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I Can See Myself Enjoying That: Using Imagery Perspective to Circumvent Bias in Self-Perceptions of Interest

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People experience life satisfaction when pursuing activities that genuinely interest them. Unfortunately, cultural stereotypes (e.g., "science is not for girls") and preexisting self-beliefs can bias people's memories, thereby hindering their ability to identify the domains that they actually experience as interesting. The current experiments tested a novel method for circumventing this problem by manipulating visual imagery perspective as people recalled their experiences. Four experiments measured (or manipulated) participants' actual experience of interest as they completed a task; the experiments also measured (or manipulated) participants' self-beliefs about their interest in the domain. The experiments then manipulated imagery perspective as participants recalled their interest in the task. Prior research suggests that imagery from an actor's first-person perspective facilitates a bottom-up processing style, whereas imagery from an external third-person facilitates a top-down processing style (Libby & Eibach, 2011). Consistent with this account, across all 4 experiments, first-person imagery (vs. third-person) caused people's recall to be less biased by the top-down influence of their self-beliefs and better aligned with their past experienced interest. The final experiment demonstrated downstream consequences of these effects on female undergraduates' intentions to pursue future activities in a domain (STEM) that negative stereotypes typically might dissuade them from pursuing. Thus, the present results suggest that first-person imagery can be a useful tool to reduce the influence of biased self-beliefs, while increasing sensitivity to past bottom-up experiences during recall. Further, these results hold practical implications for reducing psychological barriers that can keep underrepresented individuals from pursuing interests in counterstereotypical domains.

Keywords: imagery perspective, interest, self-beliefs, memory

"Choose a job you love, and you will never have to work a day in your life." This oft-repeated saying appears to be sound advice: people who are interested (vs. disinterested) in their jobs tend to be happier, miss work less often, and are more productive (Peterson, 2006). More generally, people experience life satisfaction when they pursue activities that they find genuinely interesting (e.g., Palys & Little, 1983; Peterson, Park, & Seligman, 2005; Ryan & Deci, 2000). But how do people identify the domains that genuinely interest them in the first place?

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Ideally, people would use their past experiences of feeling interested in relevant activities in order to learn which domains interest them (Silvia, 2006). For instance, a student who recognizes that she found her science class interesting would be likely to expect that future similar activities will also evoke feelings of interest (e.g., Weiner, 1986), thereby motivating her to pursue other science-related activities (e.g., Duval & Silvia, 2001; Heider, 1958). If the student also feels interested while pursuing these activities, she would use her experiences to develop a belief that she has a personal interest in the subject (see Hidi & Renninger, 2010).

However, although this process may seem relatively straightforward, a variety of factors can interfere. The current research focuses on one such factor that has the potential to set the process off course early on, by interfering with people's ability to accurately recall whether an activity interested them. In particular, people often rely on their preexisting beliefs to reconstruct their memories in a top-down manner, which can create problematic biases in recall (Ehrlinger & Dunning, 2003; McFarland, Ross, & DeCourville, 1989; Robinson & Clore, 2002; Wilson & Ross, 2003). For instance, if the student learned the stereotype that "science is not for girls," this belief may distort her memory and lead her to recall being uninterested in the science class. As a consequence, she may then feel less motivated to pursue future science-related activities, and ultimately, fail to realize her interest in the subject.

Thus, accurately recalling whether an activity felt interesting (or not) is an important early step in the process of determining which domains one finds personally interesting. And, preexisting beliefs can present an obstacle to developing personal interests by thwarting people's ability to accurately recall whether an activity interested them. The current research sought to address this issue by using visual imagery as a tool for shifting processing style during recall to limit the bias of self-beliefs and align recollections with past experienced interest.

Top-Down and Bottom-Up Influences on Recall

People develop elaborate self-concepts encompassing their propositional beliefs about their traits, preferences, personal interests, and more (see Markus, 1977). In general, these self-beliefs are a functional tool that people can use to inform their judgments, expectations, behaviors, and recollections (Swann & Buhrmester, 2012). For example, self-beliefs about one's interests can functionally guide people to pursue activities they find enjoyable (Silvia, 2006). However, people's self-beliefs are not necessarily accurate (Swann & Buhrmester, 2012; Wilson & Dunn, 2004). For instance, people might misattribute the source of their feelings when forming their self-beliefs (e.g., a student might think she dislikes science because the material is boring, when in reality, her dry professor is the source of her disengagement; Silvia, 2006). The motivation to maintain a consistent view of the self can also lead to inaccuracy as people fail to update their self-beliefs over time (e.g., a student may think she dislikes science because she formed negative self-beliefs in the domain when she was younger, even if the subject engages her more now that she is older; Christensen, Wood, & Barrett, 2003; Swann, 2011). Further, people sometimes develop self-beliefs based on cultural stereotypes rather than direct experience (e.g., a student may think she dislikes science simply because she grew up in a culture that told her "science is for boys"; Aronson & Steele, 2005; Baron, Schmader, Cvencek, & Meltzoff, 2014; Chatard, Guimond, & Selimbegovic, 2007).

As such, although people's self-beliefs can be functional, they can also be a source of bias. Indeed, people's self-beliefs can shape their experiences with a task as they are completing it (Critcher & Dunning, 2009). Previous work has addressed this issue by manipulating a variety of factors during task completion, including taking steps to make people's self-beliefs less salient (Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995), making the task itself more stimulating and engaging (Berlyne, 1960; Durik & Harackiewicz, 2007), and creating a positive incidental experience of feeling like one belongs in the domain (Walton & Cohen, 2011).

However, even when self-beliefs do not bias people's experiences in real time, they can still bias people's later recall of those experiences. When people recall past experiences, they can focus on concrete features of the past situation to reconstruct their experience in a bottom-up manner, but they can also draw on relevant self-beliefs and schemas to reconstruct their experience in a top-down manner (Bartlett, 1932; Robinson & Clore, 2002; Ross, 1989). That is, both bottom-up and top-down processes can play a role in determining people's memories. And, although these processes are not mutually exclusive, they are qualitatively distinct (e.g., Gawronski & Bodenhausen, 2007; