.29
Remember	.60	.22	.67	.19	.46	.23	.61	.22	.67	.27	.55	.26
Related												
Forget	.47	.23	.57	.27	.50	.26	.60	.24	.62	.23	.56	.25
Remember	.57	.22	.58	.28	.54	.29	.54	.28	.78	.19	.56	.29
Experiment 6												
Cued elicitation												
Forget	.51	.28	.59	.26	.43	.26	.63	.27	.64	.24	.55	.25
Remember	.60	.24	.69	.23	.58	.20	.58	.28	.72	.26	.64	.19
Cluster elicitation												
Forget	.66	.20	.62	.32	.59	.34	.74	.27	.74	.27	.77	.19
Remember	.69	.28	.80	.22	.67	.22	.76	.23	.75	.25	.81	.23

interaction, $F(2, 50) = 2.82$, $p = .069$, $\eta_p^2 = .101$, and a significant Output Order × Valence interaction, $F(2, 50) = 4.85$, $p = .012$, $\eta_p^2 = .163$. The forget group tended to recall more positive List 2 memories than the remember group, $F(1, 27) = 4.49$, $p = .044$, $\eta_p^2 = .141$. Although this was not a very large effect, it provides the only evidence so far of List 2 benefits of directed forgetting (given that the forget group recalled fewer positive List 1 memories than the remember group; see Table 2). Participants who output List 1 memories first recalled fewer negative List 2 memories ($M = 0.63$, $SD = 0.24$) than those who output List 2 memories first ($M = 0.79$, $SD = 0.16$), $F(1, 27) = 4.66$, $p = .040$, $\eta_p^2 = .147$. Because the main effect of output order and all other interactions involving output order, including the Group × Output Order × Valence interaction, were not significant (Fs < 0.63, ps $> .539$), and because output order played no role in List 1 recall, this effect is of little significance. The group and valence main effects were also not significant (Fs < 1.75, ps $> .185$).

Consistent with Experiments 1 and 2, we found that there were List 1 costs of directed forgetting for recently recalled autobiographical memories; this reliable, albeit modest, forgetting effect was not due to output order. Also, there was weak evidence of List 2 benefits for autobiographical memories. It is notable that final recall was influenced by emotional valence. Although the interaction effect was small, directed forgetting was weaker (if not absent) for negative memories than for positive and neutral memories. This might reflect differences in the initial accessibility of negative memories, as suggested by longer generation latencies for these memories at elicitation (see the Appendix). We continue our analysis of the impact of emotional valence (and emotionality) on directed forgetting in Experiments 4–6.

Experiment 4

In Experiment 4, the impact of test type on the costs and benefits of directed forgetting for recently recalled autobiographical memories was investigated. Past research indicated that the presentation of specific cues related to the forgotten material releases the inhibition initiated by the forget instruction (and by List 2 learning; E. L. Bjork et al., 1998). Thus, the directed forgetting effect is typically shown only in free, and not in cued, recall. In Experiment 4, half our participants received a free recall test and half received a cued recall test. We expected a directed forgetting effect in the forget group only when it was tested with free recall. Given our finding in Experiment 3 of a reduced (or absent) directed forgetting effect for negative memories relative to positive and neutral memories, we also were interested in whether emotional valence influenced final recall.

Method

Participants and design. We tested 56 undergraduate psychology students (23 male students, 33 female students) from the University of New South Wales, Sydney, Australia in a 2 (group) × 2 (test) × 2 (list) × 3 (valence) mixed-model design. They participated in return for credit toward their psychology course and ranged in age from 17–45 years ($M = 20.02$ years, $SD = 5.34$).

Materials. Two 15-item word lists were used to elicit memories. The 30 cues were from a larger pool of 100 words drawn from emotion and memory research (Bellezza, Greenwald, & Banaji, 1986; Cloitre, 1998; Geiselman & Panting, 1985; Myers & Brewin, 1994; Myers, Brewin, & Powers, 1998; Williams & Dritschel, 1988) and used in previous autobiographical memory research in Amanda J. Barnier's laboratory. The final 30 cues were selected because they were rated in the pilot research as reliably negative, positive, or neutral and because in pilot research, they elicited specific and reliably negative, positive, or neutral memories. More important, in this experiment (as well as in Experiments 5–6; see below), these cues reliably elicited appropriately valenced negative, positive, and neutral memories (see the Appendix). List 1 words included the following: (negative) *hurt, hostile, horrified, angry,* and *unfair;* (positive) *merry, fulfilled, entertaining, cuddle,* and *sociable;* and (neutral) *punctual, tidy, reliable, honest,* and *square.* List 2 words included the following: (negative) *sickness, hatred, tragedy, sad,* and *lonely;* (positive) *relaxed, happy, excitement, affectionate,* and *achievement;* and (neutral) *mature, reflective, hardworking, healthy,* and *door.* List 1 and List 2 cues were matched for rated valence (on the basis of pilot work). Cues were presented verbally, and order of presentation of the word lists was counterbalanced within groups. Within each list, negative, positive, and neutral words were randomly intermixed, and serial position was not controlled.

Procedure. The procedure was generally the same as the procedure in Experiments 1–3, but memory generation, interlist instruction, and free recall were administered within an individual interview session (rather than in groups via computer). Participants were told that they were taking part in an experiment that would examine individual differences in the ability to remember and think about autobiographical events. They were told that cues would be read one at a time and that their task was to generate specific memories in response to these words as quickly as possible. They were asked to think of specific memories of events from any part of their life that occurred at least 1 month ago. Unlike participants in Experiments 1–3, participants in Experiment 4 were not told at the beginning of the experiment that the cues would be presented in two lists with a break in between the presentation of the lists or that they would be required to recall the cues and the memories later in the experiment. These changes were intended to reduce the potential role of selective rehearsal in participants' recall. Participants were told that, following the presentation of each cue, they should indicate when they had a specific, relevant memory in mind by saying "yes." They then provided a brief, 10–15 word verbal description of the memory, rated its clarity on a 7-point scale ("How clear is your memory of this event?"; from 1 = *not at all clear* to 7 = *very clear*) and its valence on a 7-point scale ("How positive or negative is your memory of this event?"; from 1 = *very negative* to 4 = *neither negative nor positive* to 7 = *very positive*), and estimated how old they were when the event occurred. Memory generation latency for each event was measured from the presentation of the cue until participants indicated (by saying "yes") that they had a memory in mind.

After these instructions, the experimenter presented the 1st cue from List 1, and participants engaged in the memory generation, description, rating, and age estimation cycle until the 15 cues from this list had been presented. They were then treated according to their allocation to one of the directed forgetting groups. Participants in the forget group ($n = 28$) were told that they had just completed List 1, which was just for practice. Participants were told, “forget about the memories you just described. You won’t need to think of them again.” Further, participants were told that they would be presented with a second list of cues, List 2, and that they should “focus on these words and try to remember the memories that you will now describe because later on I will be asking you about them.” Participants in the remember group (n = 28) were told that they had just completed the first list, List 1, and that they were halfway through the cues. The participants were told, “try to remember the memories you just described. You will need to think of them again later.” Further, participants were told that they would be presented with a second list of cues, List 2, and that they should “focus on these words and try to remember the memories that you will now describe because later on I will be asking you about them.” The experimenter then presented the cues from List 2 and participants engaged in the memory generation, description, rating, and age estimation cycle until the 15 cues from this list had been presented.

After two 5-min distraction tasks (number and name checking, Australian Council on Educational Research; L-shaped puzzle, Snodgrass & Burns, 1978), participants were asked to think back to the memories they had described previously. Individuals (randomly) allocated to the free recall condition (n = 28) were instructed to “recall in any order the memories that you told me about earlier in response to the words I gave you on both lists; that is, both List 1 and List 2.” The experimenter allowed recall without interruption; this was followed by one standard prompt (“Do you recall any other memories from any part of the experiment?”). At the end of this free recall, if participants did not spontaneously provide the associated cue for each memory, the experimenter read back through the list of free recalled memories and asked for the associated cue. Individuals (randomly) allocated to the cued recall condition (n = 28) were told that the cues from both List 1 and List 2 would be read out to them and that for each cue they should “recall the memory related to that word that you described to me.” They were given 30 s to recall the memory for each cue. List 1 and List 2 negative, positive, and neutral cues were randomly intermixed in the cued recall test. Unlike Experiments 1–3, in this experiment we did not formally control output order; although we did specify order of output in the cued recall condition, cues were presented randomly rather than by list. To address output order, we calculated output order scores (see below for an analysis of output order scores for Experiments 4–6). Finally, the experimenter debriefed participants, answered their questions, and thanked them for their participation. Autobiographical memories were scored in the same way as Experiments 1–3.

