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Creativity and Memory: Effects of an Episodic-Specificity Induction on Divergent Thinking

Kevin P. Madore[1,2], Donna Rose Addis[3,4], and Daniel L. Schacter[1,2]

[1]Department of Psychology, Harvard University; [2]Center for Brain Science, Harvard University; [3]School of Psychology, The University of Auckland; and [4]Centre for Brain Research, The University of Auckland

Abstract

People produce more episodic details when imagining future events and solving means-end problems after receiving an episodic-specificity induction—brief training in recollecting details of a recent event—than after receiving a control induction not focused on episodic retrieval. Here we show for the first time that an episodic-specificity induction also enhances divergent creative thinking. In Experiment 1, participants exhibited a selective boost on a divergent-thinking task (generating unusual uses of common objects) after a specificity induction compared with a control induction; by contrast, performance following the two inductions was similar on an object association task thought to involve little divergent thinking. In Experiment 2, we replicated the specificity-induction effect on divergent thinking using a different control induction, and also found that participants performed similarly on a convergent-thinking task following the two inductions. These experiments provide novel evidence that episodic memory is involved in divergent creative thinking.

Keywords

episodic-specificity induction, episodic memory, creativity, divergent thinking, convergent thinking, imagination

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Episodic memory is typically thought of as a neurocognitive system that supports the ability to recollect specific personal experiences that happened in a particular time and place (Tulving, 1983, 2002). However, it has become clear that episodic memory also plays an important role in a variety of tasks and functions that do not require recollection of specific past personal experiences. For example, Tulving (2002) argued that episodic memory supports "mental time travel" into the future as well as the past, and indeed, numerous recent studies have provided evidence that episodic memory contributes importantly to imagining or simulating possible future experiences (for recent reviews, see Schacter et al., 2012; Szpunar, 2010). In a related vein, recent studies indicate that episodic memory contributes to solving open-ended or means-end problems that involve hypothetical social situations: More effective solutions to means-end problems are characterized by more episodic detail (Madore & Schacter, 2014; Sheldon, McAndrews, & Moscovitch, 2011).

The starting point for the present investigation comes from evidence suggesting that episodic memory may also contribute to aspects of creative thinking. For example, Duff, Kurczek, Rubin, Cohen, and Tranel (2013) reported that amnesic patients with bilateral hippocampal damage, who exhibit severe impairments of episodic memory, also exhibit impairments on a widely used battery of creativity tasks, the Torrance Tests of Creative Thinking. Consistent with these findings, a recent functional MRI study (Ellamil, Dobson, Beeman, & Christoff, 2012) revealed that brain regions typically associated with episodic memory, including the hippocampus, show increased activity when participants generate creative ideas while designing book-cover illustrations. Benedek et al. (2014) obtained similar results when participants

Corresponding Author:
Kevin P. Madore, Harvard University, Department of Psychology, 33 Kirkland St., Cambridge, MA 02138
E-mail: madore@fas.harvard.edu

performed a task that requires generating alternative uses for common objects (the Alternate Uses Task, or AUT; Guilford, 1967), which is thought to tap a key component of creativity known as *divergent thinking*—the capacity to generate creative ideas by combining diverse types of information in novel ways. In related work, Gilhooly, Fioratou, Anthony, and Wynn (2007) found that participants sometimes draw on specific past experiences when performing the AUT, and Addis, Pan, Musicaro, and Schacter (2014) found that performance on the AUT is positively correlated with the amount of episodic detail that young and older adults generate when they imagine scenarios that might occur in their personal futures.

Although the foregoing studies all suggest a link between episodic memory and creativity, the evidence is subject to various caveats and qualifications. Amnesic patients with hippocampal damage typically exhibit deficits in forming both new episodic and new semantic memories (i.e., their declarative memory is impaired; Eichenbaum & Cohen, 2001; Squire, Stark, & Clark, 2004), so it is unclear whether creativity deficits in such patients specifically implicate episodic memory. Evidence for activation in the hippocampus and related structures during generation of creative ideas and divergent thinking (Benedek et al., 2014; Ellamil et al., 2012) is consistent with a role for episodic memory, but does not provide conclusive evidence for it. In the study by Gilhooly et al. (2007), retrieval of particular episodic memories occurred infrequently during the AUT (i.e., less than 10% of the time). And although Addis et al. (2014) observed a link between divergent thinking and the amount of episodic detail in imagined future scenarios, no such link was observed between divergent thinking and the amount of episodic detail in imagined or recalled past events.

To assess more directly the possible contribution of episodic memory to specific forms of creativity, in the present experiments we took a novel approach involving the use of what we have called an *episodic-specificity induction*: brief training in recollecting details of recent experiences (Madore, Gaesser, & Schacter, 2014; Madore & Schacter, 2014, 2015). The logic of our approach is straightforward: If a cognitive task relies on episodic memory, then performance on that task should be affected by an episodic-specificity induction given prior to the task. By contrast, if performance on a cognitive task does not rely on episodic memory, then task performance should not be influenced by an episodic-specificity induction given prior to the task.

Adopting this logic, we have previously shown that compared with control inductions, an episodic-specificity induction given prior to separate tasks that require remembering past experiences, imagining future experiences, and describing a pictorial scene selectively boosts the number of episodic details that participants generate when they remember the past and imagine the future, but has no effect on the number of semantic details they generate when remembering and imagining, and no effect on the number of details they generate when describing a picture (Madore et al., 2014). An additional study demonstrated that an episodic-specificity induction has no effect on the number of details participants provide when defining and comparing words (Madore & Schacter, 2015). We have also shown that an episodic-specificity induction has beneficial effects on performance on a means-end social problem-solving task (Platt & Spivack, 1975): Participants generated more relevant solution steps after receiving the specificity induction than they did following a control induction (Madore & Schacter, 2014). On the basis of this evidence, we have suggested that the induction could influence *episodic-retrieval orientation*: a flexible, goal-directed strategy for retrieving an episode in a more or less specific way when presented with a cue (Morcom & Rugg, 2012). In the experiments reported here, we tested whether inducing a bias toward specificity in episodic retrieval affects divergent thinking.

In Experiment 1, we tested and obtained evidence for the hypothesis that performance on the AUT, which is widely used to test divergent thinking, will be enhanced after an episodic-specificity induction compared with a control induction. We dissociated this effect from performance on a semantic object association task (OAT) that also required generative responses but placed less demand on divergent thinking than does the AUT (Abraham et al., 2012). In Experiment 2, we attempted to replicate this effect and examined whether the beneficial effects of the specificity induction extend to a task that taps a form of creativity known as *convergent thinking*—the ability to generate the best single solution to a specific problem (Guilford, 1967). In both experiments we also included an imagination task that we have previously shown to be affected by the specificity induction (Madore et al., 2014; Madore & Schacter, 2014, 2015) as a manipulation check to ensure that the specificity induction was operating as expected in the present study.

Experiment 1

Method

Participants. Twenty-four young adults (mean age = 22.50 years, *SD* = 3.72 years; 15 female) were recruited via advertisements at Boston University and Harvard University. All had normal vision and no history of neurological impairment. They gave informed consent, were treated in accordance with guidelines approved by the ethics committee at Harvard University, and received pay for completing the study. Prior to the experiment, we decided on a sample size of 24 because in our previous studies with the induction paradigm (e.g., Madore et al., 2014), this sample size has been adequate for detecting at least a medium-sized effect (i.e., $d = 0.60$) if it exists (power > .80, two-tailed, for a within-subjects design). We stopped data collection after reaching the target of 24 participants. One participant was excluded because of a technical error; thus, our final sample consisted of 23 participants.

Overview of the procedure. Participants came to the lab for two sessions, at least a week apart ($M = 7.35$ days, $SD = 1.11$). In each session, participants (a) watched one of two versions of a short video of a man and woman performing various activities in a house, (b) completed a short filler task and then were questioned about the video according to the protocol of the episodic-specificity induction or control induction, and (c) completed the AUT, OAT, and imagination task. In the second session, participants watched the video they had not seen in the first session, received the induction they had not received in the first session, and performed the same three tasks but with new cues. The order of the inductions and video-induction pairing was counterbalanced across participants.

Inductions. Half of the participants were randomly assigned to receive the episodic-specificity induction in the first session (and the control induction in the second session). During this induction, participants were asked questions about the specific contents of the video they had seen; the probes used were based on the Cognitive Interview, a protocol that boosts the number of accurate details that eyewitnesses recall about an event (Fisher & Geiselman, 1992; Memon, Meissner, & Fraser, 2010). The goal of the specificity induction was to help participants recall an experienced event in an episodically specific way. Participants were first told that they were the expert about the video. They were then guided through three mental-imagery exercises, during which they were asked to close their eyes and generate a picture in their mind about the setting, people, and actions they had seen. They were asked to verbalize everything they remembered and to be as specific as possible, and were probed for more detail with open-ended questions about elements they had mentioned.

The other half of the participants were randomly assigned to receive a control induction in the first session (and the specificity induction in the second session). During the control induction, participants were also asked questions about the contents of the video they had seen. They were first asked to describe their impressions and opinions of the video and were then asked general questions about it (e.g., what adjectives they would use to describe the setting, people, and actions; what equipment might have been used to make the video). There were no mental-imagery exercises in this induction, and participants were not asked to focus on or speak about specific details from the video. We used this as our control because we wanted participants in both inductions to reflect on and speak about the contents of the video they had seen so that an effect of the specificity induction could not be attributed to simply speaking about the video. The main difference between the inductions was the degree to which participants recalled information in an episodically specific way. The inductions were approximately 5 min long (see the Supplemental Material available online for full scripts).

Main tasks. After completing the induction phase in each session, participants typed responses to the AUT, OAT, and imagination task on a computer screen. The three tasks were presented as separate blocks; the order of the object cues within each task and the order of the tasks was randomized across participants and inductions. Seventeen different object cues were presented in each session. The cues were everyday objects (e.g., newspaper, bedsheet, eyeglasses) used in the official test booklet for the AUT (Guilford, Christensen, Merrifield, & Wilson, 1960) and other studies on divergent thinking. Instructions for each task were presented on the screen before participants began the task. These instructions emphasized that participants should report everything in as much detail as possible, so that they would use comparable criteria for the three tasks when reporting the details that came to mind. Participants then responded to a practice cue to ensure that they understood the instructions and response interface. On each of the following experimental trials, a new object cue appeared on the screen, and participants had 3 min to respond to it. The experimenter asked no questions and provided no inputs during these trials.

AUT. Participants listed as many unusual and creative uses as possible for each of five different object cues (plus one practice cue). They were told that although each object cue had a common use, they should generate as many other uses as they could in as much detail as they could (Guilford et al., 1960). The AUT is thought to tap divergent thinking in that participants are asked to flexibly recombine information in novel ways (Guilford, 1967).

OAT. Participants saw five different object cues (plus one practice cue) and listed other objects typically associated with each (Abraham et al., 2012). They were instructed to list as many objects as possible, in as much detail as they could. We consider this task a good complement to the AUT because participants generate information in response to object cues for the same amount of time in the two tasks. The main difference is that the OAT is thought to involve divergent thinking and episodic imagery to a lesser degree than the AUT; generating typical semantic associates does not require the same level of flexible thinking as does generating unusual and creative uses for objects, and behavioral and neural dissociations have previously been found between these two tasks (Abraham et al., 2012).

Imagination task. Participants saw four different object cues (plus one practice cue) and generated an event (on one day in one place) that somehow incorporated each cue (Addis, Wong, & Schacter, 2008). Participants were told to generate novel events that could happen to them within the next few years and to imagine the events from a field perspective. They were asked to type everything they could imagine (e.g., people, actions) about each event in as much detail as possible. Given previous findings of a robust effect of the episodic-specificity induction on performance of the imagination task (Madore et al., 2014; Madore & Schacter, 2014, 2015), we included this task to ensure that the specificity manipulation operated as expected.

Scoring. Participants' responses were scored by one of two raters who were blind to which induction had been received and to all experimental hypotheses. For the AUT, we focused on the number of *categories of appropriate uses* (modification of the scoring system of Addis et al., 2014; Guilford, 1967; Guilford et al., 1960) because appropriateness is the most stringent criterion for a use. Appropriate, or feasible and possible, uses were clustered into distinct categories (e.g., using a safety pin for earrings and for a bracelet charm are appropriate uses that both fall under the category of jewelry; using a shoe to hold an adult and to hold a big-screen television are both inappropriate uses and would not contribute to the score); the number of categories of appropriate uses was summed across cues for each participant. To establish interrater reliability for categories of appropriate uses, we had the raters separately score 10 participants' practice responses (i.e., responses not from the experimental set); after high interrater reliability (Cronbach's α = .92) was established using this set, the raters separately scored the experimental responses.

For the OAT, raters identified responses referring to *objects* and excluded other words, to ensure consistency with previous work and task instructions (Abraham et al., 2012). For example, if the cue was a sock, "washing machine" would be counted as an associated object, and "dirty" would be excluded. The number of objects was summed across cues for each participant. The raters separately scored responses for the experimental trials after high interrater reliability (Cronbach's α = .98) was established using a set of 10 participants' practice responses, which the raters also scored separately.

For the imagination task, we focused on *internal* and *external details* (Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002). Internal details—or episodic details—are any bits of information that are tied to the central event (e.g., people, setting, actions, feelings, objects). External details—or primarily semantic details—are typically any bits of information that are nonepisodic (e.g., facts, commentary). The average number of internal details and the average number of external details were computed across events for each participant. The raters separately scored responses for the experimental trials after high interrater reliability (Cronbach's αs $\geq$ .92) was established using a set of 12 participants' practice responses, which the raters also scored separately along these dimensions.

Results

To assess whether the specificity induction had the same effects as in previous research, we examined performance on the imagination task with a 2 (induction: control vs. specificity) × 2 (detail type: internal vs. external) repeated measures analysis of variance (ANOVA). Five responses were excluded (2.71% of the total) for not referring to events falling in the next few years (results were the same when these trials were included). We found no main effect of induction, $F(1, 22) = 0.95$, $p > .250$, $\eta_p^2 = .04$; a main effect of detail type, $F(1, 22) = 53.46$, $p < .001$, $\eta_p^2 = .71$; and, most critically, an interaction between induction and detail type, $F(1, 22) = 9.30$, $p = .006$, $\eta_p^2 = .30$. Participants generated more internal details after the specificity induction (M = 30.30, SE = 2.79) than after the control induction (M = 26.12, SE = 2.87), $t(22) = 2.46$, $p = .022$, mean difference = 4.18, 95% confidence interval (CI) = [0.66, 7.71], d = 0.51. They also generated fewer external details after the specificity induction (M = 3.44, SE = 1.01) than after the control induction (M = 5.81, SE = 1.43), $t(22) = −2.23$, $p = .036$, mean difference = −2.37, 95% CI = [−4.58, −0.16], d = 0.46. These results closely replicate our previous findings (e.g., Madore & Schacter, 2014) and thus indicate that the specificity induction operated as expected.

To address our main hypothesis—that the episodic-specificity induction would enhance performance to a greater extent on the AUT than on the OAT—we conducted another 2 (induction: control vs. specificity) × 2 (task: OAT vs. AUT) repeated measures ANOVA. There was no main effect of induction, $F(1, 22) = 0.51$, $p > .250$, $\eta_p^2 = .02$; a main effect of task, $F(1, 22) = 37.77$, $p < .001$, $\eta_p^2 = .63$; and, most critically, an interaction between induction and task, $F(1, 22) = 7.18$, $p = .014$, $\eta_p^2 = .25$. Participants generated more categories of appropriate uses when they received the specificity induction (M = 34.48, SE = 3.55) than when they received the control induction (M = 28.57, SE = 2.72), $t(22) = 2.49$, $p = .021$, mean difference = 5.91, 95% CI = [0.98,

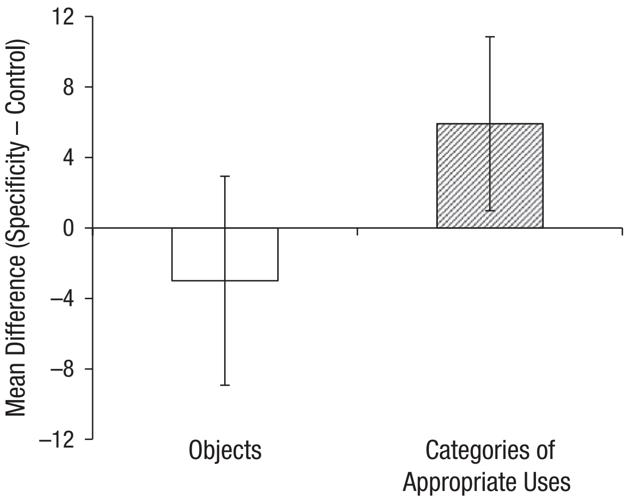

Fig. 1. Mean difference scores for the object association task (number of objects generated) and the Alternate Uses Task (number of categories of appropriate uses generated) in Experiment 1. Difference scores were calculated by subtracting performance following the control induction from performance following the specificity induction. Thus, a greater positive difference reflects a boost with the specificity induction. Error bars represent 95% confidence intervals.

