CHAPTER

18 The Need for Metaforgetting: Insights from Directed Forgetting

Lili Sahakyan *and* Nathaniel L. Foster

Abstract

Theories of metamemory are primarily concerned with mechanisms that improve memory; they do not account for processes that reduce accessibility of unwanted information, as in intentional forgetting. This chapter proposes that introducing separate terms like metaremembering and metaforgetting highlights the distinction between remembering and forgetting as different dimensions of memory. It reviews empirical evidence from directed forgetting studies. List-method directed forgetting depends on engaging active forgetting strategies, indicating the importance of control in successful intentional forgetting. The decision to engage in forgetting strategies, in turn, is affected by memory monitoring as evidenced through preexisting confidence about one's own memory ability, as well as judgments of learning solicited during the task. In item-method directed forgetting, participants control rehearsal by selectively retrieving earlier items believed to be more memorable, even when such beliefs are illusory. The chapter discusses the role of metacognitive monitoring and control in these active forms of forgetting.

Key Words: directed forgetting, DF, intentional forgetting, metamemory, metaforgetting

Metamemory has become one of the hot topics of cognitive psychology in the 21st century. It refers to our knowledge and awareness of our own memory processes, including the ability to monitor and control the learning process. Metamemory researchers are concerned with mechanisms that improve memory. For example, this topic is often discussed in reference to study habits, such as when students prepare for an upcoming exam and must determine how to go about learning and allocating their study time (for a review of research on student learning strategies see ~~Benjamin, this volume~~; Kornell & Finn, this volume). However, viewing memory through the prism of memory enhancement misses *forgetting* as an important component of memory, something that may actually promote rather than reverse learning (Bjork, 2011). It is customary to think that learning is a good thing because it accumulates knowledge, whereas forgetting is a flaw of our cognitive system because it describes the process of losing what has been gained during learning. However, in an elegant analysis of remembering, forgetting, and learning, Bjork (2011) pointed out that often conditions that produce forgetting enable new learning, whereas learning or retrieving some things could contribute to forgetting of other things. In other words, there is a complex, symbiotic relationship between remembering and forgetting.

The Missing Component in Metamemory

Relative to blooming research on metamemory and learning, there is rather limited research on metamemory and forgetting. The scarcity of this topic probably stems from the way we tend to think of forgetting as the opposite of remembering, where memory is absent, incomplete, or inaccurate—a phenomenon broadly construed as retrieval failure. However, it is important to distinguish forgetting from memory failure because of potentially different processes that could

contribute to memory failure. In theories of forgetting it is common to discuss the mechanisms that produce interference from previous or subsequent experiences; changes in context between encoding and retrieval; inappropriate/insufficient retrieval cues; changes in the nature of the memory trace itself, such as trace decay; and inhibition of information. In other words, a variety of distinct mechanisms could produce forgetting, and it is important to investigate forgetting separately from remembering, including the role of metacognitive factors in forgetting.

We propose that in the domain of metamemory research, it may be worthwhile to reserve separate terms like *metaremembering* and *metaforgetting* to denote the distinction between *remembering* and *forgetting* as different but complimentary dimensions of memory. While the concept of "remembering" itself has been the topic of controversy (e.g., Rajaram, 2007), we use this term in more a general sense characterized by the goal of retaining something in memory as opposed to forgetting unwanted information.

Incidental and Intentional Forgetting and Metamemory

As indicated earlier, forgetting is a broad term that is used in different ways. Today, memory researchers distinguish between unintentional, everyday forgetting from intentional, controlled forgetting. *Unintentional* forgetting happens to everybody outside of our desire or intention to forget. Forgotten birthdays, misplaced keys, and missed appointments are examples of unintentional forgetting. This is what people refer to when they complain that their memory is not good. However, developments in forgetting research led many scientists to conclude that people have more control over their own forgetting than they perhaps realize. In other words, we are not always passive victims of something that happens *to us*, but rather at times we are active participants of our own forgetting. At first, this idea might seem odd, because more often than not we wish to retain information rather than forget it. For instance, it is counterproductive to forget that you had already paid the electric bill and pay it again. However, sometimes situations arise when it is desirable to let go of some information because it was wrong, outdated, embarrassing, or painful. Thus, at times forgetting can be adaptive (e.g., Bjork, 1989), and to the extent that we can bring this process under our control, we would benefit from it. This form of forgetting that requires conscious control is known as *intentional* forgetting.

The limited research that investigated the relationship between metamemory and unintentional forgetting (Ariel & Dunlosky, 2011; Finn, 2008; Koriat, Bjork, Sheffer, & Bar, 2004; Rawson, Dunlosky, & McDonald, 2002; Serra & England, 2013) shows that framing things in terms of forgetting focuses on changes in retrievability over time, and such emphasis has different consequences for metamemory judgments compared to emphasis on remembering (e.g., Finn, 2008; Koriat et al., 2004). While the small number of studies in metamemory and unintentional forgetting is perhaps not too surprising, the limited research in the domain of intentional forgetting and metamemory (Foster & Sahakyan, 2012; Friedman & Castel, 2011; Sahakyan, Delaney, & Kelley, 2004; Tekcan & Aktürk, 2001) is striking and should serve as a motivation to pursue further investigation, given the role of *control* in both intentional forgetting research and metamemory research. In addition to control, *monitoring* could also be involved not only in terms of whether people are aware of the consequences of intentional forgetting (e.g., Friedman & Castel, 2011; Tekcan & Aktürk, 2001), but also in terms of how they approach intentional forgetting task in the first place. In other words, monitoring may be interesting to investigate not only on the back end of intentional forgetting, but also on the front end and throughout the task. In this chapter, we summarize our research on directed forgetting (DF) and the connections we made with metamemory, in hopes that it inspires future developments on this topic.

Bridging Metamemory and Intentional Forgetting

In general, different laboratory paradigms are used to study intentional forgetting, but what is common to them is that people are instructed to exert control over the contents of their mind by engaging in behaviors or processes that limit accessibility to unwanted information. Such control is implemented either via the instruction to forget something after it has been committed to memory (e.g., DF paradigms), or to stop thinking of a previously encoded memory when presented with a reminder cue (e.g., think-no-think paradigm). Given that research on intentional forgetting and metamemory is in its infancy stage right now, there is a golden opportunity to contribute to both literatures by bridging the methods and theories from intentional forgetting and metacognition.