Table 3
Proportion of Memories Recalled Correctly by Directed Forgetting Groups

Group	List 1		List 2	
	M	*SD*	*M*	*SD*
Experiment 4				
Free recall				
Forget	.43	.17	.57	.12
Remember	.60	.13	.68	.15
Cued recall				
Forget	.86	.10	.88	.09
Remember	.82	.09	.84	.12
Overall				
Forget	.65	.25	.72	.19
Remember	.71	.16	.76	.16
Experiment 5				
Unrelated				
Forget	.47	.19	.65	.15
Remember	.59	.13	.67	.17
Related				
Forget	.54	.19	.62	.15
Remember	.57	.16	.69	.16
Overall				
Forget	.51	.19	.63	.15
Remember	.58	.14	.68	.16
Experiment 6				
Cued elicitation				
Forget	.51	.18	.61	.20
Remember	.63	.13	.65	.18
Cluster elicitation				
Forget	.62	.19	.74	.13
Remember	.74	.15	.77	.17
Overall				
Forget	.56	.19	.68	.18
Remember	.68	.15	.71	.18

Results and Discussion

Table 3 shows the mean proportion of List 1 and List 2 memories recalled correctly in Experiment 4 (collapsed across memory valence). Table 2 shows the mean proportion of negative, positive, and neutral List 1 and List 2 memories recalled correctly in Experiment 4. For List 1 memories, a 2 (group) × 2 (test) × 3 (valence) ANOVA indicated that the forget group tended to recall fewer List 1 memories than the remember group recalled, $F(1, 52) = 3.98$, $p = .051$, $\eta_p^2 = .071$, and that participants in the free recall group recalled fewer List 1 memories than those recalled by participants in the cued recall group, $F(1, 52) = 91.11$, $p < .001$, $\eta_p^2 = .637$. Of most interest, however, participants in the free recall group showed directed forgetting of List 1 memories (F vs. R = 0.17), whereas those in cued recall showed no effect (F vs. R = −.04), as indicated by a Group × Test interaction, $F(1, 52) = 9.82$, $p = .003$, $\eta_p^2 = .159$ (see Table 3). Although the valence main effect, the Group × Valence interaction, and the Group × Test × Valence interaction were not significant (Fs < 0.94, ps > .383), the Test × Valence interaction was significant, $F(2, 104) = 6.05$, $p = .005$, $\eta_p^2 = .104$. Follow-up contrasts conducted separately for free recall and cued recall indicated that, whereas in free recall participants recalled fewer unemotional memories than emotional memories, $F(2, 54) = 3.69$, $p = .031$, $\eta_p^2 = .120$, in cued recall, participants recalled more unemotional memories than emotional memories, $F(2, 54) = 3.32$, $p = .044$, $\eta_p^2 = .110$. In other words, the forgetting of neutral material versus the remembering of negative and positive material was more pronounced in free recall. These were small effects (see Table 2).

Unlike the interaction in Experiment 3, the Group × Valence interaction was not significant in the overall ANOVA. But because we predicted directed forgetting in free recall only, we conducted separate 2 (group) × 3 (valence) ANOVAs for each recall condition. Similar to the Group × Test × Valence ANOVA, these analyses yielded a group main effect for free recall, $F(1, 26) = 9.09$, $p = .006$, $\eta_p^2 = .259$, but not for cued recall, $F(1, 26) = 1.18$, $p = .288$, and valence main effects for free recall, $F(2, 52) = 3.63$, $p = .033$, $\eta_p^2 = .123$, and for cued recall, $F(2, 52) = 3.24$, $p = .047$, $\eta_p^2 = .111$. Independent of directed forgetting instructions, participants in free recall recalled fewer neutral memories than negative or positive memories, and participants in cued recall recalled more neutral memories than negative or positive memories, although again, the effect size was small (see Table 2). However, the Group × Valence interaction remained nonsignificant in both free and cued recall conditions, $F(2, 52) = 0.56$, $p = .572$ and $F(2, 52) = 0.34$, $p = .713$, respectively. This indicates that List 1 costs did not differ across negative, positive, and neutral memories, even in free recall.

For List 2 memories, a 2 (group) × 2 (test) × 3 (valence) ANOVA indicated that participants in the free recall condition recalled fewer List 2 memories than participants in the cued recall condition, $F(1, 52) = 52.20$, $p < .001$, $\eta_p^2 = .501$. However, as for List 1 memories, the forget group recalled fewer List 2 memories than the remember group recalled when tested in free recall (F vs. R = 0.11), but showed no difference when tested in cued recall (F vs. R = 0.04), as indicated by a Group × Test interaction, $F(1, 52) = 5.12$, $p = .028$, $\eta_p^2 = .090$ (see Table 3); the group main effect was not significant, $F(1, 52) = 1.20$, $p = .279$. Again, the Test × Valence interaction was significant, $F(2, 104) = 4.80$, $p = .010$, $\eta_p^2 = .084$, whereas the valence main effect and all other interactions, including the Group × Test × Valence interaction, were not (Fs < 1.91, ps $> .153$). Follow-up contrasts conducted separately for free and cued recall indicated that in free recall, participants again recalled fewer unemotional memories than emotional memories, $F(2, 54) = 3.03$, $p = .06$, $\eta_p^2 = .101$. However, in cued recall participants recalled a similar number of unemotional and emotional memories, $F(2, 54) = 2.06$, $p = .138$. These were small effects (see Table 2).

In summary, we found that there were List 1 costs of directed forgetting when recently recalled autobiographical memories were tested in free, but not in cued, recall. As in Experiment 3, this was a modest, although reliable, forgetting effect. Re-presentation of cues that originally elicited the to-be-forgotten memories abolished directed forgetting (for similar findings with word lists, see E. L. Bjork et al., 1998). Final recall was again influenced by emotional valence but, unlike in Experiment 3, the directed forgetting effect operated equally across negative, positive, and neutral memories. Overall, participants recalled fewer unemotional (neutral) memories than emotional (negative and positive) memories, but this was dependent on the type of memory test. This pattern was not due to differences in the accessibility or quality of the memories as they were generated (see the Appendix).

Experiment 5

In Experiment 5, we investigated whether relatedness of autobiographical memories themselves reduces directed forgetting. In Experiment 2, we found List 1 costs for autobiographical memories elicited to semantically related cues. Semantic relatedness did not reduce the effect; rather it improved overall recall. One interpretation of this finding is that competition plays a different role in the directed forgetting of recently recalled autobiographical memories than in the directed forgetting of word lists (Conway et al., 2000; Golding et al., 1994). Another possibility is that the related cues in Experiment 2 did not lead to related, and thus competing, memories. Competition is particularly relevant to autobiographical memories because they are highly organized (and thus related) within the autobiographical knowledge base; for instance, at the level of lifetime periods and general events (Conway, 2001b, 2005; Conway & Pleydell-Pearce, 2000). In this experiment, we focused on thematic relatedness, whereby memories were referenced either to a single lifetime period (e.g., when I was at school) or to distinct lifetime periods (e.g., when I was at school vs. when I was on holidays). We used a procedure similar to that used in Experiment 4, but half the participants generated thematically unrelated memories for List 1 and List 2 (e.g., memories of high school for List 1 and memories of holidays for List 2), and the other half generated thematically related memories for List 1 and List 2 (e.g., memories of high school for List 1 and List 2). We expected a directed forgetting effect for the forget group. Specifically, we expected an effect consistent with Experiments 1–4 when List 1 and List 2 memories were thematically unrelated, but expected the effect to be reduced when List 1 and List 2 memories were thematically related. We also expected that emotional valence might influence final recall (either interacting with or independent of directed forgetting instructions).

Method

Participants and design. We tested 80 undergraduate psychology students (19 male students, 61 female students) from the University of New South Wales, in a 2 (group) × 2 (relatedness) × 2 (list) × 3 (valence) mixed-model design. They participated in return for credit toward their psychology course, and they ranged in age from 18–33 years ($M = 19.89$ years, $SD = 2.75$).

Materials and procedure. The two 15-item (negative, positive, and neutral) word lists were identical to the Experiment 4 word lists. The procedure used was identical to that used in Experiment 4, with two exceptions. First, rather than asking participants to think of specific memories of events from any part of their life that occurred at least 1 month ago, we asked them to think of memories that were from a specific time period and related to a specific theme. For List 1 cues, they were asked to think of memories of events they experienced when they were approximately 12–17 years old (their school years) and, in particular, memories of events they experienced at school or events they experienced on holidays (List 1 theme was counterbalanced across participants). For List 2 cues, half the participants were instructed to generate memories of experiences from a different thematic period (high school or holidays, according to counterbalancing; unrelated; $n = 40$), and half were instructed to continue generating (new) memories of experiences from the same thematic period as List 1 (related; $n = 40$). Thus, for half the participants there was a change in memory theme for List 2.[6] It is important to note that the

[6] Analyses of memories generated and recalled that involved the counterbalancing of the school theme condition versus the holiday theme condition (for List 1) yielded only one significant difference (for age at encoding; memories generated from the school period were approximately 9 months older than memories generated from the holiday period, $F(1, 78) = 6.76$, $p = .011$, $\eta_p^2 = .080$). All other variables—memory generation latencies, memory quality ratings, and final recall—showed no difference across themes (Fs $<$ 2.21, ps $> .141$). Thus, theme was excluded from further analysis.

negative, positive, and neutral cues elicited appropriately valenced negative, positive, and neutral memories equally successfully within the two thematic periods. The second exception to the procedure was that there was only one free recall test given 10 min after List 2 (and after the two distraction tasks from Experiment 4).