10.85], d = 0.52. By contrast, participants generated similar numbers of objects following the two inductions (control: M = 52.83, SE = 4.49; specificity: M = 49.83, SE = 5.19), $t(22)$ = −1.05, $p > .250$, mean difference = −3.00, 95% CI = [−8.93, 2.93], d = 0.22. Figure 1 depicts the mean difference score for each task. We found the same selective boost from the specificity induction when we examined other standard scoring dimensions for the AUT: total uses, appropriate uses, and categories of all uses (see the Supplemental Material).

Discussion

The results of Experiment 1 show clearly that an episodic-specificity induction significantly boosted performance on a task that involves divergent thinking, the AUT, but had little effect on performance of a task that is thought to involve little divergent thinking, the OAT (Abraham et al., 2012). The specificity induction also produced effects very similar to those observed in our previous studies (Madore et al., 2014; Madore & Schacter, 2014, 2015) on performance of an imagination task, boosting the number of episodic but not semantic details that participants generated when they imagined possible future events. The parallel effects of the specificity induction on divergent thinking and imagination provide novel support for the idea that both draw importantly on episodic retrieval, which is consistent with previous findings and ideas about creative cognition (Addis et al., 2014; Benedek et al., 2014; Ellamil et al., 2012; Finke, Ward, & Smith, 1992; Gilhooly et al., 2007; Smith, 1995; Smith & Ward, 2012). To our knowledge, this experiment provides the first evidence that an experimental manipulation that specifically increases episodic retrieval also increases a measure of creative thinking (for an example of related evidence, see Storm & Patel, 2014).

In Experiment 2, we addressed three issues raised by Experiment 1. First, we attempted to determine whether we could replicate the effects of the specificity induction on AUT performance. Second, we examined whether the differential effects of the specificity induction and the control induction on AUT performance reflects an increase relative to baseline produced by the specificity induction or a decrease relative to baseline produced by the control induction. The latter induction emphasizes general impressions and thoughts, which conceivably could suppress divergent thinking below the levels that would be attained following a more neutral baseline (see Koutstaal & Cavendish, 2006, and Rudoy, Weintraub, & Paller, 2009, for related evidence of retrieval-orientation manipulations). To address this issue, we replaced the impressions control induction with a task that involved completing math problems. We have previously found that the specificity induction has a similar effect on memory and imagination whether it is compared with the impressions control or the math-problems control (Madore et al., 2014; Madore & Schacter, 2015), and we expected to observe the same effect on the AUT. Third, we asked whether the effects of the specificity induction are limited to divergent thinking, or whether they also extend to the component of creativity known as convergent thinking (which, as we noted earlier, is the ability to generate the best single solution to a specific problem; Guilford, 1967). To address this issue, we used the Remote Associates Test (RAT; Bowden & Jung-Beeman, 1998; Mednick, 1962), a standard measure of convergent thinking.

Experiment 2

Method

Participants. Twenty-four young adults (mean age = 20.75 years, SD = 2.69 years; 14 female) participated in this study, which had the same recruitment and data-collection parameters as Experiment 1. Participants received pay or course credit for the study. One participant was excluded for not following task instructions; thus, our final sample consisted of 23 participants.

Procedure. Participants again came to the lab for two sessions, at least a week apart (M = 7.30 days, SD = 1.46). The design parameters and stimuli were exactly the same in Experiment 2 as in Experiment 1 with two exceptions.

First, the impressions control induction was replaced with a math-packet control induction (as in Madore et al., 2014; Madore & Schacter, 2015). In this condition, after watching the video and completing the filler task, participants worked on math problems. This control condition did not explicitly call for episodic retrieval of any kind and therefore was a more neutral baseline than the impressions control. As in Experiment 1, inductions were approximately 5 min long.

