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Selective effects of specificity inductions on episodic details: Evidence for an event construction account

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Abstract

Prior research has suggested that an episodic specificity induction – brief training in recollecting the details of a past event – affects downstream performance on remembering past and imagining future events, solving problems, and thinking creatively. We have hypothesized that a process common to these tasks that the induction may target is *event construction* – assembling and maintaining a mental scenario filled with details related to settings, people, and actions. We test this hypothesis by having participants receive a memory specificity induction, imagination specificity induction, or control induction not requiring event construction prior to memory and imagination tasks that involve event construction, and a picture description task that involves describing but not mentally constructing an event. We predicted that induction effects would be specific to episodic detail production on subsequent memory and imagination because these details assay critical elements of a constructed event. In line with an event construction account, the two specificity inductions produced significant and indistinguishable increases in the number of episodic – but not semantic – details generated during memory and imagination relative to the control. Induction did not increase detail generation on picture description. The findings provide novel evidence that event construction is a key process targeted by specificity inductions.

Keywords

event construction; episodic memory; imagination; episodic specificity induction; picture description

Most research concerning episodic memory (Tulving, 1983, 2002) has focused on retrieval of past events, but a growing number of studies suggest a much broader role for episodic retrieval in a variety of cognitive functions, including imagining future events (Atance & O’Neill, 2001; Schacter, 2012; Schacter, Addis, Hassabis, Martin, Spreng, & Szpunar, 2012; Schacter, Benoit, & Szpunar, 2017; Szpunar, 2010; Tulving, 2002), solving means-end problems (Sheldon, McAndrews, & Moscovitch, 2011), and divergent creative thinking (Addis, Pan, Musicaro, & Schacter, 2016; Duff, Kurczek, Rubin, Cohen, & Tranel, 2013).

In recent studies, we have provided evidence for the contribution of episodic retrieval to such cognitive functions through the use of an *episodic specificity induction* (ESI): brief training in recollecting details of recent experiences. The ESI used in our previous studies is based on the Cognitive Interview (Fisher & Geiselman, 1992; Memon, Meissner, & Fraser, 2010), a forensic protocol that encourages detailed episodic retrieval of a particular past experience. We reasoned that if a cognitive task draws on episodic retrieval, then administering an ESI prior to the task should boost performance on that task compared with administering a control induction that does not involve episodic retrieval.

Applying such logic, we have found that ESI selectively increases the number of episodic details generated on subsequent tasks that involve constructive uses of episodic retrieval (for review, see Schacter & Madore, 2016). For example, in several experiments we have asked participants to remember past experiences or imagine future experiences following ESI or a control induction. We scored responses using the Autobiographical Interview (AI; Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002), which distinguishes between “internal” or episodic details concerning what happened during a remembered or imagined experience, and “external” details that are mainly semantic in nature, including related facts, reflections on the meaning of what happened, or off-topic commentary. We found that participants produced more internal but not external details for both remembered and imagined experiences following the specificity induction compared with various control inductions (e.g., Madore, Gaesser, & Schacter, 2014; Madore & Schacter, 2016). Madore and Schacter (2014) observed a similar pattern of results on a means-end problem solving task, where participants are given open-ended social problems (e.g., having difficulties with one’s friends; Platt & Spivack, 1975) and generate solutions to them. Madore and Schacter (2014) found that participants included more episodic details in their problem solutions, and generated more relevant solutions, following ESI than a control induction (for related evidence, see Jing, Madore, & Schacter, 2016; McFarland, Primosch, Maxson, & Stewart, 2017). In a related study, Jing, Madore, and Schacter (2017) presented participants with a series of negative future events and asked them to generate alternative positive outcomes. Participants generated more alternative positive outcomes after receiving an ESI than a control induction. Extending this logic, Madore, Addis, and Schacter (2015) examined the effects of the specificity induction on a divergent thinking task that requires generating unusual uses of common objects, and found that the induction boosts the number of novel uses that participants provide. By contrast, the specificity induction has had no effect on other tasks that do not invoke constructive uses of episodic retrieval, such as describing pictures (Madore et al., 2014), defining words (Madore & Schacter, 2016), providing typical associates of objects (Madore et al., 2015; Madore, Jing, & Schacter, 2016a), or generating solutions in convergent creative thinking (Madore et al., 2015).

Based on this evidence, we have argued (e.g., Madore et al., 2014) that the specificity induction biases the *retrieval orientation* (Morcom & Rugg, 2012) that participants adopt during task performance in such a way that they focus on episodic details related to objects, people, places, and actions. Schacter and Madore (2016) further proposed that biasing a specific retrieval mode via the induction may facilitate a process of *event construction* (Romero & Moscovitch, 2012) that can be recruited for memory, imagination, social problem solving, and divergent creative thinking. Event construction – the assembly of a

mental scenario bound in space and time with details related to settings, people, and actions – may be facilitated by a retrieval mode that focuses on assembling a mental event with these kinds of specific details. This point also fits under the theoretical framework of an *event model* (Radvansky & Zacks, 2014), which is constructed, at least in part, of elements of previous episodic memories that are situated in a specific place and time related to physical entities and action sequences. Schacter and Madore (2016) hypothesized that event construction is involved to some extent on all the tasks that have benefited from the specificity induction but is not involved, or only minimally involved, on the tasks that do not benefit from the induction.

The hypothesis that ESI affects primarily the process of constructing mental events on subsequent tasks suggests that the key ingredient of the induction in producing the observed effects may be the requirement to generate detailed mental events. In contrast to this *constructive retrieval* hypothesis, it is possible that the effects of ESI are attributable to, and depend on, a *reproductive retrieval* process that requires remembering the details of an actual past event. By this view, downstream effects of ESI on subsequent tasks are observed only after participants have retrieved a specific event from their personal past. Indeed, to date all prior evidence for an effect of the ESI has come from experiments where participants remembered an actual event (i.e., activities in a recently viewed video) during the induction. Importantly, the ESI is based on the Cognitive Interview, a procedure that was designed to elicit accurate retrieval of information from a past experience, and meta-analyses have shown that it primarily boosts retrieval of accurate details, with a much smaller increase in retrieval of inaccurate details, which tend to be minor errors such as describing a coat as black when it was red (Köhnken, Milne, Memon, & Bull, 1999; Memon et al., 2010). The close link between the ESI and the Cognitive Interview provides a plausible basis for thinking that the ESI might enhance a primarily reproductive retrieval process.

We think that it is theoretically critical to distinguish between the constructive and reproductive retrieval hypotheses because ESI has broad effects across a range of memory, imagination, and creativity tasks, yet there have been few attempts to characterize the precise mechanism that drives these effects. Moreover, the theoretical account of ESI that we have advanced – i.e., that it impacts an event construction process – makes a strong prediction that a constructive rather than a reproductive retrieval process underpins the broad effects of ESI that have been documented. However, evidence from prior ESI studies cannot speak to whether the retrieval processes engaged by ESI are constructive or reproductive in nature. This is an important question to address because it could be, contrary to our hypothesis, that reproductive retrieval of an actual event underlies similarities observed among ESI effects on memory, imagination, and related tasks, or it could be, in line with our hypothesis, that constructive retrieval processes not tied to any one event underlie these similarities. We think the answer to this question has implications for theory and function, in terms of understanding better the nature of generative event processing and for informing treatments related to memory, psychological well-being, and aging (for review, see Schacter & Madore, 2016).

We test the competing hypotheses of constructive versus reproductive retrieval in the current study using novel induction methods in a within-subjects experiment. We examine whether

ESI selectively boosts internal details on subsequent memory and imagination tasks – but not a picture description task – even when the induction involves only imagining a detailed mental event, as opposed to remembering an actual event. If the induction affects a constructive retrieval process (i.e., event construction), then remembering an actual event during ESI may not be an essential component of the induction’s downstream effects on subsequent tasks; simply constructing an imagined event may be sufficient. By contrast, if ESI reflects the influence of a primarily reproductive retrieval process, then downstream effects of ESI should be observed only after retrieval of an actual autobiographical event. In either scenario, the predicted effects of constructive or reproductive retrieval should be specific to internal details because they refer to critical elements of an imagined or remembered event, such as people, places, objects, and their relations. By contrast, external details comprise facts, reflections, and commentary that are not essential components of an event and should not be impacted by either constructive or reproductive retrieval. Finally, a picture description task requires describing an event but not mentally constructing or retrieving one (see Gaesser, Sacchetti, Addis, & Schacter, 2011; Keven, Kurczek, Rosenbaum, & Craver, 2018; Race, Keane, & Verfaellie, 2013), and thus should not be affected by ESI.

Participants received three inductions over three separate sessions: a *memory specificity induction* for an experienced past event (a different instantiation of what we have previously referred to as ESI), an *imagination specificity induction* for a novel future event, and a *control induction* that did not draw on constructive or reproductive retrieval processes. After the induction in each session, participants completed AI-based memory, imagination, and picture description tasks to test the effect of each induction on these tasks. In line with the constructive retrieval account, we hypothesize that *both* the memory and imagination specificity inductions, compared with the control induction, should produce: 1) a significant increase in internal details generated on AI-based memory and imagination tasks; 2) no increase in external details on these tasks, and 3) no increase in any details generated on the picture description task. Given that both specificity inductions involve building a mental event, we did not expect to find differences between them.

Method

Participants

Twenty-four young adults ($M_{age} = 21.75$ years, $SD_{age} = 2.83$, $range_{age} = 18\text{--}29$, 18 female) participated in the study and were recruited from advertisements at Boston University and Harvard University. They provided written consent before completing the study, were treated in a manner approved by Harvard University’s ethics committee, and received pay as compensation. All participants had adequate vision and no history of neurological impairment. One additional participant was excluded for task noncompliance.

We decided on a sample size of 24 useable subjects before the study began and stopped data collection after reaching this number because an a priori power analysis (Faul, Erdfelder, Lang, & Buchner, 2007) showed that 24 was sufficient for detecting at least a medium-sized effect ($d = 0.60$) if it exists (power > 0.80 , two-tailed for a within-subjects design).

Moreover, our previous induction experiments (e.g., Madore et al., 2014, 2015) have used this number and detected medium- to large-sized effects.

Materials, Design, and Procedure

Overview—As depicted in Figure 1, participants came to the lab for three sessions, with the second session two days after the first session ($M = 2.04$ days, $SD = 0.20$), and the third session two days after the second session ($M = 2.38$ days, $SD = 0.77$). In each session, which lasted 1 to 1.5 hours, participants received the memory specificity induction (for a remembered past event), imagination specificity induction (for a novel future event), or control induction. After the induction, participants completed the AI-based memory, imagination, and picture description tasks. A different induction and different picture cues were used in each session. The first day of testing began with a brief stimulus collection that was used for the memory and imagination specificity inductions. Participants were debriefed at the end of the third day of testing. None of the 24 participants were aware of the manipulation's expected effects as assayed during debriefing.

Stimulus Collection—At the beginning of the first session, participants completed a brief *stimulus collection* for approximately 10 minutes (based on Addis, Pan, Vu, Laiser, & Schacter, 2009), where they generated 5 events that they had experienced in the past few years. Each event had to be on one day in one place, and involve three details that were highly familiar: a setting, person (besides themselves), and object. Participants wrote out a title for each event, as well as the name of each detail, and rated the familiarity of each detail (1 = least to 9 = most). Participants were asked to provide a unique title and different details for each event.

Inductions—After the stimulus collection and a 2-minute filler task (odd-even number judgments; see Stark & Squire, 2001), participants were randomly assigned to receive one of the three inductions (the order of which was counterbalanced across participants). Two of the inductions were meant to increase specific details generated for a mental event and drew on elements from the stimulus collection: the *memory specificity induction* and *imagination specificity induction*. The third condition was a *control induction* that did not involve episodic specificity or event construction.

In the *memory specificity induction*, participants were given the title and the three details of one of their remembered events from the stimulus collection (instead of remembering events from a video, as in our previous studies) and were asked to verbally recall it using mental imagery probes from the Cognitive Interview. Participants were instructed to close their eyes for each probe and get a picture in their mind about the setting and object, person (along with themselves), or actions of the event. Participants were also told to report everything they remembered and to be as specific and detailed as possible, as they were the chief expert. Open-ended follow-up questions were also chosen from a bank. This induction is identical to our previous ESI (e.g., Madore et al., 2014), except that participants here were recalling an event with details from the stimulus collection rather than the details of a video. The event chosen was randomly selected from those in which all three details had been rated as highly familiar (typically 7). We targeted a triplet of highly familiar details (e.g.,

setting, person, and object) to maximize participants' ability to generate detailed events. We also focused on a triplet of familiar single word cues that were constructed together to create an event because Romero and Moscovitch (2012) implemented a task methodology with at least 3 familiar single word cues per trial to establish event construction as a phenomenon.

In the *imagination specificity induction*, participants worked through similar instructions, probes, and follow-up questions as in the memory specificity induction. For the imagination induction, the focus was on constructing a novel future event rather than a past event, the first time this manipulation has been adopted in specificity induction studies. Participants were given three details (i.e., a setting, person, and object) from *different events* of the stimulus collection and were asked to verbally create a *new event* that could happen to them within the next few years that incorporated the triplet of details. This method uses Addis et al.'s (2009) experimental recombination paradigm in which participants first complete a stimulus collection and are then asked to create novel events based on recombining details from distinct past events, which rules out the possibility of recasting an actual past event as an imagined event. Romero and Moscovitch (2012) also instructed participants to construct an event from relating at least 3 familiar single word cues together. Along with this recombination procedure, the imagination induction stressed novelty by asking participants to focus on what was different or new about each detail recalled, which dovetails from the memory specificity induction. The details chosen were randomly selected from three events and highly familiar (typically rated 7). The details used in the memory and imagination inductions were different. See Appendix A for both specificity scripts.

In the *control induction*, participants completed a packet of simple addition and subtraction math problems (as in Madore et al., 2014, 2015; Madore & Schacter, 2016), which should not bias participants' episodic orientation or event construction in any way. It should be noted that in our previous experiments we have compared a memory specificity induction with both the math control condition used here, and an impressions control induction (Madore et al., 2014; Madore & Schacter, 2016), and have found no differences between the two control inductions as an indicator of baseline performance. In the present experiment, participants spent approximately 6 minutes in each induction, which did not significantly vary as a function of the manipulation.