How well one can monitor the extent of their learning could play a role in the decision to engage controlled processes to forget unwanted information. In other words, one needs to determine how well the information is learned in the first place before attempting intentional forgetting. Someone who thinks they are not doing too well in terms of committing items to memory might be unlikely to engage the processes that lead to reduced accessibility of that item. The ability to monitor the state of one's learning is likely to be affected by the characteristics of items, including illusions of memorability they could create. An item may be perceived as highly memorable compared to another item, and participants might be more willing to engage in intentional forgetting of the former than the latter item. An opposite prediction could also be made, with people selecting to forget the least memorable items thinking they might be more successful at forgetting those types of items as opposed to forgetting the most memorable items.

It is also important to consider the role of *preexisting* beliefs and theories participants might have about one's own memory efficacy. If someone thinks that their memory is not good (e.g., older adults), then instead of relying on the actual experience with the items during the experiment, they might act on preexisting beliefs about their own memory and not attempt intentional forgetting. In other words, what is the point of forgetting something on command if you believe forgetting will occur without any effort?

Last, but not least, the belief about whether people have control over forgetting is an especially important topic of investigation. Many people might have an intuitive belief that remembering is effortful whereas forgetting happens all the time without our intention, and hence there is no need to put effort into forgetting. Thus, people may be unaware they could influence and control their own forgetting. Anecdotally speaking, many people, including psychologists in the domains outside of cognitive, act surprised when they first hear that people are capable of forgetting on command.

In the sections that follow, we address some of these issues through our own research on DF, focusing on the list-method paradigm and the item-method paradigms, respectively.

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List-Method Directed Forgetting Studies

List-Method Directed Forgetting Paradigm

In list-method DF, participants study two lists of items, List 1 and List 2, for a later memory test. The typical list length ranges between 12 and 16 items per list. After studying List 1, half of the participants are instructed to forget that list. This *forget cue* is usually delivered as a verbal request by the experimenter to forget List 1 because it was "just for practice," but can sometimes come in the form of a staged computer crash (e.g., Sahakyan & Delaney, 2010), or a request to "only remember the next list" (e.g., Foster & Sahakyan, 2011). We refer to the group of participants who receive the forget cue as the *forget group*. Other participants are told to remember List 1. This *remember group* serves as a control against which the effects of the forget cue on List 1 and List 2 can be measured. Both groups of participants then study List 2, receive an instruction to remember List 2, and then receive a test of free recall for both lists (see Sahakyan, Delaney, Foster, & Abushanab, 2013, for methodological variations of the paradigm). Typical findings reveal impaired recall of List 1 in the forget group relative to the remember group—a finding known as DF *costs*. In addition, the forget group also shows enhanced recall of List 2—a finding known as DF *benefits* (Bjork, Bjork, & Anderson, 1998; MacLeod, 1998). Typical theoretical interpretations of list-method DF focus on changes in mental context, or inhibition of List 1 items (for more recent reviews, see Bäuml, 2007; Sahakyan, Delaney, Foster, & Abushanab, 2013). A complete theoretical review of this phenomenon is not the goal of this chapter, and interested readers should consult the reviews on this topic. Instead, we focus on the aspect of list-method DF where there is unanimous agreement among all the researchers investigating list-method DF; namely, the fact that it involves some active controlled mechanisms.

Controlled Forgetting Strategies and Their Role in Directed Forgetting

Our research has shown that the use of active forgetting strategies is critical for obtaining DF (Foster & Sahakyan, 2011). We collected retrospective verbal reports and discovered that 25% of people reported doing nothing to forget List 1 (further termed as "Forget-did-nothing"). The remaining participants reported a variety of forgetting strategies, all of which involve some active form of forgetting (collectively termed as "Forget-did-something"). Interestingly, the use of a forgetting strategy (doing something versus nothing) was completely unrelated to whether or not participants "endorsed" or trusted the forget cue (the correlation was zero). The DF costs were completely explained by the use of controlled forgetting strategies, and they were unrelated to whether people endorsed the forget cue

(Table 18.1). In other words, some participants in the forget group who believed they actually *would* be tested on List 1 nevertheless went along with the forget cue and attempted to forget List 1, and those participants showed DF impairment.[1]

Preexisting Beliefs About Intentional Forgetting

Unpublished work by Foster and Sahakyan has looked at pre-experimental beliefs about the possibility of intentional forgetting and the magnitude of DF. As part of the departmental mass screening we included the following yes/no question: "*Do you think it is possible to make yourself forget something after you have learned it?*" About half the sample (49%) responded "yes", whereas the remaining participants responded "no." Later in the semester, they were invited to participate in a DF experiment in our lab where they were randomly assigned to the Forget or Remember condition. We were curious to assess the magnitude of DF as a function of prior beliefs in intentional forgetting. Much to our surprise, DF impairment was identical in magnitude for those who believed that DF was possible ("yes" responses) and those who did not believe it is possible ("no" responses). Replicating prior work, what mattered for DF was whether or not participants engaged in a controlled forgetting strategy in response to the forget cue (Foster & Sahakyan, 2011). Importantly, there was virtually no relationship between people's beliefs about whether it is possible to forget something intentionally and the decision to engage in controlled forgetting strategy during the experiment. Table 18.2 shows DF recall results. These findings suggest two possibilities. Either we failed to successfully capture preexisting beliefs about DF, or DF is truly unaffected by people's prior beliefs and theories about intentional forgetting; what they do in response to the experimental manipulation carries the lion's share.

Table 18.1 Proportion list 1 recall as a function of group and forget-cue endorsement. New table based on the data reported in Foster and Sahakyan (2011).

	Group		
Cue Endorsement	Forget-Did Something	Forget-Did Nothing	Remember
"Endorsed the F-cue"	.27	.35	–
"Did not endorse the F-cue"	.25	.39	–
N/A (Remember cue)	–	–	.38

Table 18.2 Proportion list 1 recall as a function of group and preexisting belief about intentional forgetting. (Based on unpublished data collected by Foster and Sahakyan.)