Second, the OAT was replaced with the RAT. Participants saw 30 triads (plus 1 practice triad), each consisting of three words, and were asked to generate a solution word that could be combined with each word in the triad to form a common compound word or phrase (e.g., for *eight-skate-stick*, the solution word would be *figure*). We allowed participants 30 s to generate the solution word for each triad, so that equal time would be spent completing the experimental trials for this task and the AUT. Participants viewed 30 different triads (plus 1 practice triad) in the second session. The triads presented were randomized across participants and inductions. We chose 62 triads from Bowden and Jung-Beeman's (2003) normative list; to avoid floor and ceiling effects, we limited our selection to triads that between 0% and 46% of individuals could solve in 30 s (average normative success percentages were approximately 27% for the triads in both inductions after randomization).

Scoring. Participants' responses were again scored by one of two raters blind to induction and to all experimental hypotheses. For the AUT, we focused again on categories of appropriate uses (Cronbach's $\alpha = .95$) and for the imagination task, we looked at the numbers of internal and external details (Cronbach's $\alpha\text{s} \geq .92$). Interrater reliability was not calculated for RAT solution words because we simply summed the number of correct responses across all trials for each participant. Results for other dimensions of AUT performance are presented in the Supplemental Material; for these dimensions, we replicated the induction effects found in Experiment 1.

Results

As in Experiment 1, we confirmed that the manipulation had worked as intended by examining performance on the imagination task with a 2 (induction: control vs. specificity) × 2 (detail type: internal vs. external) repeated measures ANOVA. Two responses (1.09% of the total) were excluded for not referring to events falling in the next few years (results were the same when these trials were included). There was no main effect of induction, $F(1, 22) = 1.41$, $p = .247$, $\eta_p^2 = .06$; a main effect of detail type, $F(1, 22) = 75.24$, $p < .001$, $\eta_p^2 = .77$; and an interaction between induction and detail type, $F(1, 22) = 12.01$, $p = .002$, $\eta_p^2 = .35$. Participants generated more internal details after the specificity induction ($M = 32.86$, $SE = 3.04$) than after the control induction ($M = 26.84$, $SE = 2.55$), $t(22) = 2.95$, $p = .007$, mean difference = 6.02, 95% CI = [1.79, 10.25], $d = 0.62$, and they generated fewer external details after the specificity induction ($M = 5.09$, $SE = 1.65$) than after the control induction ($M = 9.21$, $SE = 1.43$), $t(22) = -3.48$, $p = .002$, mean difference = −4.12, 95% CI = [−6.57, −1.67], $d = 0.73$.

For our main analysis, we conducted another 2 (induction: control vs. specificity) × 2 (task: RAT vs. AUT) repeated measures ANOVA to examine whether (a) the effect of the specificity induction on use generation from Experiment 1 was replicated and (b) whether this effect extended to the RAT. As in Experiment 1, we found a selective boost on AUT performance after participants received the specificity induction. There were main effects of induction, $F(1, 22) = 12.42$, $p = .002$, $\eta_p^2 = .36$, and task, $F(1, 22) = 80.54$, $p < .001$, $\eta_p^2 = .79$, and a marginal interaction between induction and task, $F(1, 22) = 4.26$, $p = .051$, $\eta_p^2 = .16$. Participants generated more categories of appropriate uses when they received the specificity induction ($M = 26.57$, $SE = 1.96$) than when they received the control induction ($M = 23.09$, $SE = 2.05$), $t(22) = 3.67$, $p = .001$, mean difference = 3.48, 95% CI = [1.51, 5.45], $d = 0.77$. Participants generated nonsignificantly more correct solution words on the RAT after the specificity induction ($M = 7.83$, $SE = 0.76$) than after the control induction ($M = 6.91$, $SE = 0.77$), $t(22) = 1.13$, $p > .250$, mean difference = 0.91, 95% CI = [−0.76, 2.58], $d = 0.24$. Figure 2 depicts the mean difference score for each task.

General Discussion

The two experiments reported here provide clear and consistent evidence that an episodic-specificity induction that increases the number of episodic details participants generate in imagining future events also boosts their performance on the AUT, a classic test of divergent thinking. In both experiments, the most stringent measure of performance on the divergent-thinking task—categories of appropriate uses—showed a significant increase following the specificity induction compared with the control induction. We observed similar effects of the specificity induction when we compared it with the impressions control induction in Experiment 1 and the math-problems control induction in Experiment 2; these results are consistent with the idea that our AUT findings reflect an increase above baseline produced by the specificity induction, rather than a decrease produced by a focus on general impressions and thoughts in the impressions induction.

