


Overcoming Fixation: Creative Problem Solving and Retrieval-Induced Forgetting

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Retrieving information from memory causes the forgetting of other information in memory, a phenomenon known as *retrieval-induced forgetting* (Anderson, Bjork, & Bjork, 1994). Retrieval-induced forgetting is believed to be caused by inhibitory processes that act to resolve competition (Anderson, 2003; Storm, in press). According to this account, the attempt to retrieve a target item activates nontarget items, creating competition and requiring that the nontarget items be inhibited. Retrieval-induced forgetting is the consequence of this adaptive process—one that functions to resolve competition and facilitate retrieval.

Here, we report a study examining the role of inhibition in creative problem solving. Many problems are difficult to solve because old and inappropriate ideas cause *mental fixation*, impeding the generation of new and appropriate ideas (Smith, 2003). Inhibition may facilitate creative problem solving by providing a mechanism by which to bypass fixation and achieve a creative solution. We tested this hypothesis by measuring retrieval-induced forgetting and correlating that measure with performance on the Remote Associates Test (RAT; Mednick, 1962). To solve a RAT problem, participants must generate a common associate for three cue words (e.g., *manners*, *tennis*, *round*; solution: *table*). RAT problems are difficult to solve because the strongest associate for each cue word (e.g., *polite*, *ball*, and *square*, respectively) often bears no relationship to the other cue words and would not, therefore, serve as an appropriate solution. Once activated, however, these strong associates can cause fixation and impede the generation of creative and appropriate associates (Smith & Blankenship, 1991). We manipulated the extent to which participants experienced fixation by exposing half of the participants to misleading associates prior to problem solving. If inhibition underlies retrieval-induced forgetting, and if inhibition functions to resolve competition, then individuals who demonstrate more retrieval-induced forgetting in the retrieval-practice paradigm should also demonstrate a superior ability to overcome fixation in the RAT.

Method

Seventy-two undergraduates at the University of Illinois at Chicago served as participants. Retrieval-induced forgetting

was measured using the retrieval-practice paradigm (Anderson et al., 1994). Participants studied 48 category-exemplar pairs. Then, during retrieval practice, they retrieved new exemplars associated with half of the categories. Finally, all 48 exemplars were tested using retrieval cues consisting of the category name plus the first letter of the exemplar. Retrieval-induced forgetting was calculated by comparing recall performance for nonpracticed exemplars from practiced categories with recall performance for nonpracticed exemplars from nonpracticed categories.

In a separate task, participants were given 18 min (three 6-min blocks) to solve 20 RAT problems. Feedback was provided after each block so that participants would know which problems they had solved correctly. Half of the participants were exposed to misleading associates prior to problem solving ($n = 36$; fixation condition); half were not ($n = 36$; baseline condition). The list of misleading associates was created by selecting for each cue word from the RAT problems a response word with high forward associative strength. Participants in the fixation condition studied the misleading associates for 6 min before attempting to solve the RAT problems. (A more detailed description of the method and results can be found in the Supplemental Material available online.)

Results

Initial t tests confirmed significant effects of retrieval-induced forgetting, $t(71) = 4.33$, $p_{\text{rep}} > .99$, $d = 0.51$, and condition (fixation or baseline), $t(70) = 3.41$, $p_{\text{rep}} > .99$, $d = 0.81$. A regression analysis examined the proportion of problem-solving variance explained by condition, retrieval-induced forgetting, and the Condition \times Retrieval-Induced Forgetting interaction. The complete model was significant, $F(3, 68) = 6.78$, $p_{\text{rep}} = .99$, $R^2 = .23$, and, more important, so was the Condition \times Retrieval-Induced Forgetting interaction (when entered separately, to assess whether it accounted for additional variance), $F(1, 68) = 6.97$, $p_{\text{rep}} = .97$, $\Delta R^2 = .08$. Thus, the fixation effect

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was moderated by differences in retrieval-induced forgetting. There was a significant positive correlation between retrieval-induced forgetting and problem-solving performance in the fixation condition ($r = .38, p_{\text{rep}} = .95$), but not in the baseline condition ($r = -.23, p_{\text{rep}} = .83$).