Results and Discussion

Table 3 shows the mean proportion of List 1 and List 2 memories recalled correctly in Experiment 5 (collapsed across memory valence). Table 2 shows the mean proportion of negative, positive, and neutral List 1 and List 2 memories recalled correctly in Experiment 5. For List 1 memories, a 2 (group) × 2 (relatedness) × 3 (valence) ANOVA indicated that the forget group recalled fewer List 1 memories than the remember group recalled, $F(1, 76) = 6.59$, $p = .012$, $\eta_p^2 = .080$ (see Table 3). Unexpectedly, however, the relatedness main effect, $F(1, 76) = 0.78$, $p = .379$, and the Group × Relatedness interaction were not significant, $F(1, 76) = 1.54$, $p = .219$. This suggests that directed forgetting of List 1 memories did not differ across the unrelated and related conditions. It is notable that the valence main effect was significant, $F(2, 152) = 5.02$, $p < .008$, $\eta_p^2 = .062$, although the Group × Valence interaction was not, $F(2, 152) = 0.18$, $p = .835$ (all other interactions, including the Group × Relatedness × Valence interaction, were not significant; Fs < 2.73, ps $> .069$). Independent of directed forgetting instructions and memory relatedness, participants recalled fewer neutral memories ($M = 0.46$, $SD = 0.26$) than negative memories ($M = 0.54$, $SD = 0.24$) or positive memories ($M = 0.57$, $SD = 0.25$), $F(1, 79) = 4.83$, $p = .031$, $\eta_p^2 = .058$, and $F(1, 79) = 8.63$, $p = .004$, $\eta_p^2 = .098$, respectively for each comparison; negative and positive memories did not differ, $F(1, 79) = .592$, $p = .444$, $\eta_p^2 = .007$. These were small effects.

Unlike the interaction in Experiment 3, but similar to that in Experiment 4, the Group × Valence interaction was not significant in the overall ANOVA. But because we predicted that directed forgetting would be reduced in the related condition, we conducted separate 2 (group) × 3 (valence) ANOVAs for each relatedness condition. Unlike the Group × Relatedness × Valence ANOVA, these analyses indicated directed forgetting of List 1 memories in the unrelated condition (F vs. R = 0.12), $F(1, 38) = 8.15$, $p = .007$, $\eta_p^2 = .177$, but not in the related condition (F vs. R = 0.03), $F(1, 38) = 0.79$, $p = .378$ (see Table 3). Independent of directed forgetting instructions, participants in the unrelated condition recalled fewer neutral memories than negative or positive memories, $F(2, 76) = 7.76$, $p = .001$, $\eta_p^2 = .169$, but participants in the related condition recalled a similar number of negative, positive, and neutral memories, $F(2, 76) = 0.76$, $p = .42$ (see Table 2). The Group × Valence interaction remained nonsignificant in both the unrelated and related conditions, $F(2, 76) = 1.41$, $p = .250$ and $F(2, 76) = 0.40$, $p = .675$, respectively. This indicates that directed forgetting of List 1 memories did not differ across negative, positive, and neutral memories, even in the unrelated condition.

For List 2 memories, a 2 (group) × 2 (relatedness) × 3 (valence) mixed-model ANOVA showed only a valence main effect, $F(2, 152) = 8.18$, $p < .001$, $\eta_p^2 = .097$; all other main effects and interactions, including the Group × Relatedness × Valence interaction, were not significant (Fs < 1.48, ps $> .231$). Independent of directed forgetting instructions, participants recalled fewer negative memories ($M = 0.59$, $SD = 0.24$) and neutral memories ($M = 0.54$, $SD = 0.27$) than positive memories ($M = 0.68$, $SD = 0.24$), $F(1, 79) = 7.59$, $p = .007$, $\eta_p^2 = .088$, and $F(1, 79) = 15.27$, $p < .001$, $\eta_p^2 = .162$, respectively for each comparison; negative and neutral memories did not differ, $F(1, 79) = 1.57$, $p = .214$. These were small effects.

In summary, we found List 1 costs of directed forgetting for recently recalled autobiographical memories from recent lifetime periods. This modest, but reliable, forgetting effect was reduced when List 1 and List 2 memories were generated from the same lifetime period, compared with when they were generated from thematically distinct periods (only when related and unrelated conditions were analyzed separately; this effect did not show up in the overall ANOVA). As in Experiment 4, the directed forgetting effect operated equally across negative, positive, and neutral memories. However, independent of instructions, participants recalled fewer neutral List 1 memories than negative or positive List 1 memories and fewer negative and neutral List 2 memories than positive List 2 memories. This pattern was not due to differences in the accessibility or quality of the memories as they were generated (see the Appendix).

Experiment 6

In Experiment 6, the analysis of relatedness in Experiment 5 was extended by a focus on clusters of autobiographical memories. In Experiment 5, List 1 costs of directed forgetting were reduced for thematically related autobiographical memories within a single lifetime period (Conway, 2001b; Conway & Pleydell-Pearce, 2000). Research on event clusters indicates that memories are organized, connected, and cued also through related features, such as emotionality, personal significance, and clarity (Brown & Schopflocher, 1998; Wright & Nunn, 2000). In Experiment 6, we used a procedure similar to that used in Experiment 5, but List 1 and List 2 consisted of either unrelated memories elicited to individual cues (as in Experiments 1–5) or related memories elicited in small clusters. We used Wright and Nunn's (2000) event cluster procedure, in which participants generated a memory to an initial cue, followed by a series of memories related to each preceding memory. We expected a directed forgetting effect for the forget group, both for those who elicited memories to individual cues (on the basis of Experiments 1–5) and for those who elicited memories in clusters. However, clustering may influence overall recall or directed forgetting: Clusters of memories may be easier to remember (because their features are related) or easier to forget (because they can be segregated from other clusters). Finally, we expected that emotional valence would again influence final recall.

Method

Participants and design. We tested 80 undergraduate psychology students (15 male students, 65 female students) from the University of New South Wales, in a 2 (group) × 2 (elicitation) × 2 (list) × 3 (valence) mixed-model design. They participated in return for credit toward their psychology course, and they ranged in age from 17–49 years ($M = 19.81$ years, $SD = 4.03$).

Materials. For *cued elicitation* ($n = 40$), we used the same two 15-item word lists that were used in Experiment 4 to elicit memories. For *cluster elicitation* ($n = 40$), we used two 3-item word lists to elicit memories. Participants received one of five sets of 6 cues (subsets of the 30 cues used in cued elicitation), so that within this condition all 30 cues were used. In both cued and cluster elicitation, List 1 and List 2 cues were matched for rated valence (on the basis of pilot work). Cues were presented verbally, and order of presentation of the word lists was counterbalanced within groups. Within each list, negative, positive, and neutral cues were randomly intermixed, and serial position was not controlled. These cues reliably elicited appropriately valenced negative, positive, and neutral memories (see the Appendix).

Procedure. The procedure used for cued elicitation was identical to that used in Experiment 4, with one exception. There was only one free recall test 10 min after List 2 presentation (and after the two distraction tasks from Experiment 4). The procedure used for cluster elicitation was identical to that used in Experiment 4, with two exceptions. First, as in cued elicitation, there was only one free recall test 10 min after List 2 presentation. Second, memories were generated in clusters with Wright and Nunn's (2000) event cluster method. Participants generated three clusters of up to five memories for List 1 and then for List 2; for each list there was a negative cluster, a positive cluster, and a neutral cluster. Memory 1 of each cluster was generated to the negative, positive, or neutral cue for that list. As in cued elicitation (and in Experiments 4–6), the experimenter presented the three cues one at a time and asked participants to generate specific memories in response to them. Participants used Memory 1 as a cue to generate Memory 2 of each cluster. The experimenter read participants their own 10–15 word description for Memory 1 and said,

> give me a memory of another specific event that is related, which made you feel the same way as the memory I will be presenting. Tell me the next memory that comes to mind when I say your previous memory. The new memory should be from a different day and of a different event. . . . You told me about [participants' 10–15 word description of memory], give me a related memory that made you feel the same way.

With the same instructions, Memory 3 of each cluster was generated by participants using Memory 2 as a cue, Memory 4 was generated by participants using Memory 3 as a cue, and Memory 5 was generated by participants using Memory 4 as a cue. In this way, each new memory that participants provided (and their 10–15 word description) was used to cue the next memory in the cluster until three clusters (one negative, one positive, one neutral) of up to five related memories were formed for List 1 and for List 2. Memories in each cluster were generated in a (blocked) random order. If participants failed to generate a related memory from a previous memory, then the cluster was terminated. In both conditions, the description, rating, dating, and latency measurement for memories, as well as for the interlist forget instructions ($n = 40$) or the remember ($n = 40$) instructions, were the same as in Experiment 5.

Results and Discussion

Table 3 shows the mean proportion of List 1 and List 2 memories recalled correctly in Experiment 6 (collapsed across memory valence). Table 2 shows the mean proportion of negative, positive, and neutral List 1 and List 2 memories recalled correctly in Experiment 6. For List 1 memories, a 2 (group) × 2 (elicitation) × 3 (valence) ANOVA indicated that the forget group recalled fewer List 1 memories than the remember group recalled, $F(1, 75) = 7.85$, $p = .006$, $\eta_p^2 = .095$ (see Table 3). Also, participants who generated memories in clusters ($M = 0.68$, $SD = 0.18$) recalled more List 1 memories than participants who generated memories to individual cues ($M = 0.57$, $SD = 0.16$), $F(1, 75) = 7.75$, $p = .007$, $\eta_p^2 = .094$. It is notable that the Group × Elicitation interaction was not significant, $F(1, 75) = 0.10$, $p = .748$. This suggests that directed forgetting of List 1 memories did not differ according to elicitation method. The valence main effect was significant, $F(2, 150) = 4.21$, $p = .017$, $\eta_p^2 = .053$, although the Group × Valence interaction was not, $F(2, 150) = 0.49$, $p = .612$ (all other interactions, including the Group × Elicitation × Valence interaction, were not significant; Fs < 0.49, ps $> .612$). Independent of directed forgetting instructions and elicitation method, participants recalled fewer neutral memories ($M = 0.57$, $SD = 0.27$) than positive memories ($M = 0.68$, $SD = 0.27$), $F(1, 79) = 8.39$, $p = .005$, $\eta_p^2 = .097$; negative memories ($M = 0.61$, $SD = 0.26$) did not differ from positive or neutral memories, $F(1, 79) = 2.13$, $p = .149$ and $F(1, 79) = 1.88$, $p = .174$, respectively. These were small effects.

