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RESEARCH REPORT

Thinking Can Cause Forgetting: Memory Dynamics in Creative Problem Solving

Benjamin C. Storm
University of Illinois at Chicago

Genna Angello and Elizabeth Ligon Bjork
University of California, Los Angeles

Research on retrieval-induced forgetting has shown that retrieval can cause the forgetting of related or competing items in memory (Anderson, Bjork, & Bjork, 1994). In the present research, we examined whether an analogous phenomenon occurs in the context of creative problem solving. Using the Remote Associates Test (RAT; Mednick, 1962), we found that attempting to generate a novel common associate to 3 cue words caused the forgetting of other strong associates related to those cue words. This problem-solving-induced forgetting effect occurred even when participants failed to generate a viable solution, increased in magnitude when participants spent additional time problem solving, and was positively correlated with problem-solving success on a separate set of RAT problems. These results implicate a role for forgetting in overcoming fixation in creative problem solving.

Keywords: inhibition, retrieval-induced forgetting, problem solving, Remote Associates Test, fixation

Forgetting is often considered a failure of memory. In many ways, however, forgetting is crucial for the adaptive and efficient functioning of memory. To retain unremitting access to all information learned would severely impair one's ability to learn and recall information that is new and currently relevant. One context in which forgetting may play a particularly critical role is that of creative problem solving. The difficulty in many creative tasks lies in the constraining influence of old ideas, which can cause *mental fixation* and impede the generation of new and creative ideas (e.g., Smith, 2003). Thus, to think creatively, one must not only be able to think of new and appropriate ideas but one must also be able to put aside or forget old and inappropriate ideas.

Take, for example, the Remote Associates Test (RAT; Mednick, 1962). Three cue words are presented (e.g., *cat*, *sleep*, *board*), and participants are asked to generate a target fourth word that is associated with each of the three cue words (solution: *walk*). The target associate can be a synonym or part of a commonly spoken phrase, or it can share a more general semantic relationship with one of the cue words. Contributing to the difficulty of RAT problems is that the strongest associates to each cue word often bear no relationship to the other cue words. To illustrate, although the word *rest* is highly related to the cue word *sleep*, it is not related to the cue words *cat* and *board* and would not, therefore, serve as an appropriate solution. In fact, exposure to misleading or inappropriate associates impairs performance on the RAT. For example, Smith and Blankenship (1991) found that participants who were exposed to misleading associates through related word pairs, such as *cat–nap*, *sleep–night*, and *board–wood,* prior to attempting to generate a common associate to the words *cat*, *sleep*, and *board* were less likely to generate a viable response than participants who were exposed to unrelated word pairs (see also Wiley, 1998). Misleading associates are believed to cause fixation, thereby interfering with the ability to generate an appropriate response.

In the present research, we examine the mnemonic consequences of encountering fixation during problem solving. More specifically, we explore the possibility that fixation-inducing associates are inhibited and, thus, forgotten, as a consequence of attempted problem solving. Our rationale draws heavily on work related to retrieval-induced forgetting (for reviews, see Anderson, 2003; Bäuml, Pastötter, & Hanslmayr, 2010; Storm, 2010). In the typical paradigm used to measure retrieval-induced forgetting (Anderson, Bjork, & Bjork, 1994), participants study a list of category-exemplar pairs, receive retrieval practice for a subset of exemplars from a subset of categories, and then, after a brief delay, are given a final cued-recall test. Retrieval-induced forgetting is observed when nonpracticed exemplars from practiced categories are recalled less well than exemplars from nonpracticed categories. The inhibitory account of retrieval-induced forgetting contends that nonpracticed exemplars from practiced categories are inhibited during retrieval practice and that the retrieval-induced forgetting observed on the final test is the consequence of this inhibition (Anderson, 2003; Storm, 2010). According to this account, the category cues presented during retrieval practice activate nontarget items, creating competition; and, to increase the probability of retrieval practice succeeding, the items causing that competition are inhibited. We believe that the same type of inhibitory process may be involved in creative problem solving. Specifically, a prob-

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Benjamin C. Storm, Department of Psychology, University of Illinois at Chicago; Genna Angello and Elizabeth Ligon Bjork, Department of Psychology, University of California, Los Angeles.

Correspondence concerning this article should be addressed to Benjamin C. Storm, Department of Psychology, University of Illinois at Chicago, 1007 West Harrison Street (MC 285), Chicago, IL 60607-7137. E-mail: bstorm@uic.edu

lem may activate misleading or contextually inappropriate solutions, causing fixation; and, to increase the probability of achieving problem-solving success, the misleading solutions are inhibited.

If retrieval-induced forgetting does reflect an inhibitory process that can help problem solvers overcome fixation, then individuals who exhibit more retrieval-induced forgetting should be better able to overcome fixation during problem solving. Storm and Angello (2010) tested this hypothesis by measuring individual differences in retrieval-induced forgetting and by correlating that measure with performance on the RAT. In their experiment, participants attempted to solve a series of RAT problems. Critically, half of the participants were exposed to misleading associates prior to problem solving (fixation condition), whereas half were not (baseline condition). For example, participants in the fixation condition studied *manners–polite*, *tennis–ball*, and *round–square* before attempting to generate a common associate to *manners*, *tennis*, and *round* (solution: *table*). As expected, participants in the fixation condition solved fewer problems than participants in the baseline condition. More importantly, the degree to which participants suffered from fixation was moderated by individual differences in retrieval-induced forgetting. Participants who demonstrated the least retrieval-induced forgetting suffered from significantly more fixation than participants who demonstrated the most retrieval-induced forgetting. This relationship strengthened as participants continued to solve the problems. In the end, participants who demonstrated the least retrieval-induced forgetting suffered from a 21% fixation effect, whereas participants who demonstrated the most retrieval-induced forgetting suffered from only a 2% fixation effect.

The study by Storm and Angello (2010) suggests that inhibition may play an important role in creative problem solving by providing a mechanism by which to overcome fixation. It is important to note, however, that their results do not provide direct evidence that attempting to solve a problem actually causes participants to *forget* the misleading, fixation-inducing associates. Presumably, if inhibition does play a role in problem solving, then there should be observable consequences of that inhibition: Namely, the items causing fixation should become less recallable on a subsequent memory test than items not causing fixation. We tested this hypothesis in our first experiment by exposing participants to a list of cue–response pairs and then asking them to solve a series of RAT problems. Critically, half of the pairs presented misleading associates for the to-be-solved RAT problems, whereas half presented associates for items that were not included in the to-be-solved RAT problems. We predicted that attempting to solve the RAT problems would cause participants to forget the misleading responses associated with the cues from those problems, thus demonstrating problem-solving-induced forgetting.

Experiment 1

Method

Participants. Forty University of California, Los Angeles (UCLA) undergraduates (31 women, nine men; mean age = 20.3 years) participated for credit in an introductory psychology course.

Materials. Twenty RAT problems were selected, each consisting of three cue words associated with a common associate (e.g., *playing*, *credit*, *report*; solution: *card*; Mednick & Mednick, 1967), and were divided into two sets of 10 for counterbalancing purposes. Sixty cue–response pairs were formed (e.g., *playing–fun*, *credit–union*, and *report–paper*) by pairing each of the 60 cue words that made up the RAT problems with a response word of moderate forward associative strength. Care was taken to avoid selecting response words that were associated to other cue words or to RAT solutions.

Procedure. The experimental procedure consisted of three phases: cue–response training, problem solving, and cue–response test.

Cue–response training. Participants were first exposed to all 60 cue–response pairs in random order for 5 s each. Following exposure, participants were given a cued-recall test with feedback. Specifically, they were shown the cue words and were asked to recall the corresponding response words. Items recalled correctly were dropped from the list; items not recalled correctly were placed at the back of the list and tested again. Cue–response training ended once participants successfully recalled each response given its cue.

Problem solving. Participants attempted to solve 10 of the 20 RAT problems, with the particular set of 10 problems counterbalanced across participants. Each problem was presented individually for 40 s, and participants were required to continue attempting to solve a given problem until they had either provided the correct solution or the allotted time had elapsed, at which point the next trial began. If participants provided a nontarget solution, they were told that their solution was not the particular solution we were looking for and to keep trying. Participants were warned that none of the earlier learned response words would ever serve as viable solutions.