	Group		
Preexisting Belief	Forget-Did Something	Forget-Did Nothing	Remember
"It is possible"	.28	.37	.40
"It is NOT possible"	.26	.40	.41

Preexisting Confidence in Memory and Directed Forgetting

In addition to theories and beliefs about forgetting and remembering, people might also have beliefs about their own memory efficacy. Regardless of how valid those beliefs are, they might also play a role in DF. For example, if some people think that their memory is not good and they think that they already forgot, they may see no need to engage any controlled strategies when given the forget cue.

Consistent with ~~the~~ view, Sahakyan, Delaney, & Goodmon (2008) found that older adults did not show DF unless they either provided older adults with the forgetting strategy (in Experiment 1) or modified the forget cue by instructing them to attempt to forget even if they thought that they had already forgotten (in Experiment 2). The latter instruction, which they had termed the "modified forget cue," was implemented largely because many older adults in response to the forget cue spontaneously volunteered that they had already forgotten anyway. Hence, to bypass their concerns about their own memory, they emphasized the importance of attempting forgetting even if they believed they had already forgotten. The "modified forget cue" produced DF among older adults, and Sahakyan et al. (2008) traced their successful DF to engagement of forgetting strategies (Figure 18.1). Only those older adults who reported engaging in forgetting strategies showed DF, whereas the majority of older participants did not engage in any strategy, and they

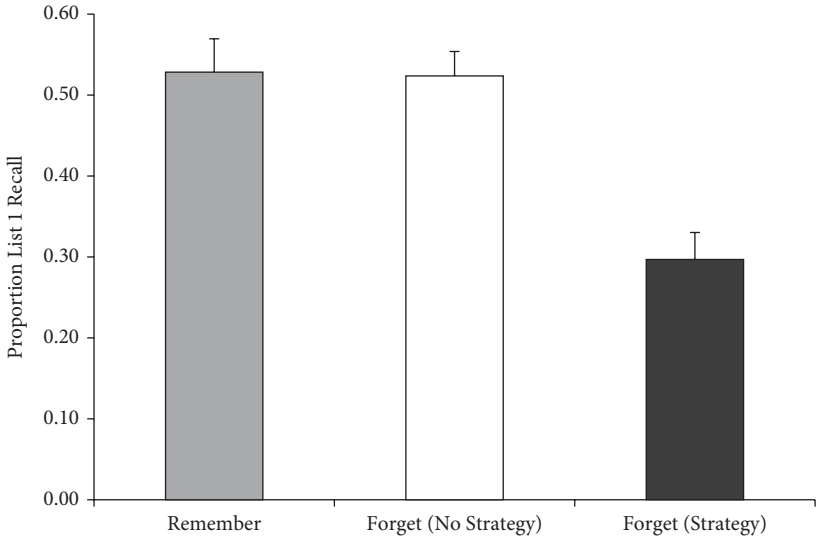

Figure 18.1 Proportion recalled from List 1 among older adults in Experiment 2 reported by Sahakyan, Delaney, and Goodmon (2008).

did not show DF. Importantly, the engagement of forgetting strategies was affected by the forget cue. Whereas the standard forget cue led many older adults to not engage in any strategies, the modified forget cue substantially increased the likelihood of engaging in some sort of forgetting strategy.

Although older adults did not show overall DF in the standard forget-cue condition, we might expect individual differences in DF if their confidence about their own memory efficacy is a contributor to these effects. Specifically, older participants who received the standard forget cue should show DF if they had higher confidence in their memory, whereas older adults with lower confidence might not show DF. In Sahakyan et al. (2008), we had not reported DF as a function of memory confidence (in part because younger adults were at ceiling on their reported confidence in memory, and there was not much variability in the responses among younger adults). However, there were some interesting trends in the older adult data, and hence we re-examined this issue for this chapter.

Prior to the experiment, older adults completed a demographic and health questionnaire, including estimating how good they thought their memory was on a 7-point Likert scale, with higher numbers indicating higher confidence in memory. The average reported confidence among older adults was $M = 4.74$, $SD = 1.15$.

Figure 18.2 indicates that higher confidence in memory was positively related to remembering but negatively related to forgetting in the standard forget condition. In other words, DF was larger in magnitude among older adults who rated their memory being quite good, and this was driven not only by better memory in the Remember group, but also by worse recall in the standard Forget group.

Particularly noteworthy are the findings in the modified-Forget group, where there was virtually no relationship between memory confidence and recall. In other words, the negative relationship between the confidence and recall observed in the standard-forget group was eliminated in the modified-forget group. Why would more confidence in memory produce lower recall in the forget condition but have no impact on recall in the modified-forget condition? We suspect that the results in the standard-forget group might be due to people with higher confidence attempting to engage in forgetting strategies, whereas people with lower confidence were not engaging in controlled strategies because they see no need in doing so. If forgetting strategies mediate the relationship between confidence and DF, this could explain the pattern of findings. In the modified forget group, the instruction deliberately downplayed memory confidence, and instead focused on the need to attempt to forget even if participants believed they had already forgotten. This could explain why the relationship between confidence and recall was absent in the modified-forget group.

Since we had obtained retrospective verbal reports of forgetting strategies employed by older adults in the experiment, we examined whether