Unlike the interaction in Experiment 3, but similar to the interaction in Experiments 4 and 5, the Group × Valence interaction was not significant in the overall ANOVA. But because we were specifically interested in the impact of elicitation method on directed forgetting, we conducted separate 2 (group) × 3 (valence) ANOVAs for each elicitation condition. Unlike the Group × Elicitation × Valence ANOVA, these analyses indicated directed forgetting of List 1 memories in the cued condition but not in the cluster condition. In cued elicitation, there was a significant, albeit small, group main effect, $F(1, 38) = 5.68$, $p = .022$, $\eta_p^2 = .130$, but in cluster elicitation, the group main effect was not significant, $F(1, 37) = 2.68$, $p = .110$ (see Table 3). However, the differences in recall of List 1 memories by forget and remember groups within these elicitation conditions appeared to be similar (F vs. R = 0.12), and differences between the elicitation conditions did not show up in the Group × Elicitation × Valence ANOVA.[7] This suggests that the directed forgetting instructions influenced memories irrespective of how they were generated. Independent of directed forgetting instructions, participants in cued elicitation recalled fewer neutral and negative memories than positive memories, $F(2, 76) = 3.39$, $p = .039$, $\eta_p^2 = .082$, but participants in cluster elicitation recalled a similar number of negative, positive, and neutral memories, $F(2, 74) = 1.19$, $p = .312$ (see Table 2). However, the Group × Valence interaction remained nonsignificant in both the cued and cluster conditions, $F(2, 76) = 0.22$, $p = .802$ and $F(2, 74) = 0.69$, $p = .506$, respectively. This indicated that directed forgetting of List 1 memories did not differ across negative, positive, and neutral memories.

[7] Our failure to find a group main effect that was significant in cluster elicitation, compared with a group main effect that was significant in cued elicitation, may reflect a lack of power. Whereas the effect size for cued elicitation was .130, it was only .068 for cluster elicitation (and the power of the analysis to detect a group main effect for the cluster condition was only .36).

For List 2 memories, a 2 (group) × 2 (elicitation) × 3 (valence) ANOVA showed only an elicitation main effect, $F(1, 75) = 12.01$, $p < .001$, $\eta_p^2 = .138$; all other main effects and interactions, including the Group × Elicitation × Valence interaction, were not significant (Fs < 1.76, ps $> .176$). Consistent with List 1 memories, participants who generated memories in clusters ($M = 0.80$, $SD = 0.21$) recalled more List 2 memories than did participants who generated memories to individual cues ($M = 0.60$, $SD = 0.22$).

Participants' memory clusters gave us the opportunity to test whether directed forgetting operated on autobiographical memories and not just on the cues. Because memories in each cluster were generated in a random order, Memories 2–5 were separated from (and not cued by) the word that elicited Memory 1. This means that participants may have been less likely to use a cue-based retrieval strategy at final recall (i.e., recall the cue, then recall the memory related to it). Such a strategy requires inhibition of only the cues not of the memories.[8] By analyzing recall of Memories 2–5 in each cluster, we determined whether directed forgetting operated independently of the cues used to elicit memories. In the Group × Elicitation × Valence ANOVA reported above, the forget group recalled fewer List 1 memories than the remember group recalled (F vs. R = 0.12). When we analyzed the number of List 1 memories (2–5) recalled by participants in the cluster condition, we found a near-significant group main effect, $F(1, 36) = 3.22$, $p = .081$, $\eta_p^2 = .082$. Consistent with the Group × Elicitation × Valence ANOVA, the forget group ($M = 0.61$, $SD = 0.19$) recalled fewer List 1 memories (2–5) than the remember group recalled ($M = 0.71$, $SD = 0.15$). In other words, we found directed forgetting of List 1 memories, unrelated to specific word cues.

In summary, we found that there were List 1 costs of directed forgetting for recently recalled autobiographical memories that were elicited both to individual cues and in clusters. Again, this was a modest, but reliable, forgetting effect. Clustering did not appear to increase or decrease directed forgetting (although the group main effect was significant only in the overall ANOVA). However, similar to the impact of semantically related cues in Experiment 2, generating memories in clusters led to higher levels of recall overall. This suggests that clustering created sufficient relatedness within List 1 and List 2 to assist recall, yet sufficient unrelatedness (and thus competition) between List 1 and List 2 to generate inhibition and, thus, directed forgetting. Directed forgetting operated equally on negative, positive, and neutral memories. However, independent of instructions, neutral memories were again the most likely forgotten (although as in Experiments 4–5, these were small effects). This pattern was not due to differences in the accessibility or quality of the memories as they were generated (see the Appendix). Finally, it is important to note that our analysis of Memories 2–5 in each cluster suggested that directed forgetting operates on memories not just on cues used to elicit them.

Mega-Analysis of Directed Forgetting Effects

Given the large number of participants tested across the six experiments, we combined the data and conducted a mega-analysis (McArdle & Horn, 2002) to confirm the presence of a directed forgetting effect and clarify the impact of valence on directed forgetting.[9] Planned comparisons of 305 participants' data across all six experiments confirmed the List 1 costs of directed for the getting for autobiographical memories (F vs. R = 0.11), $F(1, 303) = 22.82$, $p < .001$, $\eta_p^2 = .068$, but showed no evidence of List 2 benefits (F vs. R = 0.03), $F(1, 303) = 2.05$, $p = .154$. As in each experiment above, the forget groups, combined across the experiments, recalled fewer List 1 memories ($M = 0.58$, $SD = 0.22$) than remember groups recalled, combined across the experiments ($M = 0.69$, $SD = 0.17$); but forget ($M = 0.67$, $SD = 0.19$) and remember ($M = 0.70$, $SD = 0.17$) groups recalled a similar number of List 2 memories. We predicted directed forgetting for the 213 participants in Experiments 1, 3, 4 (free recall condition), 5 (unrelated condition), and 6 but not for the 92 participants in Experiments 2, 4 (cued condition), and 5 (related condition; refer to Tables 1 & 3). Reconducting the planned comparisons separately for these two sets of participants, we confirmed that List 1 costs of directed forgetting were found across experiments and conditions in which we predicted the effect (F vs. R = 0.14), $F(1, 211) = 29.16$, $p < .001$, $\eta_p^2 = .121$, but not found across experiments and conditions in which we did not predict the effect (F vs. R = 0.04), $F(1, 90) = 0.82$, $p = .368$. The effect size in the predicted conditions was approximately double the effect size in all conditions, although it was still in the small range.

To examine the impact of valence, we conducted separate 2 (group) × 3 (valence) ANOVAs of the negative, positive, and neutral List 1 and List 2 memories recalled correctly by the 245 participants across the four experiments that were used to analyze valence (Experiments 3–6; refer to Table 2). The ANOVA of List 1 memories yielded a group main effect that was small, $F(1, 242) = 17.50$, $p < .001$, $\eta_p^2 = .067$, and a valence main effect that was very small, $F(2, 241) = 5.66$, $p = .004$, $\eta_p^2 = .023$. The Group × Valence interaction was not significant, $F(2, 241) = 2.38$, $p = .094$. This confirmed that, despite the findings from Experiment 3, List 1 costs of directed forgetting were similar across negative, positive, and neutral memories. We reconducted this analysis after removing Experiment 3 from the data set and found the same pattern: a group main effect that was small, $F(1, 213) = 12.65$, $p < .001$, $\eta_p^2 = .056$, a valence main effect that was very small, $F(2, 212) = 7.12$, $p = .001$, $\eta_p^2 = .032$, and no Group × Valence interaction, $F(2, 212) = 0.87$, $p = .418$. With (or without) Experiment 3, valence influenced final recall of List 1 memories independent of directed forgetting instructions: Participants recalled fewer neutral memories ($M = 0.55$, $SD = 0.29$) than either negative ($M = 0.60$, $SD = 0.25$) or positive ($M = 0.61$, $SD = 0.27$) memories, $F(1, 243) = 7.72$, $p = .006$, $\eta_p^2 = .031$, and $F(1, 243) = 9.07$, $p = .003$, $\eta_p^2 = .036$, respectively; negative and positive memories did not differ, $F(1, 243) = 0.11$, $p = .737$. These were very small effects.

The 2 (group) × 3 (valence) ANOVA of List 2 memories (for the 245 participants in Experiments 3–6; refer to Table 2) yielded only a valence main effect that was very small, $F(2, 241) = 5.40$,

[8] We thank Michael Anderson for pointing out this possibility and for suggesting an analysis to test it.

[9] In this approach, all raw data from separate studies are used as a collective. Mega-analysis of multiple sets of raw data offers estimation of parameters with more breadth, precision, and reliability than can be achieved by any single study (McArdle & Horn, 2002).

p = .005, η_p^2 = .022; the group main effect and the Group × Valence interaction were not significant, $F(1, 242) = 1.08$, p = .301 and $F(2, 241) = 0.73$, p = .482, respectively. Valence influenced recall of List 2 memories independent of directed forgetting instructions: Participants recalled the same number of neutral memories (M = 0.64, SD = 0.27) and negative memories (M = 0.66, SD = 0.25), $F(1, 243) = 0.92$, p = .338, but participants recalled more positive memories (M = 0.71, SD = 0.24) than neutral or negative memories, $F(1, 243) = 10.14$, p = .002, η_p^2 = .040, and $F(1, 243) = 5.01$, p = .026, η_p^2 = .020. These were very small effects.