Adapted Autobiographical Interview (AI)—After completing the induction phase in each session, participants completed an adapted AI (see Gaesser et al., 2011; Madore et al., 2014) where they viewed 12 different picture cues (4 per task) that depicted common scenes (e.g., a library, park). Participants had 3 minutes per picture, and typed out their answers in a text box on the computer screen in front of them. A 3-minute time limit and a typing response format were adopted because comparable downstream ESI-related effects on task generation have been exhibited whether a 3-minute, 5-minute, or self-paced method is implemented, along with a verbal, handwritten, or typed response (Madore & Schacter, 2014; Madore et al., 2016a). Each picture remained on the screen for the trial's duration. The screen automatically moved to a task difficulty rating for 8s (1 = least to 9 = most) after time expired before advancing to the next picture. Picture cues were blocked by task; order of cues and tasks was randomized across participants. There was no probing or experimenter input during the tasks, so one experimenter completed each session. Participants were asked

to *remember* an actual event from the past few years or *imagine* a plausible event within the next few years, from a field (i.e., own eyes) perspective, that occurred on one day in one place and was related to the picture, or to *describe* the literal contents of the picture. For all three tasks participants were instructed to include every detail possible. See Appendix B for task instructions.

Scoring and Coding—Participants' responses on the AI-based tasks were scored for *internal* and *external details* per trial (see Levine et al., 2002). Internal details for memory and imagination were any episodic and on-topic bits of information about the central event (e.g., people, objects, setting), whereas external details were semantic (e.g., facts and commentary), off-topic, or repetitive. For picture description (see Gaesser et al., 2011; Madore et al., 2014), internal details were items literally depicted in the picture (e.g., people, objects, setting), whereas external details were inferences about the picture (e.g., describing a conversation between individuals), off-topic, or repetitive.

Responses were scored by one of two coders blind to induction and hypotheses. Before the scoring of experimental trials, the coders were trained and independently scored an interrater packet of 20 responses with high agreement (Cronbach's alpha = .94 for internal details and .92 for external details). The 20 responses in the interrater packet included 6 memory trials, 6 imagination trials, and 8 picture description trials from an independent dataset that involved the same three tasks (Madore et al., 2014). Each coder rated half of the experimental trials.

Results

As a task compliance check, 22 memory and imagination trials (3.82% of total) were excluded (19 for not falling in the past/next *few* years, and 3 due to a technical glitch); all picture description trials were included. We also confirmed that there were no significant effects of the between-subjects variable of induction order (e.g., control followed by memory specificity followed by imagination specificity) on performance (tested in our ANOVA models, p s < .18-.76). Differences in ratings of difficulty by participants also did not vary significantly as a function of induction, task, or the interaction between the two variables. To address our main hypotheses, we then conducted a repeated-measures ANOVA with the within-subjects factors of induction (control vs. memory specificity vs. imagination specificity), detail type (internal vs. external), and task (memory vs. imagination vs. picture description). The results of this model are reported below, starting with main effects and then two-way and three-way interactions (Greenhouse-Geisser corrections were used for sphericity violations). The descriptive statistics of these results are presented in Table 1 below.

We found no significant main effects of induction, $F(1.57, 36.20) < 1$, $MSE = 15.11$, $p = .38$, $\eta_p^2 = 0.04$, or task, $F(1.32, 30.39) < 1$, $MSE = 46.00$, $p = .64$, $\eta_p^2 = 0.01$, and a significant main effect of detail type, $F(1, 23) = 152.35$, $MSE = 664.46$, $p < .001$, $\eta_p^2 = 0.87$, indicating that participants generated more internal than external details across the three tasks and inductions. This pattern replicates previous work on AI-based tasks (e.g., Gaesser et al., 2011).

Analysis of two-way interactions revealed no significant interaction between detail type and task, $F(2, 46) = 1.24$, $MSE = 58.89$, $p = .30$, $\eta_p^2 = 0.05$, indicating that participants did not differ in the number of internal or external details that they generated on each task irrespective of induction. We also found significant interactions between induction and task, $F(4, 92) = 4.06$, $MSE = 5.98$, $p = .004$, $\eta_p^2 = 0.15$, and induction and detail type, $F(2, 46) = 10.57$, $MSE = 31.41$, $p < .001$, $\eta_p^2 = 0.32$, as in our previous work (i.e., Madore et al., 2014).

Most critically and in support of our main hypotheses, these findings were qualified by a significant three-way interaction of induction, detail type, and task, $F(2.43, 55.91) = 4.97$, $MSE = 34.11$, $p = .007$, $\eta_p^2 = 0.18$. Below we report follow-up repeated-measures ANOVAs (see Fritz, Morris, & Richler, 2012) for internal details on the three tasks as a function of induction, followed by external details.

Internal details.