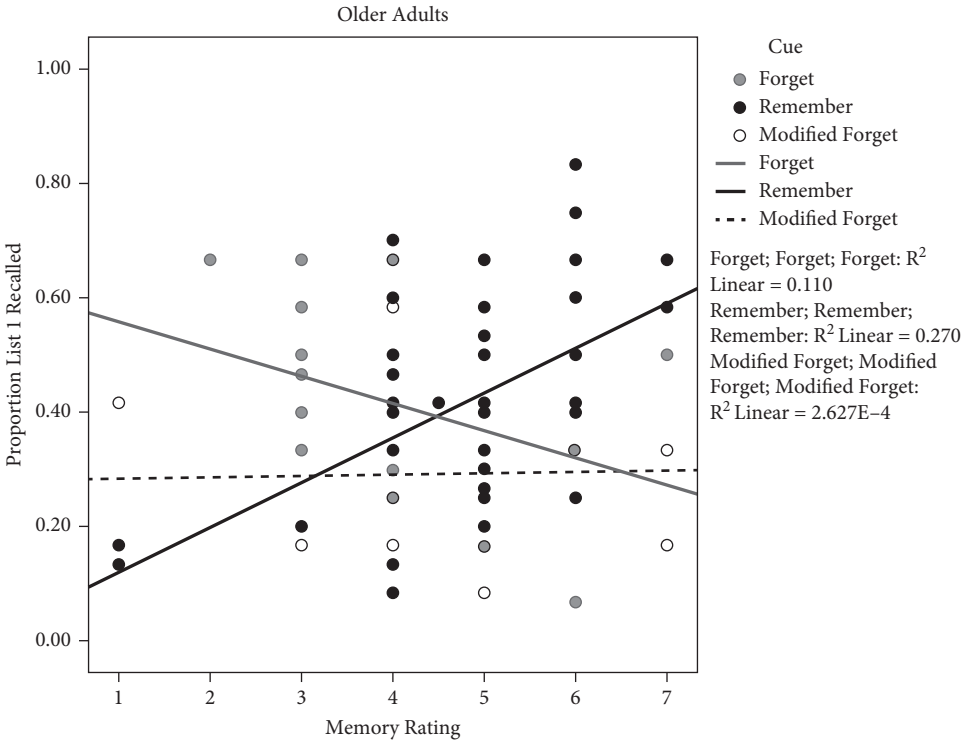

Figure 18.2 Proportion recalled from List 1 among older adults as a function of directed forgetting cue and memory rating.
New figure based on the data from Experiment 2 in Sahakyan, Delaney, and Goodmon (2008).

participants who reported engaging in forgetting strategies had higher confidence in their memory compared to those who reported doing-nothing.

Figure 18.3 confirmed that older adults who reported engaging in some sort of forgetting strategy had significantly higher confidence in their memory than participants who reported doing nothing in response to the forget cue. Hierarchical regression revealed that once the strategy factor was regressed out of List 1 recall in the forget condition,

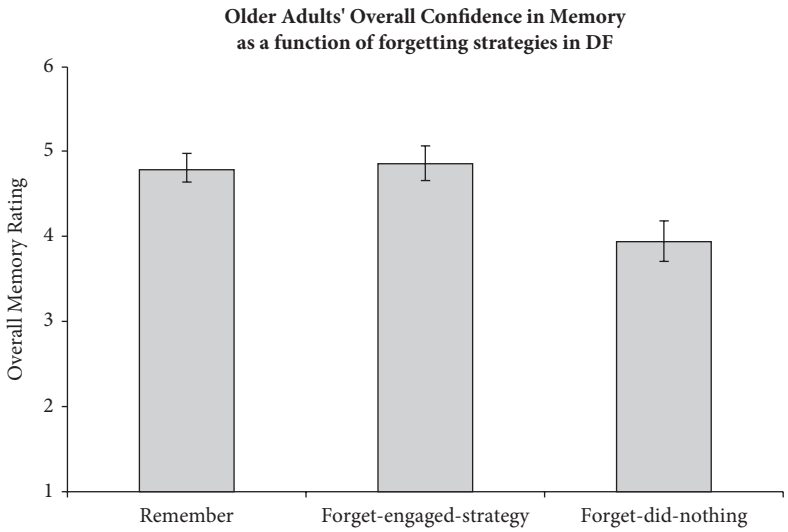

Figure 18.3. Mean confidence in memory as a function of forgetting strategy among older adults.
New figure based on the data reported in Sahakyan, Delaney, and Goodmon (2008).

confidence no longer accounted for significant additional variance. Thus, it appears that memory confidence was related to DF because of its relationship with engaging in controlled forgetting strategies. People with low confidence in their memory ability were less likely to initiate a forgetting strategy, presumably because they thought they had already forgotten the List 1 items. In contrast, people with greater confidence in their own memory were more likely to initiate a strategy to try to forget. As mentioned earlier, the engagement of controlled forgetting strategies is what determines whether DF is obtained or not.

To summarize, if participants have low preexisting confidence about their own memory, they might see no need to spontaneously engage in strategies in order to forget unwanted items in response to the forget cue. Finally, if the instructions are modified to downplay the concerns about memory, then the relationship between confidence and DF becomes eliminated as expected.

Beliefs About Memory Developed During the Experiment

Beliefs about memory efficacy could develop also *during* the experiment, which in turn could affect the likelihood of engaging in DF. Prior research shows that predictions about List 1 learning are related to DF magnitude. Sahakyan, Delaney, and Kelley (2004) had college adults study a list of 15 words and then indicate how many of those words they thought they could recall later on (i.e., they indicated a global judgment of learning, or JOL, for List 1). Participants then received a remember or forget cue for List 1, studied List 2, and then did recall for List 1. Results indicated a change in the magnitude of DF as a function of List 1 JOLs (Figure 18.4). Specifically, as List 1 JOLs increased, the magnitude of DF increased. Thus, it is possible that the use of effortful forgetting strategies is mediated by beliefs about List 1 learning. The more someone thinks they have learned List 1, the more likely they are to do what it takes to try to forget List 1. Specific forgetting strategies were not collected in that experiment to confirm this mechanism, so it is possible that individual differences in overall intelligence and working memory capacity could also mediate the relationship between cue and DF. Overall, the relationship between beliefs about memory efficacy developed during the experiment and the magnitude of DF provides support for the hypothesis that metacognitive processes contribute to list-method DF.

Summary and Future Directions

Our research has shown that list-method DF requires the use of forgetting strategies. DF emerges when participants report engaging in controlled

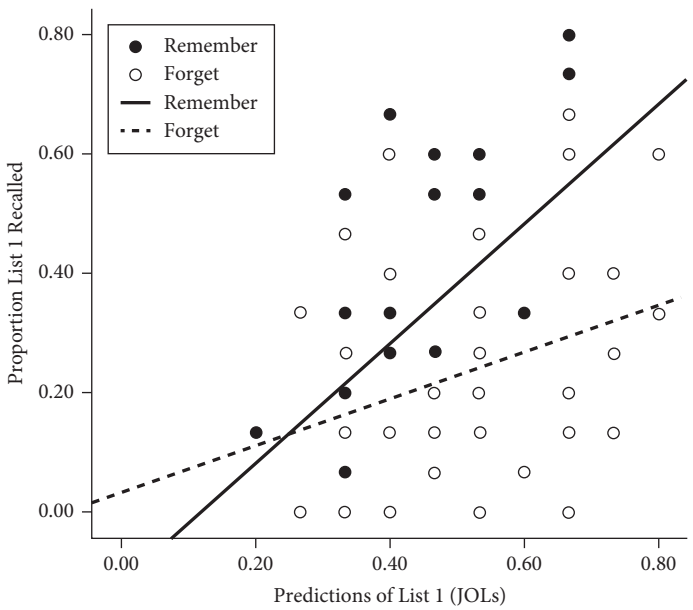

Figure 18.4 Proportion recalled from List 1 as a function of directed forgetting cue and List 1 aggregate JOL.
New figure based on the data reported in Sahakyan, Delaney, and Kelley (2004).