These mega-analyses highlight two crucial findings: (a) modest, but reliable, forgetting of recently recalled (List 1) autobiographical memories, particularly in experiments and conditions for which we predicted the effect; and (b) small, but consistent, effects of valence that were independent of instructions. We found similar List 1 costs of directed forgetting for negative, positive, and neutral memories, although overall, participants tended to recall fewer unemotional memories than emotional memories.

Further Analysis of Output Order

The directed forgetting effects for List 1 memories in Experiments 1–6 may be mediated by inhibitory processes that were triggered by the instruction to forget. Alternatively, these effects may be due to output interference. That is, participants in the forget group may have a bias for recall of List 2 memories first, which then blocks or overshadows the yet-to-be-recalled List 1 memories, whereas participants in the remember group may recall List 1 memories first or distribute their recall more evenly across the lists. In Experiments 1–3, we formally controlled output order during final recall. Although Experiments 1–3 individually yielded no effects of output order, we combined the data and conducted a mega-analysis to ensure that output order played no role in our findings. A 2 (group) × 2 (output order) ANOVA of List 1 memories that were correctly recalled by the 89 participants in Experiments 1–3 yielded only a group main effect, $F(1, 85) = 11.66$, p = .001, η_p^2 = .121. Consistent with findings reported above, the main effect of output order and the Group × Output Order interaction were not significant (Fs < 0.80, ps > .374). A similar analysis of List 2 memories yielded no significant main or interaction effects (Fs < 1.32, ps > .255). Thus, we found no evidence of output order influencing directed forgetting in these experiments.

In Experiments 4–6, we did not formally control output order, but we did take note of the order in which participants recalled memories, and we then calculated mean recall positions of List 1 and List 2 memories (for a similar analysis, see Barnier, Hung, & Conway, 2004; Conway et al., 2000). We assigned a score of 1 to the first recalled memory (whether List 1 or List 2), a score of 2 to the second, a score of 3 to the third, and so on. We then added the recall positions for each list and divided it by the total number of memories recalled. Lower position scores indicate earlier recall. Table 4 presents the mean recall positions for List 1 and List 2 memories according to directed forgetting group. Lower scores across List 1 and List 2 indicate that one set of memories was recalled earlier. Higher scores across forget and remember groups or across experimental conditions indicate only that more memories were recalled overall in that condition. The critical comparison is whether, within one group or condition, List 2 position scores are significantly lower than List 1 scores, indicating earlier recall and evidence of output interference.

Table 4
Recall Position for Memories by Directed Forgetting Groups

	List 1		List 2	
Group	*M*	*SD*	*M*	*SD*
Experiment 4				
Free recall				
Forget	8.46	2.53	8.42	1.99
Remember	11.30	2.50	9.34	1.84
Experiment 5				
Unrelated				
Forget	8.03	2.24	8.05	3.33
Remember	8.77	2.20	9.15	2.64
Related				
Forget	8.23	2.85	8.13	2.69
Remember	9.49	2.30	8.89	3.24
Experiment 6				
Cued elicitation				
Forget	8.75	3.11	8.57	2.49
Remember	9.67	2.84	9.19	2.37
Cluster elicitation				
Forget	11.68	2.70	9.27	2.69
Remember	11.05	3.09	11.29	2.34

Note. Recall positions were not calculated for the Experiment 4 cued recall condition because the (random) recall position was imposed by the cued recall test.

Separate 2 (group) × 2 (list) ANOVAs for each of the five conditions listed in Table 4 yielded no significant main or interaction effects for the unrelated and related conditions in Experiment 5 (Fs < 1.74, ps > .195) or for the cued elicitation condition in Experiment 6 (Fs < 1.43, ps > .24). For the free recall condition in Experiment 4, the analysis yielded a group main effect, $F(1, 26) = 6.94$, $p < .014$, η_p^2 = .211; a list main effect, $F(1, 26) = 4.84$, $p < .037$, η_p^2 = .157; and a Group × List interaction, $F(1, 26) = 4.50$, $p < .044$, η_p^2 = .148. Whereas the forget group's recall was distributed evenly across the lists, the remember group recalled List 2 memories earlier than they recalled List 1 memories (see Table 4). However, this pattern does not explain the forget group's directed forgetting of List 1 memories. For the cluster elicitation condition in Experiment 6, the analysis yielded a Group × List interaction, $F(1, 38) = 4.35$, $p <$ .044, η_p^2 = .103 (the group and list main effects were not significant; Fs < 2.89, ps > .097). Whereas the remember group's recall was distributed evenly across the lists, the forget group recalled List 2 memories earlier than they recalled List 1 memories (see Table 4). This is the only finding consistent with output interference as an interpretation of the directed forgetting effects in Experiments 1–6.

General Discussion

Across six experiments, we observed reliable directed forgetting of recently recalled autobiographical memories. Our mega-analysis indicated that memories elicited to List 1 cues and then subjected to a directed forgetting instruction were recalled, on average over all conditions, at a rate of 55%. In contrast, memories elicited to List 1 cues and then subjected to a remember instruction were recalled, on average over all conditions, at a rate of 66%. Thus, the forget instruction consistently and reliably impaired recall of List 1 memories to approximately 11% below the baseline performance of the group instructed to remember. In Experiments 3–6, we explored the impact of emotional valence on directed forgetting of autobiographical memories. Independent of directed forgetting instructions, participants recalled fewer unemotional (neutral) memories than emotional (either negative or positive) memories. However, the directed forgetting instruction was successful, irrespective of the emotional valence of the targeted memories. The directed forgetting effect was abolished when participants were tested by cued recall (in Experiment 4), and it was reduced when List 1 and List 2 memories were drawn from related lifetime periods (in Experiment 5). However, related memory cues and memories that were elicited (and thus related) in clusters had little or no effect on directed forgetting but instead increased overall recall (in Experiments 2 and 6). This suggests an important, but complex, role for organization in the control of autobiographical remembering.

These novel findings demonstrate that the list-method directed forgetting procedure can be extended to complex emotional and personal representations and that this laboratory procedure influences autobiographical material in some of the same ways as it does recently acquired, simple verbal information. It is worth noting that our forgetting effects were small: Effect sizes for group (as measured by partial eta squared) ranged from .068 (in the mega-analysis) to .259 (in the free recall condition of Experiment 4), which can be compared with the effect size for test type (free vs. cued recall) in Experiment 4 ($\eta_p^2 = .637$). These effect sizes may reflect low power. Nevertheless, the forgetting effects, although small, were consistent, and they point to a successful adaptation of the directed forgetting procedure to autobiographical recall. It is more important to note that the consistency of our findings supports arguments that directed forgetting can be used to investigate the inhibition of autobiographical memories that are seen in particular forms of everyday and/or pathological forgetting (Anderson & Green, 2001; E. L. Bjork et al., 1998; Conway, 2005; Levy & Anderson, 2002) and that the processes that mediate directed forgetting may also underlie aspects of impaired memory in everyday life (Joslyn & Oakes, 2005; Koutstaal & Schacter, 1997; Racsmány & Conway, 2006).

Influences on Directed Forgetting of Autobiographical Memories

Three features of autobiographical memory and autobiographical remembering influenced directed forgetting: emotion, retrieval dynamics, and organization. We consider each in turn.

Emotion. One striking finding of the present experiments is that the forget instructions impaired negative, positive, and neutral autobiographical memories equally. Irrespective of valence, all memories were less likely to be recalled following the forget instruction, which is consistent with Wessel and Merckelbach's (2006) directed forgetting findings for negative and neutral words and with Barnier, Hung, and Conway's (2004) retrieval-induced forgetting findings for negative, positive, and neutral autobiographical memories. Experiment 3 produced the only exception to this pattern. The directed forgetting effect was smaller for negative memories. Possibly this occurred because of the negative memory cues used here (a difference from Experiments 4–7), because of a change in the presentation of the cues (a computer-based task rather than the one-on-one interview used in Experiments 4–7), or perhaps there was something about the memories themselves that rendered them less prone to directed forgetting (participants took longer to elicit these memories in the first place; see the Appendix).

Given the consistency of forgetting over all experiments and in most memories, this reduced effect for negative memories in Experiment 3 might have been a chance fluctuation that was based on several factors. Or it may point to the possibility that in certain circumstances, certain memories are more or less susceptible to forgetting. Together with Elke Geraerts, we recently collected data in this autobiographical directed forgetting paradigm (using the same cues and procedure as Experiment 4) from participants defined as high anxious or low anxious and high defensive or low defensive. High-anxious people showed List 1 forgetting for negative, but not positive, memories; low-anxious people showed no List 1 forgetting for either negative or positive memories (for other forgetting findings with this population, see Barnier, Levin, & Maher, 2004; Geraerts, Merckelbach, Jelicic, & Smeets, 2006). These findings suggest that when individuals do show directed forgetting, memory valence may not be the best predictor. In their Experiment 1, Joslyn and Oakes (2005) found equivalent directed forgetting for negatively and positively valenced events and for high and low emotional intensity events; however, in their Experiment 2, they reported less directed forgetting for low emotional intensity events. The likelihood of forgetting such events may be determined, not by valence or intensity, but by the information that memories contain about goals or about the self. Memories that are central to working self-goals may be resistant to inhibition (Conway, 2005; see also Barnier, Hung, and Conway, 2004; Joslyn & Oakes, 2005; McAdams, 2001). Further investigation is needed to identify the characteristics of individuals or the characteristics of individual memories that predict susceptibility to intentional forgetting.