Cue–response test. Following a brief, 5-min retention interval, participants were given a surprise cued-recall test for each of the cue–response pairs. The 60 cue words were presented in a different random order from that used during training, and participants were given 5 s to recall each response word. For each participant, 30 cue–response pairs consisted of cue words that had not been presented during problem solving (baseline pairs), whereas 30 pairs consisted of cue words that had been presented during problem solving (fixation pairs), with the particular set of cue–response pairs serving in each condition counterbalanced across participants.

Results and Discussion

Participants generated correct solutions for 28.5% (SD = 13.1%) of the RAT problems. More importantly, as shown in the top portion of Table 1, recall performance on the cue–response test was significantly lower for items in the fixation condition (M = 89.2%, SE = 1.5%) than for items in the baseline condition (M = 91.9%, SE = 1.3%), $t(39) = 2.55$, $p < .05$, $d = 0.42$. In other words, participants were significantly less likely to recall response words associated with cues that had been presented in the problem-solving phase than response words associated with cues that had not been presented in the problem-solving phase. Thus, we observed evidence of problem-solving-induced forgetting. Interestingly, recall performance was lower, though not significantly, for response words associated with problems that had not been solved successfully (M = 88.8%, SE = 1.1%) than for response words

Table 1
Mean Percentage of Response Words Correctly Recalled During the Final Cue-Response Tests of Experiments 1, 2, and 3

Condition (time spent on RAT problem)	*M* %	*SD* %	*d*
Experiment 1			
Baseline	91.9	7.9	
Fixation (≤40 s)	89.2	9.6	0.42
Experiment 2			
Baseline	95.6	5.0	
Fixation (20 s)	93.7	8.5	0.26
Fixation (60 s)	91.9	9.2	0.53
Experiment 3			
Baseline	77.4	16.4	
Fixation	72.0	16.7	0.49

Note. RAT = Remote Associates Test; *d* = effect size of the difference between each fixation condition and baseline.

associated with problems that had been solved successfully (M = 90.1%, SE = 1.6%). This observation suggests that forgetting was not contingent on participants generating the target solution.

Finally, we found no correlation between problem-solving performance and problem-solving-induced forgetting ($r = -.03$, $p >$ .05), which, at first glance, appears to contradict the hypothesis that problem-solving-induced forgetting reflects an adaptive process that helps participants overcome fixation. After all, if it does reflect such a process, then participants who demonstrated more forgetting should have outperformed participants who demonstrated less forgetting. There are reasons, however, not to expect such a correlation. Participants who performed worse on the problem-solving task may have done so precisely because they experienced greater amounts of fixation, making it even more necessary for the misleading response words to be inhibited. Moreover, participants who failed to generate accurate solutions would have spent more time attempting to solve the problems, thus providing even more opportunity to inhibit and forget the response words. As such, the benefits of problem-solving-induced forgetting on problem-solving performance cannot be validly tested when both forgetting and performance are measured with the same set of problems. We address this issue in Experiment 3 by measuring problem-solving-induced forgetting using one set of problems and correlating that measure with problem-solving performance on a separate set of problems.

Experiment 2

The results of Experiment 1 show that problem solving can cause forgetting. We attempted to replicate this finding in Experiment 2 using impossible RAT problems—that is, problems for which the three cue words do not share a common associate. Our motivations were two-fold. First, as there is evidence that retrieval success is not a necessary condition for retrieval-induced forgetting (e.g., Storm, Bjork, Bjork, & Nestojko, 2006), we wanted to test whether, likewise, problem-solving success would not be a necessary condition for problem-solving-induced forgetting. Additionally, prior research has shown that increasing the number of retrieval-practice trials can increase the magnitude of retrieval-induced forgetting (e.g., Storm, Bjork, & Bjork, 2008). Perhaps, then, forcing participants to spend a longer time attempting to solve a given problem would likewise increase the problem-solving-induced forgetting effect. By administering impossible problems, we could manipulate the amount of time participants spent attempting to solve a given problem (i.e., 20 s vs. 60 s) and, thus, test this possibility.

Method

Participants. Sixty UCLA undergraduates (41 women, 19 men; mean age = 20.6 years) participated for credit in an introductory psychology course.