strategies, whereas "doing nothing" to forget List 1 does not lead to DF impairment (Foster & Sahakyan, 2011). Interestingly, people's beliefs and theories about whether it is possible to intentionally forget things appear to be unrelated to DF. It is possible that our single item in the questionnaire did not properly capture people's beliefs about intentional forgetting, and a more sensitive measure is warranted to understand whether such beliefs play any role in DF. However, it could also be the case that the way participants respond to the DF manipulation is completely unrelated to their beliefs and theories, and what they do at the time they receive the forget cue (e.g., "doing something" vs. "doing nothing") is what solely determines DF. Future research should more critically evaluate people's beliefs about intentional forgetting, including beliefs about the forgetting abilities of others that might differ from beliefs about their own forgetting ability. Our investigation also showed that DF is influenced by how confident people are in their memory ability a priori to having had experience with the items in the experiment (Sahakyan et al., 2008). Specifically, older participants with higher preexisting confidence in their memory efficacy show much larger DF compared to participants with lower preexisting confidence. A similar relationship may exist also among younger adults, but we were unable to confirm this because of the restricted range in the confidence ratings of younger adults, who rated their memory ability rather high. With more sensitive measures of preexisting confidence in memory, such results may be possible to obtain in future research. Finally, DF appears to be related to how well people think they have learned a list of items after having had an experience with items in the experiment (Sahakyan et al., 2004). Overall, DF is greater among older participants who have higher preexisting confidence in their memory, or among younger participants who make higher global JOLs for List 1. While the factors that promote strategic forgetting are not fully understood, in some cases we were able to pin down forgetting strategies as an important mediating factor, with participants who reported engaging in controlled strategies having higher preexisting confidence. When the variance due to forgetting strategies was regressed out, confidence no longer accounted for significant variance. Although we obtained individual forgetting strategies, samples sizes within each reported strategy were too small to conduct meaningful analyses. Future research can evaluate the effectiveness of specific strategies in the list-method.

Item-Method Directed Forgetting Studies

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Item-Method Directed Forgetting Paradigm and Measurement Issues

In item-method DF, items are typically studied for a few seconds before being followed either by a forget cue or a remember cue. Every item in the list receives its own cue, and the assignment of cues to items is usually random with the constraint that there are an equal number of items cued to be remembered (TBR) as there are items cued to be forgotten (TBF). Traditionally, item-method DF has been measured by comparing memory of TBR items compared to TBF items. Memory is typically tested via free recall or recognition, and the DF effect is obtained using both types of tests (for reviews, see Basden & Basden, 1998; E. L. Bjork, Bjork, & Anderson, 1998; MacLeod, 1998).

Traditionally, item-method DF has been explained in terms of terminating rehearsal of TBF items upon presentation of the forget cue (Basden, Basden, & Gargano, 1993; R. A. Bjork & Woodward, 1973; MacLeod, 1999). The basic idea is that the TBR items are rehearsed more elaborately and extensively than the TBF items, whereas the TBF items are simply dropped from the rehearsal set. Recently, however, this passive notion of rehearsal termination of TBF items has been challenged, and some researchers argued that the process of stopping rehearsal of TBF items engages active inhibitory mechanisms (Fawcett & Taylor 2008, 2010; Hourihan & Taylor, 2006; Taylor, 2005; see also Zacks, Radvansky, & Hasher, 1996). For example, Fawcett and Taylor (2010) had participants study a list of items, each of which was cued TBR or TBF. Following each cue, participants had to perform a secondary task, in which they were told to press a key on half of the trials but withhold the keypress on the other trials. The results showed that participants were more successful at stopping the motor response following the TBF cue than the TBR cue. Most important, the reaction times on the secondary task were *slower* following forget trials compared to remember trials, implying that intentional forgetting is more effortful and requires more cognitive resources than the task of remembering (see also Fawcett & Taylor, 2008, 2012; Taylor, 2005). Neural correlates support the notion that item-method DF requires more active processes (e.g., Anderson & Hanslmayr, 2014; Nowicka et al., 2011; Rizio & Dennis, 2014; Wylie et al., 2007). For example, prefrontal and parietal regions of the brain are more active during the TBF items that are subsequently forgotten as opposed

to the TBR items that are subsequently forgotten, indicating that item-method DF engages additional processes beyond what is associated with the lack of remembering. Together, neural and behavioral evidence indicate that forgetting in the item-method DF task is more effortful than we may have thought.

In this section, we propose that metacognitive processes play a role in item-method DF, thus contributing to the active and effortful nature of an item-method DF task. Specifically, we argue that the process of rehearsal itself involves controlled mechanisms that are rooted in metacognitive monitoring. Namely, we propose that participants use controlled rehearsal as a strategy for achieving the goal of intentional forgetting. Furthermore, metacognitive monitoring dictates which items participants select to rehearse in response to the forget cue. We elaborate on these ideas and describe our research that bears relevance to these issues.

We view item-method DF as a task that involves two simultaneous goals—remembering TBR items and forgetting TBF items. Hence, the role of controlled rehearsal may change depending on which goal(s) participants pursue. For example, remembering TBR items may simply depend on participants' using TBF trials as "empty intervals" to engage in further processing of some of the TBR items in order to maximize retention of TBR items. Thus, the items that participants choose to rehearse—items judged easy to remember versus difficult to remember—can tell us how participants decide to allocate study time when the goal is to maximize remembering. In contrast, when the goal is to forget TBF items, participants may use TBF trials to selectively rehearse earlier items that are thought to serve as more effective "blockers" of recently studied material. For example, items judged as easy to remember may be preferentially rehearsed because participants believe these items will come to mind more easily and serve to prevent spontaneous retrieval of the recently presented TBF item. Thus, the various metacognitive beliefs about the memorability of items may lead to different patterns of recall depending on whether participants are trying to accomplish the goal of remembering TBR items or the goal of forgetting TBF items.