Participants generated significantly more *internal details on the memory task* after the memory specificity induction compared with the control, and imagination induction compared with the control, smallest $F(1, 23) = 14.29$, $MSE = 17.11$, $p = .001$, $\eta_p^2 = 0.38$. Similarly, participants generated significantly more *internal details on the imagination task* after the memory specificity induction compared with the control, and imagination specificity induction compared with the control, smallest $F(1, 23) = 9.81$, $MSE = 14.02$, $p = .005$, $\eta_p^2 = 0.30$. Internal details on memory or imagination were similar after the two specificity inductions, largest $F(1, 23) = 1.67$, $MSE = 25.86$, $p = .21$, $\eta_p^2 = 0.07$. Importantly and in contrast to the event tasks, participants generated a similar number of *internal details on the picture description task* across the three inductions, largest $F(1, 23) = 1.41$, $MSE = 17.88$, $p = .25$, $\eta_p^2 = 0.06$.

External details.

Analysis of external details revealed that participants generated significantly or marginally fewer *external details on the memory task* after the memory specificity induction compared with the control, and imagination specificity induction compared with the control, smallest $F(1, 23) = 3.80$, $MSE = 20.99$, $p = .063$, $\eta_p^2 = 0.08$. Participants also generated significantly or marginally fewer *external details on the imagination task* after the memory specificity induction compared with the control, and imagination specificity induction compared with the control, smallest $F(1, 23) = 6.86$, $MSE = 25.25$, $p = .015$, $\eta_p^2 = 0.23$. External details on memory or imagination were similar after the two specificity inductions, largest $F(1, 23) = 2.12$, $MSE = 15.97$, $p = .16$, $\eta_p^2 = 0.08$. In addition, there were no significant differences in *external details on the picture description task* between the memory specificity induction and control, or imagination specificity induction and control, largest $F(1, 23) = 2.00$, $MSE = 3.87$, $p = .17$, $\eta_p^2 = 0.08$, though there was a trending difference between the two specificity inductions, $F(1, 23) = 4.28$, $MSE = 2.99$, $p = .050$, $\eta_p^2 = 0.16$. Collectively, this pattern of findings replicates and extends our previous work (e.g., Madore et al., 2014, 2015) and indicates that the specificity inductions operated as expected.

General Discussion

The results of the present experiment provide novel evidence that event construction is a key process targeted by specificity inductions. In line with the constructive retrieval hypothesis, and contrary to the reproductive retrieval hypothesis, we found that a memory specificity induction and imagination specificity induction led to indistinguishable increases in internal/episodic detail generation on subsequent memory and imagination tasks, without increasing external/semantic detail generation on these tasks and without increasing any sort of details generated on a picture description task. These results in combination indicate that effects of a specificity induction on an actual event in the past or imagined event in the future can affect generative processing of subsequent remembered and imagined events, which underscores how overlap in memory and imagination documented in this study and in a prior decade of work may stem from constructive rather than reproductive retrieval processes. This pattern of findings indicates that the reproduction of an actual event from the past is not necessary for observing downstream ESI-related impacts or overlap in memory and imagination, a result that has implications for theory and function related to event processing, psychological well-being, and aging.

These considerations support Schacter and Madore's (2016) suggestion that the specificity induction targets an event construction process. The event construction account receives critical support from the three-way interaction of induction, task, and type of detail, which highlights that the specificity inductions selectively affected internal details on subsequent memory and imagination tasks but not the picture description task. The fact that neither specificity induction had any detectable effect on the picture description task despite significant effects on memory and imagination is also critical because this task requires *description* but not *construction* of an everyday event.

Our results align well with recent data that also support a constructive retrieval account of ESI effects. Thakral, Madore, Devitt, and Schacter (2018) combined ESI and control inductions with the Deese-Roediger-McDermott (DRM; Deese, 1959; Roediger & McDermott, 1995) false recall paradigm. Thakral et al. reported that administering ESI (vs. a control induction) just after presentation of DRM associate lists, and just before a free recall test, boosted subsequent levels of false recall of critical lure words while having no impact on levels of true recall. This pattern of results is in line with a constructive retrieval account of ESI effects and contrary to a reproductive retrieval account.

More broadly, we think that these results are compelling and have implications for theory and function because they highlight how constructive uses of episodic retrieval impact the generative processing of events. The data fit with contemporary theoretical frameworks on the ways in which episodic retrieval supports flexible and relational processing of different elements of an event (e.g., Eichenbaum & Cohen, 2014; Moscovitch, Cabeza, Winocur, & Nadel, 2016; Roberts et al., 2018; Schiller et al., 2015). The pattern of findings also suggests that the processes targeted by the induction on event construction tasks are likewise targeted on related tasks that draw on these processes for completion. These functional tasks may include means-end problem solving and divergent creative thinking, among others (Rubin, Watson, Duff, & Cohen, 2014; Schacter & Madore, 2016). Moreover, specificity inductions

similar to the ones examined here have been shown to have beneficial functional effects on psychological well-being and emotion regulation (Jing et al., 2016, 2017), and in a variety of clinical populations (for a review, see Hitchcock, Werner-Seidler, Blackwell, & Dalgleish, 2017). It is critical to better understand the mechanisms underlying these effects. We note that the effects of ESI appear to be transient, and that specificity protocols such as MEST (i.e., MEMory Specificity Training; Raes, Williams, & Hermans, 2009) that incorporate multiple sessions with homework, interactive feedback, and a psychoeducation piece about the importance of memory specificity (e.g., Neshat-Doost et al., 2013) may lead to longer lasting impacts. More generally, given the wide-ranging effects of specificity inductions, the findings reported here have potentially broad theoretical and functional implications.