Materials. Twenty-two RAT problems were selected, most of which had also been used in Experiment 1. Sixty-six cue–response pairs were created by pairing each of the cue words from the RAT problems with a response word of moderate associative strength. Four of the problems were kept intact and always served as possible RAT problems; the other 18 problems were mixed up to form impossible RAT problems. Specifically, the cue words that made up the problems were shuffled such that the three cue words in any given problem would no longer be associated with a common associate (e.g., globe, narrow, purse; silk, ruin, secret). The 18 impossible problems were divided into three counterbalanced subsets. For a given participant, six of the impossible problems served as baseline (were not presented to be solved), six were presented for 20 s, and six were presented for 60 s.

Procedure. Participants were exposed to the 66 cue–response pairs during cue–response training via the same method described in Experiment 1. During problem solving, participants were first given the four possible problems (two for 20 s and two for 60 s), followed by 12 critical impossible problems (six for 20 s and six for 60 s). The impossible problems were randomly interleaved, ensuring that participants would not be able to predict the amount of time they would have to solve any problem. As in Experiment 1, participants were warned that none of the earlier learned response words would ever serve as solutions to the problems. Participants were occasionally able to generate arguably viable solutions to impossible problems. On such occasions, participants were told that their solution was not the particular solution we were looking for and to keep trying.

Results and Discussion

Performance on the final cue–response test is shown in the middle portion of Table 1 and was analyzed with a repeated-measures analysis of variance. Response words associated with 20-s and 60-s problems were recalled 93.7% (SE = 1.1%) and 91.9% (SE = 1.2%) of the time, respectively, compared with a baseline of 95.6% (SE = 0.6%). The linear contrast was significant, $F(1, 59) = 12.97$, $p < .001$, $\eta^2 = .18$, indicating that a participant's ability to recall the response words decreased with time spent attempting to solve a problem. The problem-solving-induced forgetting effect was marginally significant after 20 s, $t(59) = 1.80$, $p = .08$, $d = 0.26$, and was robustly significant after 60 s, $t(59) = 3.60$, $p < .001$, $d = 0.54$. These results provide additional evidence that attempting to solve a problem can cause the forgetting of information that interferes with solving that problem. Furthermore, they confirm that problem-solving success is not a necessary condition for problem-solving-induced forgetting and that the magnitude of the forgetting effect increases with time spent problem solving.

Participant-generated RAT solutions were also analyzed. On average, participants offered a solution on 65% of the impossible problems (*SD* = 30%). Interestingly, the number of solutions offered failed to correlate with problem-solving-induced forgetting ($r = -.19$, $p > .05$). In fact, participants who offered more solutions tended to show less problem-solving-induced forgetting than did those who offered fewer solutions. Finally, despite telling participants that none of the earlier learned response words would ever serve as valid solutions, at least one response word was offered as a possible solution on 13% of the trials (*SD* = 17%).

Experiment 3

Although both Experiments 1 and 2 demonstrate significant effects of problem-solving-induced forgetting, neither experiment provides direct evidence that such forgetting is associated with problem-solving success. If, however, the process that underlies problem-solving-induced forgetting does play an adaptive role in creative problem solving, then it stands to reason that individuals who exhibit more problem-solving-induced forgetting should also achieve greater problem-solving success. We examined this hypothesis in Experiment 3 by measuring problem-solving-induced forgetting using one set of impossible RAT problems and correlating that measure with problem-solving ability on a separate set of possible problems.

We used impossible problems to prevent individual differences in problem-solving ability from affecting the amount of time participants spent attempting to solve the RAT problems. Experiment 2 showed that having participants spend additional time attempting to solve a problem can lead to additional forgetting. Thus, if we used possible problems, participants who performed better would, as a consequence, spend less time attempting to solve the problems and would be less likely to demonstrate problem-solving-induced forgetting. By using impossible problems, we could ensure that all participants, regardless of problem-solving ability, would spend the same amount of time attempting to solve the problems.

Method

Participants. Forty-two University of Illinois at Chicago undergraduate students (27 women, 15 men; mean age = 19.7 years) participated for credit in an introductory psychology course. The paradigm used in Experiments 1 and 2 was adapted to allow multiple participants to take part simultaneously. All participants took part in two phases of the experiment: the first to measure problem-solving performance and the second to measure problem-solving-induced forgetting.