To establish the influence of metacognition on controlled rehearsal in the item-method DF more firmly, it is important to implement manipulations that affect beliefs about item memorability without affecting the objective memorability of items. Rhodes and Castel (2009) showed that during auditory presentations of items, manipulating the volume of each item affects JOLs but does not affect recall rates. They had participants study a mixed list of loud and quiet items, and JOLs obtained immediately after each item indicated a perceived increase in memorability for loud items over quiet items despite there being no difference in recall between the two item types. Critically, loudness affected future study decisions, with participants selecting to restudy quiet items more than loud items.

In our approach to investigate the role of metacognition in item-method DF, we used the volume manipulation to investigate whether monitoring affects item-method DF and, if so, we examined how metacognitive information influenced selective rehearsal in service of forgetting goal, the remembering goal, or both goals. Furthermore, we included a baseline condition to help disentangle these two goals, a task that is naturally complicated in the item-method procedure because the difference in memory of TBR and TBF items could reflect selective remembering of TBR items, intentional forgetting of TBF items, or some combination of both. Thus, in an experiment reported by Foster and Sahakyan (2012), participants in the DF group studied a mixed list of loud and quiet items, each of which was cued as TBR or TBF, whereas participants in the baseline group received all TBR cues. Results showed equivalent impairment in the DF group for both quiet and loud TBF items relative to baseline (compare the light gray bars to the white bars in Figure 18.5), indicating that beliefs about loudness did not affect DF impairment. In contrast, TBR items were better remembered in the item-method DF group relative to the baseline group, but the advantage was particularly evident for the loud rather than the quiet items. We refer to the effect of volume on TBR items in the item-method DF group as the loud item recall advantage.

In our lab, we have obtained similar effects of metacognition on item-method DF by using manipulations other than item volume. For example, it is known that people perceive large font items to be more memorable than small font items, even though this is a complete illusion as evidenced by equivalent recall across both item types (Rhodes & Castel, 2008; Mueller, Dunlosky, Tauber, & Rhodes, 2014). In an unpublished experiment, Foster and Sahakyan crossed the item-method DF manipulation with the font size manipulation (instead of the volume manipulation, items were presented visually in large and small fonts). The results are summarized in Figure 18.6. The findings are similar to what we obtained with volume manipulation. Namely, there

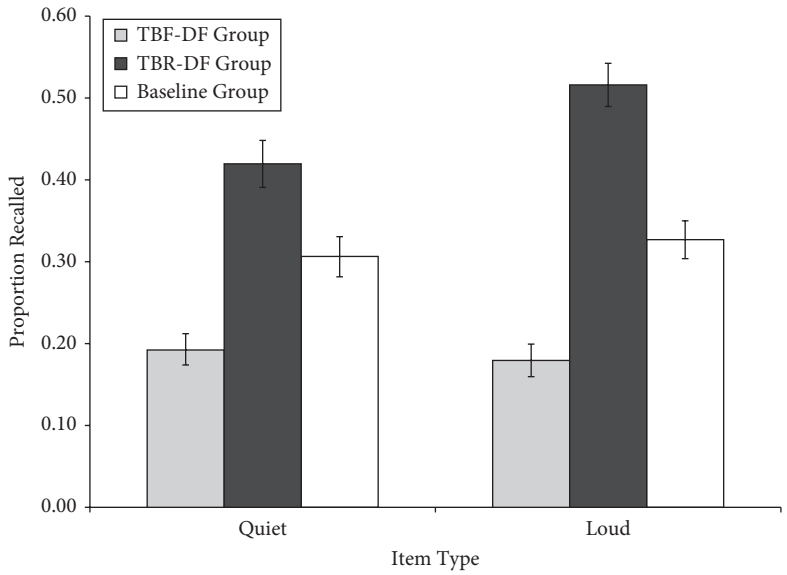

Figure 18.5 Proportion recalled as a function of volume and directed forgetting cue.
Experiment 1 in Foster & Sahakyan (2012).

is an equal magnitude of TBF forgetting across large and small font items, but greater remembering of large TBR items compared to small TBR items. These effects were absent in the baseline group, where performance was strictly governed by the remembering goal. Thus, across both volume and font-size manipulations, participants remembered a greater proportion of TBR items that were judged as more memorable (i.e., loud items or large font items), but such effects were restricted only to contexts where intentional forgetting must be engaged.

Are the DF contexts exclusively responsible for the influence of volume (or font size) on recall, or could these effects be explained by methodological culprits? For example, the loud item recall advantage may be due to the presence of extra rehearsal opportunities in a DF condition compared to an all-remember baseline condition. Foster and

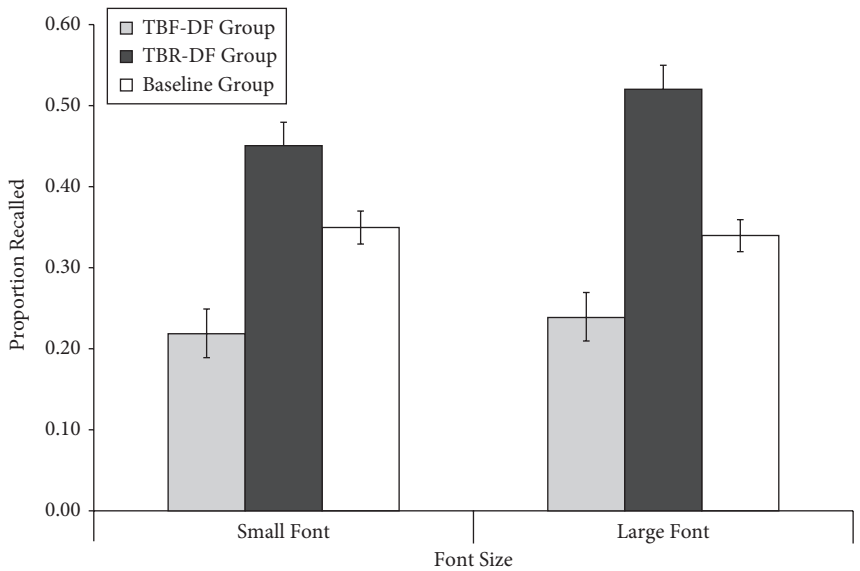

Figure 18.6 Proportion recalled as a function of font size and directed forgetting cue.
Data from an unpublished experiment by Foster and Sahakyan.