In addition to robust directed forgetting for all memories, participants recalled fewer neutral memories than negative or positive memories. This small, although reliable, effect was independent of forgetting instructions. In analyses of the accessibility (latency) and qualities (valence, clarity, age) of memories as they were generated (see the Appendix), no differences were found except that, as expected, neutral memories were rated as less negative than negative memories and as less positive than positive memories. There were no other features or aspects of memories to explain why neutral memories were less memorable on the final test. Barnier, Hung, and Conway (2004) found similar evidence of emotional asymmetry in final recall; but in their experiment, neutral memories were more memorable than negative or positive memories. Again, perhaps the low (or high) likelihood of recalling neutral memories depends on the value of the content of memories—that is, the value for the self. Memories associated with strong emotions (regardless of valence) might generally be more memorable than memories associated with weaker emotions because memories associated with strong emotions contain important information about self-goals, a view developed further in Conway and Pleydell-Pearce (2000); Conway, Singer, and Tagini (2004); and Conway (2005).

Retrieval dynamics. There was little evidence of enhanced final recall of List 2 memories after the forget instruction. According to inhibitory accounts, retrieval inhibition of List 1 items releases List 2 items from proactive interference (Anderson, 2005; E. L. Bjork et al., 1998). In Experiment 3, the forget group recalled fewer positive List 1 memories but more positive List 2 memories than the remember group recalled. But, this was the only effect of instruction on List 2 memories. Enhanced recall of List 2 items, interpreted by researchers as release from proactive interference, is an inconsistent effect, even in experiments involving word lists (Conway et al., 2000; MacLeod, 1998). In our experiments, the task of generating memories rather than simply studying words may have rendered release from proactive interference unlikely or irrelevant, despite the consistent (inhibitory) forgetting effects for List 1 memories. Alternatively, impaired List 1 recall, but not enhanced List 2 recall, might reflect the operation of two distinct processes. Sahakyan and Delaney (2005; see also Sahakyan, 2004; Sahakyan & Delaney, 2003; Sahakyan et al., 2004) argued that the directed forgetting costs and benefits are due to context change and strategy shift, respectively. By this account, the benefits, enhanced List 2 recall, arise because participants given the forget cue are more likely to shift to better study strategies for List 2 than are participants given the remember cue. In our experiments, the participants' primary task of actively generating memories, rather than passively studying presented material, may have meant there were no study strategies to change. Autobiographical memories may be organized and retrieved in such a way that processes that operate to impair (inhibit) or enhance (facilitate) simple verbal material may operate in quite different ways with these rich memories (see next section for more on the role of organization and a later section for more on the context-change and strategy-shift accounts).

Directed forgetting and release of inhibition were influenced by retrieval conditions at final recall. In Experiment 4, the directed forgetting effect was abolished when participants were tested with cued recall rather than with free recall. These findings are consistent with directed forgetting of word lists, in which re-presenting some or all of the words releases inhibition of some or all of the list, but a simple intention to remember is ineffective (Basden, Basden, & Wright, 2003; E. L. Bjork & Bjork, 1996; Conway et al., 2000; Geiselman, Rabow, Wachtel, & Mackinnon, 1985; MacLeod, 1999). Thus, participants' failure to retrieve to-be-forgotten autobiographical memories was not due to a strategic or social motivation to not report. Whereas the initiation of directed forgetting appears to be goal directed and consciously controlled, once triggered by the intention to forget and the second list learning, its effects (via inhibition) appear to be outside conscious control and not easily overcome by an intention to remember (Anderson, 2005; Conway et al., 2000). These qualities distinguish directed forgetting from retrieval-induced forgetting, in which both the initiation of forgetting and its effects on recall are unintentional (Anderson & Spellman, 1995), and from thought suppression or think/no-think tasks, in which avoidance, but not necessarily forgetting, is intentional (Anderson & Green, 2001; Wenzlaff & Wegner, 2000; for a comparison of forgetting methods, see Anderson, 2005).

One implication of Experiment 4 is that a person may intentionally avoid encountering cues that have the potential to overcome the forgetting of memories that he or she has intentionally tried to forget and would rather not remember. Memories of negative experiences or experiences that reflect an unwanted self might often be in some partly inhibited, difficult-to-access state, which renders them hard to intentionally recall. This would be adaptive behavior because people would be less likely to retrieve memories that make them feel depressed or anxious, for instance, and more likely to retrieve memories that do not induce a negative mood state (just as the forget group recalled more List 2 memories; Conway, 2005; Strauman, 1992). Avoidance of cues that trigger unwanted recall is a feature of psychological disorders, such as posttraumatic stress disorder, and can lead to extreme and persistent maladaptive behavior (for a recent review, see Brewin & Holmes, 2003). Cue avoidance, then, may represent an adaptive attempt to maintain lowered accessibility and inhibition of unwanted memories of past experiences.

Organization. In Experiments 2, 5, and 6, we examined the impact of the organization of memories on directed forgetting. Organization is particularly relevant to autobiographical memories, because personal memories are highly organized within the autobiographical knowledge base (Conway, 2005; Conway & Pleydell-Pearce, 2000; Conway et al., 2004; see also Brown & Schopflocher, 1998; Wright & Nunn, 2000). Indeed, Racsmány and Conway (2006) proposed that the hierarchical and partonomic nature of the knowledge structures of autobiographical memory makes them especially well-suited to inhibitory control. In Experiment 5, in which we capitalized on the preexisting organization of memories, we found a reliable directed forgetting effect of 12% when List 1 and List 2 memories were drawn from different lifetime periods. This finding is particularly interesting because it suggests that directed forgetting can attenuate access to knowledge and memories contained in a period of a person's life. However, the effect was reduced to 3% when List 1 and List 2 memories were drawn from the same lifetime period. (Parenthetically, this finding lies outside the range of accounts of the directed forgetting effect that emphasize selective rehearsal, changes in encoding strategy, etc.). This impact of related memories reinforces the view that inhibitory processes are triggered by the potential for List 1 and List 2 memory representations to compete during retrieval and that integration across the lists reduces or even abolishes directed forgetting. Competition may determine the magnitude of inhibitory effects and, at extremes, where there is integration between the lists rather than competition, may act as a boundary condition. It is notable that these attenuating effects of integration or lack of competition have been found to hold for directed forgetting of both word lists and autobiographical memories (see also Conway et al., 2000; Golding et al., 1994). A different interpretation of Experiment 5 is that the process of generating related memories, and not relatedness itself, reduced directed forgetting. Participants in the related condition may have allocated extra rehearsal time to List 1 memories as they decided whether each List 2 memory belonged to the List 1 lifetime period. If this was the case then we should have seen an increase in recall relative to the unrelated condition, but we detected no such increase.

In Experiments 2 and 6, competition and integration were manipulated in different ways. In Experiment 2, semantically related List 1 and List 2 cues did not reduce the directed forgetting effect for memories elicited to those cues. Unlike the findings for semantically related word lists (Conway et al., 2000), related cues merely boosted overall recall. This may be because related cues did not elicit related, and thus integrated, memories. Instead, the related cues provided additional, and perhaps slightly more informative, retrieval cues when List 1 and List 2 memories were recalled. Similarly, in Experiment 6, the imposed organization created by eliciting memories in clusters had little effect on directed forgetting but increased overall recall. The findings of this experiment were somewhat harder to interpret; we found a directed forgetting effect for all participants in the overall ANOVA, a similar difference between forget and remember groups across cluster and cued elicitation (12%), but a directed forgetting effect in only the cued and not the cluster condition when the analysis was focused on the elicitation conditions separately.

Together, the findings of these experiments suggest a complicated relationship among directed forgetting, valence, and memory organization. Nonetheless, two main points clearly emerge. The first is that competition is an important prerequisite for directed forgetting of recently recalled autobiographical memories. This triggering influence of competition places directed forgetting close to retrieval-induced forgetting, which also requires competition between practiced and unpracticed exemplars (via a shared category cue; Barnier, Hung, & Conway, 2004), and somewhat distinguishes directed forgetting from thought suppression and think/no-think, which do not necessarily require competition between wanted and unwanted material. Interestingly, however, studies of thought suppression suggest that focusing on an alternative thought (which effectively competes with the unwanted thought) increases suppression success (Wenzlaff & Wegner, 2000; for review, see Koutstaal & Schacter, 1997). The second point is that the preexisting structure of the autobiographical knowledge base may facilitate (or dysfacilitate) inhibition when organization naturally delineates (or integrates) two or more sets of memories that have the potential to compete in recall.

Alternatives to an Inhibitory Account

Directed forgetting is typically described and explained in terms of retrieval inhibition (R. A. Bjork, 1989; MacLeod, 1998). That is, directed forgetting is seen as reducing the accessibility, but not the availability, of information for retrieval. But do our findings genuinely reflect inhibition? Output interference, differential rehearsal, and the two-factor account (context-change & strategy-shift) offer three alternative, noninhibitory explanations. Output interference refers to the possibility that an output order bias exaggerates the appearance of an inhibitory effect (Anderson, 2005; E. L. Bjork et al., 1998; Conway et al., 2000). In Experiments 1–3, we controlled output order and found directed forgetting effects irrespective of which memories participants recalled first (both within each experiment and in the mega-analysis across experiments; see Racsmány & Conway, 2006, for highly related findings involving word lists). In Experiments 4–6, we recorded output order (but did not formally control it) and, with only one exception (Experiment 4, cluster condition), we found no differences in the recall positions of List 1 and List 2 memories across forget and remember groups. On the basis of these controls and analyses, it appears that output interference played little or no role in our directed forgetting findings.