Measuring problem-solving performance. Participants were first given cue–response training for 60 fixation-inducing pairs and then were given 18 min to solve 20 possible RAT problems. The 60 cue–response pairs, each consisting of a cue word that would be used in one of the 20 subsequent RAT problems, were presented for study on a single sheet of paper, and participants were told that they would be tested on their ability to recall the response words given the cue words. After 4 min of study, participants were given 3 min to retrieve as many response words as they could when given cue-plus-one-letter stem retrieval cues, which were also presented on a single sheet of paper. This practice test served to strengthen the cue–response associations, thereby increasing the likelihood of inducing fixation on the subsequent RAT problems. The RAT problem-solving task immediately followed, with the 20 RAT problems appearing on a single sheet of paper. Participants were warned that the earlier learned response words would never serve as viable solutions. Corrective individualized feedback was provided every 6 min to ensure that participants would continue attempting to solve any incorrectly answered problems. Performance was measured as the total number of problems solved after 18 min of problem solving.

Measuring problem-solving-induced forgetting. In the second phase of the experiment, participants were first exposed to a new list of 69 cue–response pairs. As in the problem-solving performance phase, participants were presented with the cue–response pairs on a single sheet of paper, given 4 min to study, and then 3 min to recall the response words given cue-plus-stem retrieval cues. Of the 69 cue–response pairs, 54 had been constructed to be associated with 18 impossible RAT problems, and 15 had been constructed to be associated with five possible and relatively easy RAT problems. Next, participants were given 8 min to solve 14 RAT problems (five possible and nine impossible), which were also presented on a single sheet of paper. The possible problems were included to ensure that participants would not become suspicious of the impossible problems. Once again, participants were warned that the earlier learned response words would never serve as viable solutions. Immediately following the problem-solving phase, participants were given a cue–response test for each of the 69 cue–response pairs previously studied. In this test, all of the cues were listed on a single sheet of paper, and participants were given 4 min to recall the associated responses. For each participant, the 27 responses associated with cues in the nine impossible RAT problems presented during problem solving served as fixation items, whereas the 27 responses associated with cues in the nine impossible RAT problems that had not been presented served as baseline items, with the particular set of items serving as fixation and baseline counterbalanced across participants.

Results and Discussion

As shown in the bottom portion of Table 1, significant problem-solving-induced forgetting was observed: Recall performance on the cue–response test was significantly lower for fixation items ($M = 72.0\%$, $SE = 2.6\%$) than for baseline items ($M = 77.4\%$, $SE = 2.4\%$), $t(41) = 3.18$, $p < .01$, $d = 0.49$. On average, participants offered solutions on 28% of the impossible RAT problems. As in Experiment 2, however, we failed to find a correlation between the number of solutions participants offered during impossible problem solving and problem-solving-induced forgetting ($r = .04$, $p > .05$).

We next analyzed problem-solving performance on the set of 20 possible problems. On average, participants provided valid solutions for 38.6% of the problems (*SD* = 16.5%). Importantly, as shown in Figure 1, the amount of problem-solving-induced forgetting that was observed in the second phase of the experiment

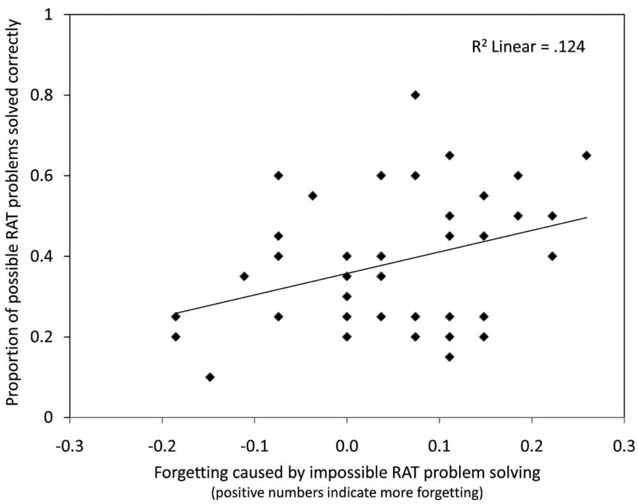

Figure 1. Proportion of possible Remote Associates Test (RAT) problems solved correctly as a function of the amount of problem-solving-induced forgetting (proportion of baseline items recalled − proportion of fixation items recalled) exhibited after attempting to solve a separate set of impossible RAT problems in Experiment 3. Line shows the best fitting linear regression.