Sahakyan (2012) designed a special baseline condition that mirrored the procedure of a DF condition with one exception. Every TBF trial was replaced with an unrelated filler task that involved neither remembering nor forgetting (Experiment 2). Furthermore, we included four conditions: Some participants were told that during spare time, they should rehearse whichever items they believe will help them maximize their memory performance. Other participants were not given any specific instructions on what to rehearse during the spare time. Finally, two additional groups were included and told to rehearse either loud items or quiet items during spare time (these groups were meant to assess whether participants could distinguish quiet and loud items and rehearse them preferentially). In all four groups, participants studied a mixture of loud and quiet items, each followed by TBR cues, but instead of TBF trials, they performed a visual search task. Hence, there were opportunities to engage in additional rehearsal during those trials. We found no differences between recall of loud and quiet items in the group that was not given any specific instruction as to what to rehearse during spare time, nor did we find recall differences in the group that was encouraged to rehearse the items that they believed would help them maximize memory performance, even though overall memory was higher in the latter group than in the "no-instruction" group. Thus, participants must have rehearsed both types of items equally frequently. With that said, the groups that were told to rehearse either quiet or loud items showed recall advantage for the specific type of items they were told to rehearse. This effect is important because it suggests that participants are capable of engaging in preferential rehearsal of loud or quiet items when instructed to do so. However, when left to their own devices, or even when they are told to attempt to raise their memory performance, participants do not show preference for loud or quiet items. This experiment along with the previous item-method DF study collectively suggest that it is the intentionally forgetting of TBF items that prompts selective rehearsal and subsequent recall of loud TBR items over quiet TBR items. In the absence of any forgetting goal, volume has no influence on recall.

Through additional experiments that involved crossing the volume manipulation with a point value manipulation, Foster and Sahakyan (2012) confirmed that contexts encouraging intentional forgetting engaged metacognitive-driven rehearsal processes, which in turn lead to the preferential recall of loud items. Specifically, in one of the experiments (Experiment 4), we assigned some words positive values (+10 points) and some words negative values (–5 points), conceptually replicating the item-method DF manipulation. We called this group the *forgetting* group. Along with this group, we also included a baseline group, which we called the *prioritized remembering* group, because some words were assigned positive values (+10 points), whereas other words were assigned 0 points. In both groups, participants were told that recalling items associated with different points would adjust their cumulative recall total accordingly, and the objective was to remember the words that would accumulate the most points. Thus, both groups should focus rehearsal on the positive value points of the greatest value, but the forgetting group must also engage in processes of intentional forgetting for the negative items because their score will decrease if these items are remembered. If engaging in the intentional forgetting of some items is important for showing metacognitive-driven rehearsal processes favoring loud items, then a loud item advantage should emerge only when positive items are intermixed with negative items; the same effect should not be observed in the prioritized remembering group because, even though some items are worth more points than others, there is no specific need to forget 0-value items. Indeed, as can be seen from Figure 18.7, the prioritized remembering group showed better recall of +10 items than 0 items, thus confirming that they preferentially rehearsed items with higher value more. However, there was no effect of volume in the prioritized remembering group, indicating that both quiet and loud +10 items were rehearsed equally often. In contrast, in the forgetting group, +10 items were better remembered than –5 items (confirming DF), but loud +10 items were rehearsed more than quiet +10 items. These findings further confirmed that the effect of volume on recall emerges only when participants must engage in some form of item-level intentional forgetting.

These conclusions were backed-up by retrospective reports about rehearsal preferences. Foster and Sahakyan (2012) asked participants to report which type of item they preferred to rehearse more during study (i.e., specifically quiet items, specifically loud items, or both items equally). Participants in DF groups reported rehearsing previous TBR items more often than did baseline participants, thus suggesting that DF is associated with greater study-phase retrieval of TBR items. Importantly,

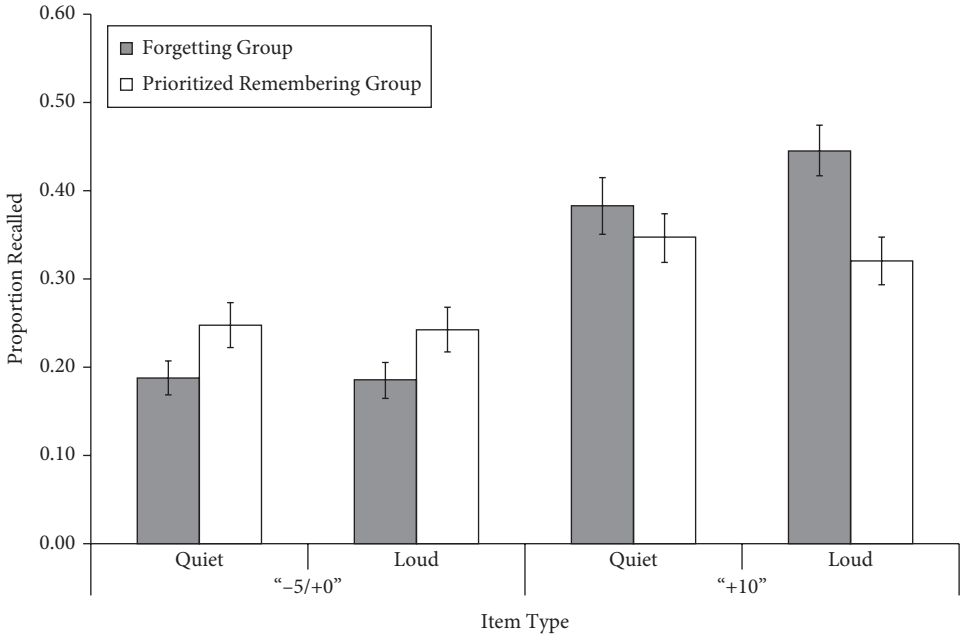

Figure 18.7 Proportion recalled as a function of volume and value reported by Foster & Sahakyan (2012) in Experiment 4.

more DF participants reported a preference for rehearsing specifically loud items compared to the baseline participants. Thus, beliefs about item memorability affect rehearsal preferences in the context of DF scenarios, with participants preferring to rehearse items that they think are more memorable.