Differential rehearsal refers to the possibility that participants in the forget group do not rehearse List 1 items and instead focus all their attention on List 2 items, whereas participants in the remember group continue to rehearse List 1 items while studying List 2 items. This may explain why the forget group's recall of List 1 is impaired and their recall of List 2 is improved, whereas the remember group's recall of List 1 is improved and their recall of List 2 is impaired (E. L. Bjork et al., 1998; MacLeod et al., 2003). This account assumes that during presentation of either or both List 1 and List 2, participants in the remember group are motivated to think back and rehearse their memories of List 1 material. Although we cannot directly rule out selective rehearsal in our findings, we can draw some inferences about its influence from participants' task performance and pattern of recall.

Whereas participants in Experiments 1–3 were told at the beginning of the experiment that they would have to recall all memories later on, those in Experiments 4–6 were not told that they needed to recall List 1 (and List 2) memories until they received the midlist instruction. Although participants in Experiments 1–3 may have had more reason to rehearse List 1 memories (at least up until the mid-list instruction) they showed directed forgetting similar to that shown by participants in Experiments 4–6. This does not completely exclude the possibility of selective rehearsal in all experiments, but it does make it an unlikely explanation for the full pattern of findings. In the directed forgetting procedure that we adapted, participants actively generated memories from their past rather than passively looked at words on a screen (as in a standard directed forgetting experiment). They took, on average, 5–15 s to generate each memory, which is consistent with iterative access to autobiographical knowledge and the time necessary to generate specific, detailed, emotional memories from the past (Conway, 1990). For instance, Haque and Conway (2001) found that if participants' autobiographical retrieval was interrupted by an early (2 s) rather than a late (5 s) probe about the contents of consciousness, they reported general memories rather than specific memories. If participants in our remember groups were rehearsing previous memories during List 1 and/or List 2 generation, as well as trying to generate new memories, we might have seen evidence of this dual tasking in their memory generation latencies and memory specificity ratings. But we observed no such differences. Also, if participants were reflecting on earlier memories while generating later ones, we might have expected memories to be cued by and related to each other (rather than different from each other, as per instructions). Given the findings of Experiment 5, such a process would have increased relatedness and integration of List 1 and List 2 memories and thereby reduced or altogether abolished the directed forgetting effect. We did not find this either. Finally, recall of List 2 memories by the forget group was not significantly better or worse than that of the remember group, which also is an argument against differential rehearsal. Overall, these observations strongly suggest that differential rehearsal does not offer a plausible explanation of the full pattern of findings.

Finally, as noted above, the two-factor account (context-change and strategy-shift) supports the argument that the forget groups' poorer recall of List 1 memories is due to a change in context between List 1 and List 2 in response to the forget instruction but that the forget group's better recall of List 2 memories is due to a shift toward a more effective, elaborative encoding strategy for List 2 (Sahakyan & Delaney, 2003, 2005; Sahakyan et al., 2004; see also Basden, Basden, & Morales, 2003; but for an inhibitory interpretation of context-change and strategy-shift accounts, see

Anderson, 2005). Sahakyan and Delaney (2005) argued that these mechanisms generally operate together to produce the full directed forgetting effect; however sometimes they operate independently to produce directed forgetting costs but not directed forgetting benefits, or directed forgetting benefits but not directed forgetting costs. Could this be the case in our experiments with autobiographical memories? With regard to strategy shift, by Sahakyan and Delaney's (2005) account, we failed to find List 2 benefits because participants did not change their encoding strategy. However, as noted earlier, there were no obvious memory encoding or study strategies to change, as participants actively generated memories from their past rather than passively studied presented words. Experiment 5 offered the clearest opportunity for strategy shift when some participants were asked to recall memories from two distinct lifetime periods. Even here, we found no List 2 benefits.

For context change, by Sahakyan and Delaney's (2005) account, our List 1 costs were the result of participants encoding the List 2 items within a new mental context. Again, it is not clear whether this context change process operates in the same way for people retrieving previously encoded autobiographical memories rather than encoding new verbal material. If a change in mental context was responsible we might have expected to see stronger List 1 costs under conditions that potentially maximized context change. Again looking at Experiment 5, participants in the unrelated condition were encouraged to cast their mind back to a completely different life period. Yet their forgetting was no greater in that experiment than in any other experiment. For these reasons, then, the two-factor (context-change and strategy-shift) account does not provide a full explanation of the present findings (although a more detailed investigation of the role of context change in autobiographical forgetting would be valuable, as in Sahakyan & Kelley, 2002). Nonetheless, a version of the context change account that conceptualizes context change as a trigger for inhibition can address the present findings, and it is this we turn to next.

What Is Inhibited?

Our interpretation of the findings as reflecting inhibition, rather than the non-inhibitory processes considered above, is consistent with a generally accepted view that the directed forgetting procedure inhibits the forget group's memory for List 1 (R. A. Bjork, 1989; Conway et al., 2000; Racsmány & Conway, 2006). But what exactly is inhibited? Recently, we have proposed that what is inhibited in directed forgetting and other procedures thought to induce inhibition in remembering are the features or content of episodic memories that were formed during original learning. We term this view *episodic inhibition* (Racsmány & Conway, 2006). In episodic inhibition, the intention to forget and the learning of List 2 both act to trigger inhibition of a recently formed episodic memory of learning List 1. We suggested that the end of List 1 learning, clearly marked by the midlist instruction and change in activities and goals, constitutes an *event boundary* (Zacks, Speer, Swallow, & Braver, in press). In response to detection of this cognitive juncture in continuous experience, an episodic memory is formed (Williams, Conway, & Baddeley, in press). The memory contains goal-relevant knowledge that dominated during the event, such as copies of lexical and semantic representations of words and concepts; that is, the List 1 items, contextual features, affect, and other goal information. At the point of formation and until the learning of List 2, the content of the episodic memory of List 1 are all in a state of activation that will optimize their later recall. Subsequently, however, the forget instruction primes inhibitory processes. Learning List 2 items triggers these processes and directs them to the episodic memory of List 1, a memory that has already been targeted for inhibition and that has the potential to compete with List 2 in later recall.[10]

In this way, a pattern of activation/inhibition is configured over the previously uniformly activated indices or features of the episodic memory of List 1. Exactly how this pattern is formed is not known, but it may be channeled by the access of List 1 items during List 2 learning. Participants occasionally report becoming aware of accessing List 1 items during List 2 learning, and it seems reasonable to assume that this access might well occur at an unconscious level even more frequently. Thus, we postulate that accessing List 1 items during List 2 learning targets inhibition on those List 1 items and in this way, a pattern of activation/inhibition is constructed over the content of the episodic memory of List 1. Thus, List 1 items accessed during List 2 learning (consciously or unconsciously) are inhibited, whereas List 1 item that are not accessed during List 2 learning remain in their original activated state. It is this pattern of activation/inhibition that determines the accessibility of memory content during later recall (Racsmány & Conway, 2006).

In the present experiments, the content of a memory of List 1 will contain a record of the memories generated and the List 1 cues used to elicit them. According to the episodic inhibition approach, inhibitory processes triggered during List 2 learning are then targeted at specific representations contained in the episodic memory of List 1. Those representations of memories and cues contained in the episodic memory of List 1, which are accessed during List 2 learning, are selected for inhibition.[11] Whether this takes the form of a lowering of their current activation values, a type of dysfacilitation, and/or a change to a negative

[10] An alternative account, termed retrieval inhibition, is that inhibition is triggered during final recall rather than during second list learning (Bjork et al., 1998). But if it is assumed that retrieval inhibition is targeted at episodic memories, such as an episodic memory of List 1, then it is virtually identical with episodic inhibition. The only difference is that the inhibition is triggered during retrieval rather than during second list learning. We believe that inhibition can be triggered in both ways but, in directed forgetting, is most powerfully triggered during second list learning and only weakly present in later recall (see Racsmány & Conway, 2006). In other tasks, such as retrieval practice, inhibition triggered at retrieval may play a more prominent role.

[11] An alternative interpretation is that the participants inhibited the cues used to elicit memories and not the memories generated to those cues. In our analysis of memories elicited in clusters in Experiment 6, we argued against this possibility. These memories were elicited from preceding memories and not to individual cues. Thus, recalling the cue would have been an ineffective means to access the memories. Final recall of Memories 2–5 in the Experiment 6 cluster condition suggests that memories were forgotten independently of the cue used to elicit the cluster to which they belonged. That is, directed forgetting operated on memories and not on cues. More generally, if cues were inhibited but memories were not, then we should have seen some cases of recall of memories without recall of the cue originally used to prompt recall. But this pattern of recall was not observed in any of the above experiments. Thus, it appears unlikely that what was inhibited were the cues used to elicit recall.

state, is not known. But whatever the exact mechanism, the net effect is that these representations become less accessible in later acts of remembering. This is reflected throughout the present set of experiments, in which recall of List 1 items by the forget groups was consistently and reliably attenuated but not abolished altogether, presenting a pattern of recall predicted by the episodic inhibition account.