A median-split analysis revealed that participants who demonstrated the least retrieval-induced forgetting ($M = -3.6\%$, $SD = 7.5\%$) exhibited a 21% fixation effect, $t(34) = 4.38, p_{\text{rep}} > .99, d = 1.46$, whereas participants who demonstrated the most retrieval-induced forgetting ($M = 16.3\%$, $SD = 7.5\%$) exhibited only a 2% fixation effect, $t(34) = 0.45, p_{\text{rep}} = .62, d = 0.15$. Fixation effects were calculated by subtracting the percentage of problems solved correctly by participants in the fixation condition from that of participants in the baseline condition. As shown in Figure 1, participants exhibiting less retrieval-induced forgetting became more fixated over time, whereas participants exhibiting more retrieval-induced forgetting became less fixated over time.

Discussion

The inhibitory account of retrieval-induced forgetting predicts that individuals who demonstrate more retrieval-induced forgetting should be superior to others at overcoming fixation during problem solving. Alternative accounts, such as blocking and associative interference, predict the opposite. The present results strongly, and unambiguously, support the inhibitory account. Although the evidence for the involvement of inhibition is indirect, the results clearly demonstrate the adaptive purpose that inhibition is presumed to afford—namely, the resolution of competition from outdated and unwanted information in memory. Furthermore, the

present results provide additional evidence that semantic retrieval can cause the inhibition of competing information in episodic and semantic memory (Bäuml, 2002; Johnson & Anderson, 2004).

It is interesting that problem-solving performance did not correlate positively with retrieval-induced forgetting in the baseline condition. Bristol and Viskontas (2006) have argued that inhibition may facilitate creativity by reducing access to unwanted associates, but also impair creativity by reducing access to remote associates. Thus, it is possible that inhibition facilitates performance only when the benefits of overcoming fixation outweigh the costs of inhibiting a potentially viable solution—which may have been the case in the fixation condition, but not in the baseline condition.

Inhibition is generally assumed to stifle creativity (e.g., Eysenck, 1995; Martindale, 1999). The current results paint a richer, albeit more complicated, picture. Inhibition has the power to both impair and facilitate creativity. At times, the propensity to inhibit irrelevant information comes at a price—specifically, potentially relevant information may be inhibited as well. As shown here, however, inhibition can also provide a means by which to overcome fixation. The ability to suppress outdated and inappropriate information is critical for performance on many creative tasks. To “think outside the box,” one must forget what is “inside the box.” Thus, the mechanisms that underlie retrieval-induced forgetting can enhance one’s ability to think, and to remember, creatively.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Supplemental Material

Additional supporting information may be found at <http://pss.sagepub.com/content/by/supplemental-data>

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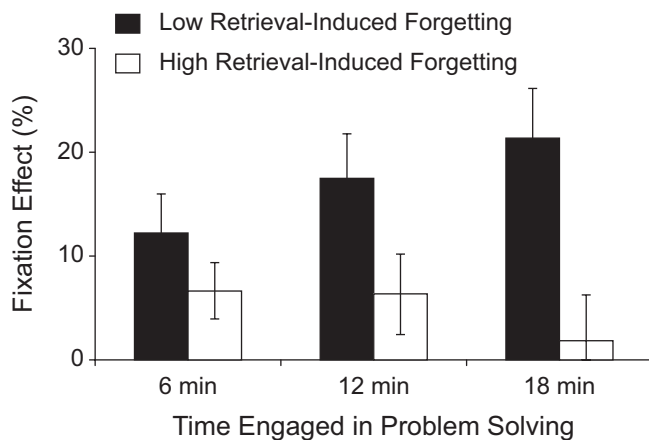


Fig. 1. Cumulative fixation effects as a function of problem-solving block for participants exhibiting high and low levels of retrieval-induced forgetting, as determined by a median split. Participants with high retrieval-induced forgetting demonstrated a 16.3% ($SD = 7.5\%$) effect of retrieval-induced forgetting; participants with low retrieval-induced forgetting demonstrated a 3.6% ($SD = 7.5\%$) effect of retrieval-induced facilitation. Error bars represent standard errors of the differences between performance in the baseline and fixation conditions.

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