There are a few limitations to our conclusions that should be noted. The first involves the use of the picture description task. While no induction effects were found on the picture description task, it is unclear whether the induction manipulation did not affect picture description performance or whether the picture description task itself did not lend itself to exposing differences as a function of induction. Three pieces of evidence speak against the alternative that picture description performance has reached an asymptote or is indifferent to any kind of induction effects. First, difficulty ratings were comparable across the memory, imagination, and description tasks, but the induction affected memory and imagination without affecting picture description. Second, the main effect of task and two-way interaction of task x detail were non-significant (indicating that a comparable number of details were generated across the three tasks) but the induction impacted performance in memory and imagination. Third, previous work has shown that older adults often generate fewer details on picture description than young adults (Gaesser et al., 2011; Madore et al., 2014), which suggests that variability can be observed on this task. While these pieces of evidence suggest that picture description performance could have been affected by the induction manipulation, future work should address this issue more systematically by including a picture description induction and examining whether it affects subsequent picture description performance.

Another limitation that should be noted concerns induction-related effects on both internal and external detail production on memory and imagination. Both specificity inductions increased internal details and decreased external details on memory and imagination. This pattern of findings could imply that the math control induction depressed performance below baseline, in that fewer internal details and a greater number of external details on memory and imagination were observed following this induction relative to the specificity inductions. We think this pattern of results can be ruled out for three reasons. First, the math control is a neutral baseline and should not depress performance on subsequent tasks because it does not involve any sort of gist-like processing. Second, in many of our previous ESI studies we have compared the math control induction to another control induction where participants provide their general impressions of a recently viewed video, and we have found no differences in subsequent effects produced by these inductions (e.g., Madore et al., 2014, 2015, 2016b; Jing et al., 2016). Third, we have found in several prior studies (e.g., Madore et al., 2014, 2016b; Madore & Schacter, 2016) that the specificity induction increases internal details generated on memory and imagination without affecting external detail generation, which suggests that the manipulation leads to an increase in internal details rather than a

decrease in external details. Future work should continue to investigate the links between internal and external detail production (for a detailed analysis, see Devitt, Addis, & Schacter, 2017) to assess how these constructs can be mapped onto performance, as well as how detail generation may be affected by the adoption of familiar versus unfamiliar cue stimuli (e.g., Robin & Moscovitch, 2014).

A third limitation and point for future research is *how* the specificity induction operates to affect event construction. We think that mundane demand characteristics and participant compliance cannot explain ESI-related impacts, in part because in debriefing none of the participants reported that they were aware of the manipulation's expected effects. Consistent with this observation, given that ESI *selectively* benefits tasks (memory and imagination but not description) and type of details (internal but not external), it seems highly unlikely that participants would intuit this pattern of results and produce it through compliance. It appears that the time limit of 3 minutes and the typing response format during the main tasks are also not the main drivers of ESI-related effects; comparable ESI-related effects have been observed across a variety of methods (Madore & Schacter, 2014; Madore et al., 2016a). Moreover, main task instructions were equated across induction conditions, which indicates that report criterion thresholds should have been similar following induction conditions before the main tasks were completed. The inclusion of a picture description main task also speaks to this issue. Training in ESI to describe and prioritize setting, people, and action details is not enough to observe ESI-related effects because picture description involves this process but ESI-related effects were selectively observed on memory and imagination, which also involve this process. A parsimonious explanation for our findings is that training in ESI to mentally orient to construct and maintain an event in the past or future with setting, people, and action details has observable downstream impacts on subsequent tasks that invoke this sort of mental set or retrieval orientation for completion.

A major extrapolation from the findings of the present study is that event construction may also be involved in other tasks that have been enhanced by the memory specificity induction in prior work, as noted by Schacter and Madore (2016): generating solutions to open-ended social problems (e.g., Madore & Schacter, 2014) and unusual uses for common objects (e.g., Madore et al., 2015; Madore et al., 2017). Thus a prediction from our view is that the imagination specificity induction used in the current study will boost performance on both of these tasks to the same extent as the memory specificity induction. We make the same prediction for related tasks that have been used previously to assess event construction, and scene construction, which is a particular type of event construction focused on assembling and maintaining the spatial coherence of an event (Mullally & Maguire, 2014; Irish et al., 2015, 2017; Robin & Moscovitch, 2014; Robin, Wynn, & Moscovitch, 2016; Romero & Moscovitch, 2012; Rubin & Umanath, 2015). To gain traction on the mechanistic underpinnings of ESI, future work should assess whether ESI effects can be explained by a scene construction account, or other plausible accounts. Tests of these hypotheses should increase our understanding of the basis of the induction effects observed here and in previous studies, and also extend our knowledge of how constructive uses of episodic retrieval affect generative processing of mental events.