In Experiment 1, the effects of the specificity induction were limited to the divergent-thinking task; no comparable effects were observed on the OAT, which is thought to elicit

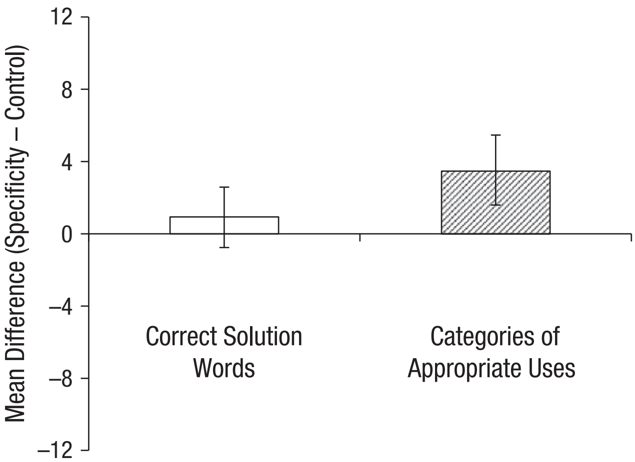

Fig. 2. Mean difference scores for the Remote Associates Test (number of correct solution words) and the Alternate Uses Task (number of categories of appropriate uses generated) in Experiment 2. Difference scores were calculated by subtracting performance following the control induction from performance following the specificity induction. Thus, a greater positive difference reflects a boost with the specificity induction. Error bars represent 95% confidence intervals.

little divergent thinking (Abraham et al., 2012). Experiment 2 suggests that the observed effects do not extend to convergent thinking: We failed to observe reliable effects of the specificity induction on RAT performance. However, some interpretive caution is required on this point, because the Induction × Task interaction was marginal.

Why does the episodic-specificity induction boost performance on the AUT? We have previously argued (e.g., Madore et al., 2014) that because the specificity induction increases episodic details reported on both memory and imagination tasks, it affects a process tapped by both remembering and imagining. As mentioned in the introduction, one process common to both is episodic-retrieval orientation, a flexible, goal-directed strategy invoked when one is presented with a retrieval cue (Morcom & Rugg, 2012). The episodic-specificity induction biases retrieval toward specificity—that is, toward a focus on episodic details related to places, people, or actions—and may affect performance on subsequent memory, imagination, and divergent-thinking tasks because they all involve creating mental scenarios that contain details like those emphasized during the induction (for additional theoretical elaboration, see Schacter & Madore, in press). By contrast, the OAT and RAT focus more on generating semantic information, and hence performance on these tasks shows little effect of the specificity induction.

An interesting question concerns whether adopting a retrieval orientation biased toward specificity enables participants to retrieve more past episodes that involve alternate uses of objects, more readily retrieve and recombine episodic details that support constructing entirely new uses of objects, or both. Using a procedure in which participants label uses on the AUT as "old" or "new" ideas, other researchers (Benedek et al., 2014; Gilhooly et al., 2007) have obtained results indicating that new ideas arise from recombining semantic information and imagery. We collected preliminary data suggesting that the specificity induction may boost both old and new ideas (see the Supplemental Material), but the issue requires more systematic investigation.

More broadly, episodic specificity affects performance on tasks that tap imaginative functions beyond divergent thinking. We recently found that it also increases the number of relevant steps that individuals generate when solving means-end problems concerning hypothetical social scenarios (Madore & Schacter, 2014). Future work should use the specificity induction as a tool to identify the contribution of episodic processes to performance of other cognitive tasks that are not usually thought of as episodic memory tasks, yet nonetheless rely on constructive uses of episodic retrieval.

Author Contributions

All three authors developed the study concept and contributed to the study design. K. P. Madore performed data collection and statistical analyses under the supervision of D. R. Addis and D. L. Schacter. K. P. Madore and D. L. Schacter drafted the manuscript, and D. R. Addis provided critical revisions. All three authors approved the final version of the manuscript for submission.

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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.

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Supplemental Material

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

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