significantly predicted performance at solving the possible RAT problems in the first phase of the experiment ($r = .35$, $p < .05$). Specifically, individuals who exhibited more problem-solving-induced forgetting exhibited greater problem-solving success. Interestingly, problem-solving-induced forgetting did not correlate with the proportion of possible problems for which participants provided incorrect solutions ($r = -.21$, $p = .16$). In fact, as shown in Figure 2, there was, if anything, a negative correlation between problem-solving-induced forgetting and the generation of incorrect solutions. These results suggest that individual differences in problem-solving-induced forgetting specifically predict a person's ability to generate valid solutions, not the tendency to generate a greater number of solutions overall.

General Discussion

Old and inappropriate ideas can cause mental fixation, impairing one's ability to generate new and creative ideas (Smith, 2003; Smith & Blankenship, 1991). For example, generating new and viable solutions in the RAT (Mednick, 1962) is often difficult because strong, yet inappropriate, associates get in the way. The current research shows that attempting to solve a RAT problem can cause the forgetting of these inappropriate fixation-inducing associates. Although the size of the problem-solving-induced forgetting effect is numerically small (ranging from 2.7% to 5.4% across the three experiments), several considerations make this small, but significant and replicable, effect both compelling and theoretically interesting. First, Cohen's *d* ranged from 0.42 to 0.53 across the three experiments, suggesting a moderate effect size; and, in terms of explaining variance in forgetting, the effect was sizeable. For example, in Experiment 2, baseline response words were forgotten 4.4% of the time. However, 60 s of problem solving caused associated response words to be forgotten 8.1% of the time. Thus, a response word was 83% more likely to be forgotten following attempted problem solving. Moreover, the effect is extremely surprising—there are reasons to expect that attempting to solve a problem should *enhance*, not impair, the later recall of inappropriate associates. Participants received considerable training on the cue–response pairs. Thus, when they were exposed to the same cues during problem solving, it seems likely that the cues would have primed or prompted the activation or retrieval of the associated response words. For example, in Experiment 2, despite telling participants that the earlier learned response words would never serve as accurate solutions, participants provided the response words as solutions on over 13% of the trials and later during debriefing reported that the inappropriate response words came to mind during 69% of the RAT trials. Thus, it would not have been surprising to see problem-solving-induced facilitation instead of problem-solving-induced forgetting.

Problem-solving-induced forgetting was not contingent on problem-solving success. In Experiment 1, participants were just as likely to forget the misleading associates following failed problem-solving attempts as they were following successful problem-solving attempts. Moreover, Experiments 2 and 3 demonstrated that even impossible RAT problems can lead to significant problem-solving-induced forgetting. That forgetting was observed even when problem solving failed makes sense in light of recent work on retrieval-induced forgetting showing that impossible retrieval practice is just as capable of causing forgetting as is successful retrieval practice (e.g., Storm et al., 2006). The rationale is that forgetting of inappropriate responses is necessary whether a retrieval or problem-solving attempt eventually succeeds. In fact, in the current context, problem-solving failures may lead to even larger effects of forgetting because they require the participant to continue attempting to solve the problems, thereby increasing the likelihood of forgetting the inappropriate associates. This possibility is supported by the results of Experiment 2, which showed that

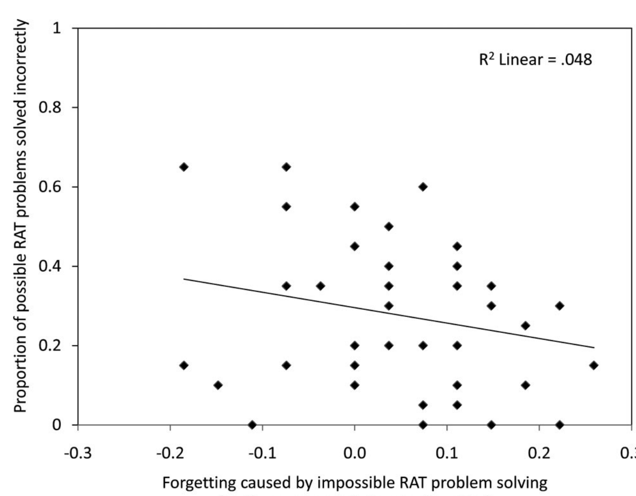

Figure 2. Proportion of possible Remote Associates Test (RAT) problems solved incorrectly as a function of the amount of problem-solving-induced forgetting (proportion of baseline items recalled − proportion of fixation items recalled) exhibited after attempting to solve a separate set of impossible RAT problems in Experiment 3. Line shows the best fitting linear regression.

more forgetting occurred after participants attempted to solve a problem for 60 s than for 20 s.