Consistent with the idea that people's beliefs about item memorability affect the loud item recall advantage, we tested further whether belief magnitude predicted the magnitude of the recall advantage. We found that, among DF participants, the stronger people's beliefs about item memorability

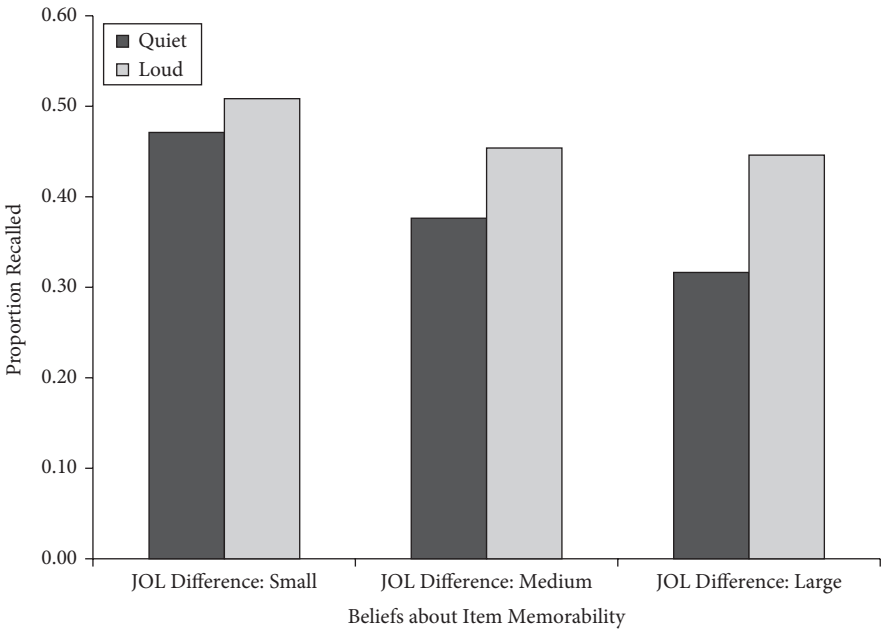

Figure 18.8 Proportion recalled as a function of volume and tercile split on beliefs about volume.
New figure based on the data reported in Experiments 1, 3, and 4 by Foster & Sahakyan, (2012).

were (captured via JOLs), the greater the loud item recall advantage. Specifically, we calculated the difference between the average JOLs assigned to loud items and the average JOLs assigned to quiet items for each participant in the DF groups (e.g., from Experiments 1, 3, and 4 in Foster & Sahakyan, 2012). Larger scores on this difference measure indicate stronger beliefs that loud items are more memorable than quiet items. We used this JOL difference measure to further divide DF-participants into three equal groups, reflecting differences in beliefs about item memorability. People in the lower tercile showed 7% nonsignificant advantage for quiet items (i.e., no loud item JOL advantage); people in the middle tercile showed only a 9% significant JOL advantage favoring loud items; finally, people in the upper tercile showed a 30% significant JOL advantage favoring loud items. We refer to these three groups as the *small, medium,* and *large JOL difference* groups, respectively. When we compared our main recall findings across the three groups (results are plotted in Figure 18.8), the recall advantage for loud items over quiet items was the largest in the large JOL difference group, and it was significant. In the medium JOL difference group, the effect was diminished, although it was still significant. In the small JOL difference group, there was no longer a significant recall advantage for loud items. In other words, participants that rated loud items as more memorable than quiet items showed the largest loud item recall advantage, whereas participants who did not rate loud items as more memorable than quiet items did not show this effect. We find these results interesting because they suggest that recall outcomes varied as a function of how extreme people's beliefs were regarding item memorability. They also provide a direct link between volume-based beliefs, which are exclusively metacognitive, and processes contributing to recall.

Summary and Future Directions

In this section, we introduced the idea that processes of metacognition interact with item-method DF to influence recall and hence the magnitude of DF. Past research has shown that item-method DF is an active rather than passive process (e.g., Fawcett & Taylor, 2010). We propose that people hold different beliefs about the memorability of certain items during study (metacognitive monitoring), and that one type of active process that operates in response to these beliefs is controlled selective rehearsal. In other words, under conditions of item-method DF, people tend to select certain TBR items for rehearsal according to information gathered through monitoring (e.g., participants rehearse the items that they think will help them perform intentional forgetting or that they think will help prevent encoding of the recently presented TBF item). Evidence for this claim comes from our research showing that manipulations that affect JOLs but not recall under normal learning conditions (e.g., volume, font size) actually affect recall during DF and thus affect the magnitude of DF. Interestingly, the increase in DF magnitude is not driven by forgetting of TBF items, but rather by enhancement of TBR items, thus implicating the role of controlled selective rehearsal. People report a preference to rehearse loud items more often under DF conditions, however, thus suggesting that they hold a belief about the effectiveness of loud item rehearsal when engaged in DF. Indeed, the larger the difference between JOLs for loud and quiet items, the greater the likelihood that loud TBR items will be rehearsed more and remembered better. It is not entirely clear why people believe rehearsing loud items is helpful for DF. More research is needed to uncover the bases of this belief and to examine whether it is developed online during the task, or whether it exists preexperimentally.

Concluding Remarks

Theories of metamemory currently do not account for the phenomenon known as intentional forgetting. Because theories of memory typically present forgetting as something more than just the opposite of remembering—and thus deserving of independent investigation—metamemory theory might also benefit from a distinction between what might be referred to as *metaremembering* versus *metaforgetting*. In the context of intentional forgetting, metaforgetting implies that metacognition operates in service of accomplishing directed or intentional forgetting. In this chapter, we presented two examples in which DF and metacognition interact, one for the list-method and one for the item-method. Global beliefs about list memorability were shown to be related to outcomes in list-method DF. However, beliefs about intentional forgetting ability specifically were not. In contrast, item-level beliefs were related to item-method DF by way of influencing which items were rehearsed to achieve the goal of intentional forgetting. Future research will be needed to understand how these types of beliefs are developed, why some beliefs influence list-method DF while others do not, and the role of ad hoc beliefs about item memorability

in item-method DF, among many others. An account of metamemory that incorporates all facets of intentional forgetting can be influential to theories of metacognition as well as theories of DF.

Note

1. Readers who are interested about the relative effectiveness of various forgetting strategies in producing DF impairment should refer to Sahakyan et al. (2013).

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