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Appendix A: Memory Specificity Induction script

Introduction

Now we are going to do a memory exercise. I want you to think about the memory you thought about with the title of *(xx)*, involving the setting of *(xx)*, the person of *(xx)*, and the object of *(xx)*. *[From one memory with setting, person, object]* I don't know anything about this setting, person, and object, so you're the expert on that. First you'll tell me about the setting and objects, then about yourself and the other person there, and then about the actions you were both doing.

Mental imagery about the surroundings

First I want you to close your eyes and get a picture in your head about the setting in your memory. I want you to think about what types of objects were in the environment and how they were arranged and what they looked like. Once you have a really good picture in your head, I want you to tell me everything you can remember about the setting and the objects in it. One of the objects should be the one mentioned above. Try to be as specific and detailed as you can.

General probing about the surroundings

- Tell me more about... (details mentioned).
- Tell me more about how (the setting) was arranged.
- Tell me more about what was in (the setting).

Mental imagery about the people

Now I want you to close your eyes again and get another picture in your head, this time about yourself and the other person in your memory. This person should be the one listed above. I want you to think about what you and the other person looked like and what you and the other person were wearing. Once you have a really good picture in your head, I want you to tell me everything you can remember about yourself and the other person. Again, try to be as specific and detailed as you can.

General probing about the people

- Tell me more about... (details mentioned)
- Tell me more about your/the other person's outfit.
- Tell me more about your/the other person's face.

- What color hair did you/the other person have?

Mental imagery about the actions

Now I want you to close your eyes one last time and get another picture in your head, this time about the actions that happened in your memory. I want you to think about what you and the other person were actually doing and how you did these things. Once you have a really good picture in your head, I want you to tell me everything you can remember about these actions starting with the first one and ending with the last one. Try to be as specific and detailed as you can.

General probing about the actions

- Tell me more about... (action mentioned)

Follow-up and repeat for actions

[only do this if participant doesn't give sequence of actions first time around]

- What happened after that? What was the next thing? What was the last thing?

Appendix A (continued): Imagination Specificity Induction script

Introduction

Now we are going to do an imagination exercise. I want you to think about a new event that could happen to you within the next few years that incorporates the setting of (xx), the person of (xx), and the object of (xx). (*Recombination of setting, person, and object from three different memories*) I don't know anything about this setting, person, and object, so you're the expert on that. First you'll tell me about the setting and objects, then about yourself and the other person there, and then about the actions you're both doing.

Mental imagery about the surroundings

First I want you to close your eyes and get a picture in your head about the setting in your imagination. I want you to think about what types of objects are in the environment and how they are arranged and what they look like. Try to imagine something new about the environment- Is it nighttime instead of daytime? Is it fall instead of spring? What's different about it? Once you have a really good picture in your head, I want you to tell me everything you can imagine about the setting and the objects in it. One of the objects should be the one mentioned above. Try to be as specific and detailed as you can.

General probing about the surroundings

- Tell me more about... (details mentioned).
- Tell me more about how (the setting) is arranged.
- Tell me more about what is in (the setting).

Mental imagery about the people

Now I want you to close your eyes again and get another picture in your head, this time about yourself and the other person in your imagination. This person should be the one listed above. I want you to think about what you and the other person look like and what you and the other person are wearing. Try to imagine something new about yourself and the other person- is there a new haircut or outfit involved? Does anyone look older? What's different about you and the other person? Once you have a really good picture in your head, I want you to tell me everything you can imagine about yourself and the other person. Again, try to be as specific and detailed as you can.

General probing about the people

- Tell me more about... (details mentioned)
- Tell me more about your/the other person's outfit.
- Tell me more about your/the other person's face.
- What color hair do you/the other person have?

Mental imagery about the actions

Now I want you to close your eyes one last time and get another picture in your head, this time about the actions happening in your imagination. I want you to think about what you and the other person are actually doing and how you're doing these things. Once you have a really good picture in your head, I want you to tell me everything you can imagine about these actions starting with the first one and ending with the last one. Try to be as specific and detailed as you can.

General probing about the actions

- Tell me more about... (action mentioned)

Follow-up and repeat for actions

[only do this if participant doesn't give sequence of actions first time around]

- What is happening after that? What is the next thing? What is the last thing that will happen?

Appendix B: Adapted Autobiographical Interview (AI) instructions

Memory

In this part of the experiment you are going to see 4 different pictures. For each picture you will be asked to remember a RECENT event that happened to you within the past few years that the picture reminds you of. You should think about one event that happened in one place. The event should be one that lasted a few minutes to a few hours. You should think about the event through your own eyes and not as an outside observer.

For example, if you remember going on a vacation, try to think about one event that happened on one day of the vacation rather than the vacation as a whole.