Although the present results provide clear and compelling evidence that attempting to solve a problem can cause forgetting, the theoretical mechanism underlying such forgetting is somewhat less clear. One potential explanation is that participants inhibited the misleading responses during problem solving, thus rendering them less recallable on the final test. In fact, there is good reason to believe that the same type of inhibitory process that underlies retrieval-induced forgetting also underlies the current phenomenon. Inhibition has been argued to be a goal-general mechanism that acts to resolve competition and override unwanted or inappropriate responses in whatever context they are encountered (Anderson, 2005). In the context of retrieval, such a mechanism involves selecting against or inhibiting inappropriate items that are activated by a given retrieval cue. Similarly, in the context of RAT problem solving, such a mechanism might involve selecting against or inhibiting inappropriate solutions that are activated by a given problem cue. An alternative theoretical account is that problem-solving-induced forgetting may simply be the consequence of blocking or interference. That is, participants may have generated potential solutions related to the RAT cue words during problem solving, which then, in turn, interfered with the ability to recall the response words on the final test. Such an interference account is also cited as a potential counter-argument to the inhibitory account of retrieval-induced forgetting.

Several considerations lead us tentatively to favor the inhibitory account of problem-solving-induced forgetting. First, the inhibitory account is in some ways the most parsimonious. There is now substantial evidence supporting the inhibitory account of retrieval-induced forgetting (Anderson, 2003; Storm, 2010), and, given the similarities between the two phenomena, it seems likely that they would be accomplished by the same underlying mechanism. Second, if problem-solving-induced forgetting was caused by interference from solutions generated during problem solving, then one might have expected participants who generated more solutions (regardless of appropriateness) to demonstrate more forgetting, yet no such correlation was observed. Finally, the two theoretical accounts make very different assumptions about the nature of problem-solving-induced forgetting. Whereas the interference account contends that forgetting is a side-effect of problem solving, the inhibition account contends that forgetting is a consequence of mechanisms designed to facilitate problem solving. Specifically, when problem solvers are exposed to misleading associates that cause fixation, inhibition is presumed to provide a mechanism by which to reduce the accessibility of those associates, thereby reducing fixation and facilitating the generation of viable associates. The results of Experiment 3 are consistent with this explanation: Individuals exhibiting greater problem-solving-induced forgetting also demonstrated superior problem-solving performance. In fact, not only did they generate significantly more appropriate solutions, they tended to generate fewer inappropriate solutions.

It is worth noting the possibility that the relationship between forgetting and problem-solving performance may actually be mediated by some other construct, such as working memory capacity (WMC). WMC is believed to be important for problem solving, and recent work has shown that WMC correlates significantly with retrieval-induced forgetting (Aslan & Bäuml, 2011). Thus, problem-solving-induced forgetting may not, in of itself, be responsible for facilitating problem-solving performance. Rather, individual differences in WMC may explain both problem-solving performance and the amount of forgetting that is observed. However, prior work has shown that performance improves when there is a delay or incubation period between exposure to fixating response words and problem solving, presumably because such a delay allows for the response words to be forgotten (e.g., Smith & Blankenship, 1991). Thus, if problem-solving-induced forgetting reduces the accessibility of inappropriate fixation-inducing associates, as the current results clearly show it can, then it would be very surprising if such forgetting did not also facilitate one's ability to achieve problem-solving success.

Concluding Comment

The three experiments reported here provide novel and intriguing insight into the memory dynamics of creative problem solving. Attempting to solve a problem can cause the forgetting of information that interferes with the solving of that problem. We argue that this problem-solving-induced forgetting can be characterized as a form of *goal-directed forgetting* (Bjork, Bjork, & Anderson, 1998)—by forgetting inappropriate associates, problem solvers are better able to generate new and appropriate associates. In this sense, creative cognition may rely not only on one's ability to remember but also on one's ability to forget.

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