It is important to note that because participants in the present experiments could, after all, remember that they studied two lists, the actual List 1 memory itself is not inhibited. The fact that they can remember some, although comparatively few, of the List 1 items (cues and memories) shows that the contents of the memory can be accessed at least to some extent. Thus, what is inhibited is some aspects of the memory of remembering (see also Arnold & Lindsay, 2001, 2005; Conway, 2005). This version of episodic inhibition, combined with the spontaneous use of directed forgetting in everyday life, may help in the understanding of some forms of memory pathology. For example, the forgot-it-all-along effect occurs when patients recall a traumatic episode that they had apparently forgotten but, they are then surprised to learn, had described to others during the period of supposed forgetting (Arnold & Lindsay, 2001, 2005; Schooler, Bendiksen, & Ambadar, 1997). The forgot-it-all-along effect may arise if the patient, having recalled the traumatic event (equivalent to List 1 in the directed forgetting procedure), immediately attempts to forget this moment of recall (with a self-administered forget instruction) and turns their attention to encoding some other aspect of ongoing experience (equivalent to List 2 learning). In this way, the patient becomes unaware of their recent recall of the troubling event as their memory of recalling the event is inhibited (for a different example of forgetting previous remembering, see Read & Lindsay, 2000).

Obviously the exact procedures mediating this effect in a patient will be more complicated than this. There will, for instance, be many self-administered episodes of directed forgetting and many other attempts at avoidance and intentional forgetting (for supportive evidence, see Schooler et al., 1997). Together these might give rise to quite powerful, long-sustained, and even proceduralized inhibition and avoidance of destabilizing mental contents. That a single attempt at directed forgetting can attenuate memory for recently recalled emotional and unemotional autobiographical memories, which is what the present series of experiments have demonstrated, indicates the potential of this method to maintain impaired access to selected memories in everyday life. Thus, given this attenuating effect with a single trial of directed forgetting, it is to be expected that repeated attempts, perhaps occurring on many occasions over long periods of time, could well have the effect of imposing an intense inhibition on specific autobiographical memories, even to the extent that the person who remembers cannot recall having recalled the memories previously. Nonetheless, such an inhibition can be overcome by sufficiently specific cues, as demonstrated in Experiment 4, and consequently, the inhibition must be reestablished (an observation originally made by Freud, 1915/1957). Episodic inhibition of memories of recalling negative information and information with other types of valence may then result from the spontaneous use of (list) directed forgetting in everyday life. Such spontaneous directed forgetting may feature in pathology, in which it might give rise to a phenomenon such as the forgot-it-all-along effect but, more generally, may also be present in the everyday management of memory.

Conclusions

The findings from our six experiments demonstrate that recently recalled autobiographical memories can be inhibited by the relatively simple, single action of being instructed to forget them, followed by the turning of attention to another set of to-be-remembered memories. There were boundary conditions on this effect: Cues to either the list or list items overcame the directed forgetting, and the organization of knowledge that reduced competition reduced the effect. Although characteristics of the targeted memories may render them more or less susceptible to forgetting, the directed forgetting effect did not differ as a function of memory valence. Our success in reliably inducing inhibition of recently recalled autobiographical memories in the laboratory with a simple, unrepeated procedure suggests that in everyday cognition, much more powerful effects might be present. Spontaneous and repeated use of a directed forgetting procedure on the same knowledge may induce much stronger and enduring inhibitory effects. In everyday life, there may be many opportunities for repeated directed forgetting, and inhibitory control of autobiographical memories may be both common and effective.

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Appendix

Memory Accessibility and Memory Quality Data

In each experiment, we indexed the accessibility of participants' memories via generation latencies. We also indexed the quality of participants' memories via self-report estimates of memory age and self-report ratings of importance, clarity, intensity, and frequency of rehearsal (in Experiments 1–3, on 5-point Likert scales) and self-report ratings of clarity and valence (in Experiments 4–6, on 7-point Likert scales). Valence ratings were especially important for confirmation that negative, positive, and neutral cues reliably elicited appropriately valenced negative, positive, and neutral memories.

Experiment 1

The majority of participants generated memories to the majority of cues (missing cases were less than 1%). Mean generation latency was 6,375 ms (SD = 4,463). These comparatively slow and highly variable generation latencies are typical of autobiographical memory retrieval findings (for a recent example, see Conway, Pleydell-Pearce, & Whitecross, 2001, and for a review, see Conway, 1990). Mean age of memory was 10 years (mean age

(*Appendix continues*)

at encoding was 23.10 years, $SD = 11.40$). Also consistent with past research, memories were rated as moderately important ($M = 2.40$, $SD = 1.20$), generally clear ($M = 3.20$, $SD = 1.10$), relatively unemotional ($M = 2.10$, $SD = 1.10$), and not often thought of or talked of ($M = 2.10$, $SD = 1.10$).

Experiment 2

The majority of participants generated memories to the majority of cues. Mean generation latency was 7,004 ms ($SD = 8{,}142$) and memories were on average 10 years old (mean age at encoding was 20.10 years, $SD = 13.10$). Memories were rated as moderately important ($M = 2.40$, $SD = 1.30$), generally clear ($M = 3.00$, $SD = 1.10$), relatively unemotional ($M = 2.60$, $SD = 1.10$), and not often thought of ($M = 2.10$, $SD = 1.20$).

Experiment 3

The majority of participants generated memories to the majority of cues. Memory generation latency was slowest for negative cues ($M = 16{,}523$ ms, $SD = 27{,}856$), faster for positive cues ($M = 14{,}401$ ms, $SD = 20{,}753$), and fastest for neutral cues ($M = 9951$ ms, $SD = 16{,}169$). This pattern is consistent with previous reports of slower retrieval times for emotionally valenced memories (see Conway, 1990; Conway et al., 2001; Robinson, 1976). The longer generation latencies for neutral cues in this experiment, relative to Experiments 1 and 2, may reflect a general slowing of all autobiographical memory retrieval when emotional memories are constructed. Memories were on average 8 years old (mean age at encoding was 27.50 years, $SD = 13.50$). They were rated as somewhat more important ($M = 3.00$, $SD = 1.20$), clearer ($M = 3.60$, $SD = 1.00$), more emotionally intense ($M = 3.30$, $SD = 1.10$), and more often thought of ($M = 2.70$, $SD = 1.10$) than memories generated in Experiments 1 and 2, which again reflects this experiment's focus on emotional events.

Experiment 4

The majority of participants generated memories to the majority of cues. Mean generation latency was 6,468 ms ($SD = 3{,}846$) and the memories were on average only 2 years old (mean age at encoding was 17.90 years, $SD = 4.80$), which was much more recent than memories from Experiments 1–3. Memories were rated overall as very clear ($M = 5.70$, $SD = 0.70$). Notably, memories generated to negative cues ($M = 2.10$, $SD = 0.60$) were rated as more negative and less positive than memories generated to neutral cues ($M = 4.60$, $SD = 0.70$), which in turn were rated as more negative and less positive than memories generated to positive cues ($M = 6.00$, $SD = 0.70$). In other words, the negative, positive, and neutral cues generated appropriately valenced memories as intended. Unlike Experiment 3, however, memory latencies did not differ for negative, positive, and neutral memories.

Experiment 5

The majority of participants generated memories to the majority of cues. Mean generation latency was 15,960 ms ($SD = 1{,}210$). The longer latencies found here, compared with Experiment 4, may reflect the instruction to retrieve memories from specific lifetime periods rather than from any lifetime period. Memories were on average 4 years old (mean age at encoding was 16.00 years, $SD = 1.20$), which reflects our focus in this experiment on (1st year psychology students' recent) experiences during high school. Memories were rated overall as very clear ($M = 5.60$, $SD = 0.70$). As in Experiment 4, memory valence ratings indicated that the negative, positive, and neutral cues generated negative ($M = 2.60$, $SD = 0.7$), positive ($M = 5.90$, $SD = 0.60$), and neutral ($M = 4.50$, $SD = 0.70$) memories as instructed, irrespective of whether participants were generating memories of school or of holidays (one only need think of family Christmas celebrations to appreciate that negative, as well as positive and neutral, memories can be elicited from most life periods). Unlike what we found in Experiment 3, however, memory generation latencies did not differ for negative, positive, and neutral memories.

Experiment 6

The majority of participants generated memories to the majority of cues. Mean generation latency was 9,861 ms ($SD = 5{,}011$), and memories were on average 2 years old (mean age at encoding was 18.00 years, $SD = 4.00$). Memories were rated overall as very clear ($M = 5.60$, $SD = 0.70$); as in Experiments 4 and 5, memory valence ratings indicated that negative, positive, and neutral cues generated negative ($M = 2.60$, $SD = 0.80$), positive ($M = 5.60$, $SD = 0.70$), and neutral ($M = 4.20$, $SD = 0.90$) memories as instructed, irrespective of whether participants elicited memories to individual cues or memories in clusters. As in Experiments 4 and 5, memory generation latencies did not differ for negative, positive, and neutral memories.

Summary

For these experiments, we tested for differences in the accessibility and quality of memories at elicitation. Separate ANOVAs of these data yielded no effects apart from valence in Experiments 3–6. Consistent with the demands in these experiments, participants generated appropriately valenced negative, positive, and neutral autobiographical memories in response to negative, positive, and neutral cues. Importantly, the number of memories generated, memory generation latencies, age of memories, and ratings did not vary as a function of group, list, or any other between-subjects factors. Thus, neither the accessibility nor the quality of the autobiographical memories as they were generated can account for the forgetting observed in these experiments.

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