Try to write out everything you remember about the event, what you did, who you were with, and what you were feeling. You will have 3 minutes to write out as much detail as you can for each event. Do you have any questions? You will start now.

Imagination

In this part of the experiment you are going to see 4 different pictures. For each picture you will be asked to imagine an event within the next FEW years that could happen to you that incorporates the general setting of the picture. You should imagine an event that hasn't happened yet. It should be one event that occurs in one place. It should also last a few minutes to a few hours. You should think about the event through your own eyes and not as an outside observer.

For example, if you imagine going on a vacation, try to think about one event that will happen to you on one day of the vacation rather than the vacation as a whole.

Try to write out everything you imagine about the event, what you will be doing, who you will be with, and what you might be feeling. You will have 3 minutes to write out as much detail as you can for each event. Do you have any questions? You will start now.

Picture Description

In this part of the experiment you are going to see 4 different pictures. For each picture you will be asked to describe what you see in the picture. Try to describe the people, objects, and environment in the picture as they are. You should describe the picture as if you were writing to someone who can't see it.

Try to write out everything you see in the picture in as much detail as you can. You will have 3 minutes to describe each picture. Do you have any questions? You will start now.

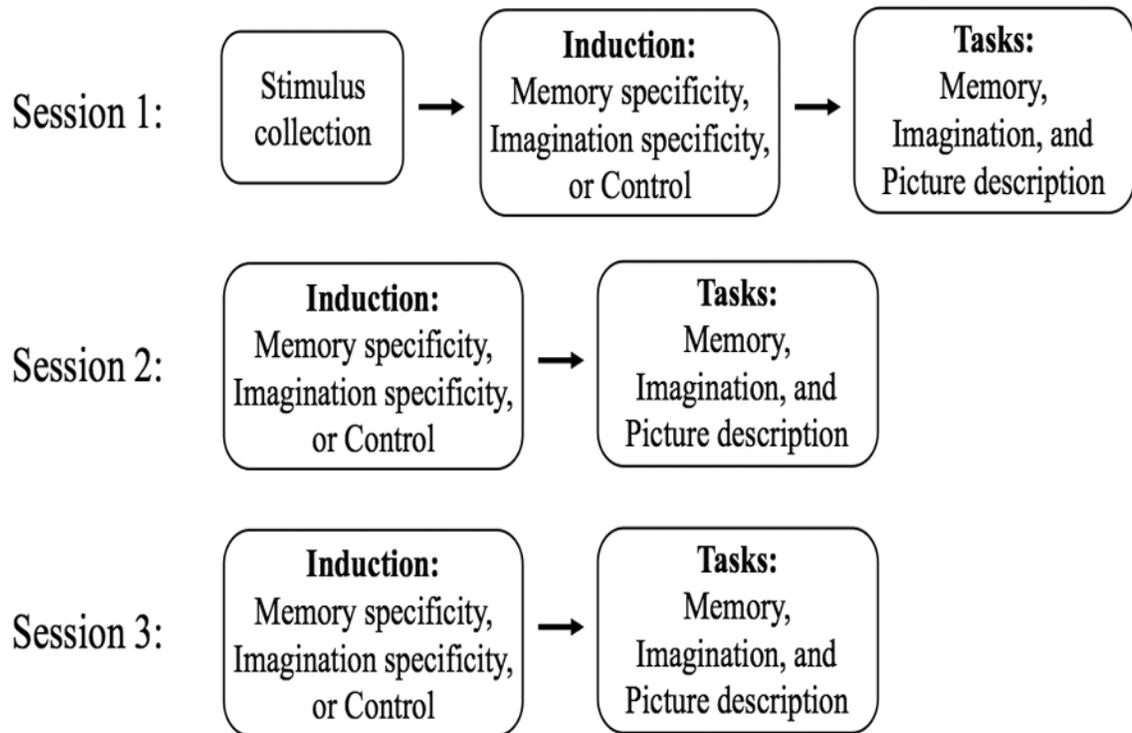
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Order of inductions was counterbalanced between participants. *Order of tasks* was blocked and randomized.
Task scoring: Internal and external details.

Figure 1.
 Schema of experimental design.

Table 1

Autobiographical Interview metrics	Control induction	Memory specificity induction	Imagination specificity induction
Internal details			
Memory task	30.59 (12.78)	35.10 (13.01)	35.82 (12.49)
Imagination task	30.19 (12.75)	33.57 (14.19)	35.47 (11.75)
Picture Description task	34.60 (13.50)	35.20 (12.83)	33.75 (11.86)
External details			
Memory task	5.90 (7.06)	1.84 (3.43)	3.52 (5.73)
Imagination task	6.05 (6.15)	2.25 (4.61)	2.32 (3.07)
Picture Description task	2.09 (2.43)	2.90 (2.99)	1.86 (1.71)

Note. Descriptive statistics for internal and external details on memory, imagination, and picture description tasks as a function of induction. Numeric values are presented as mean per trial (with standard deviation in parentheses).

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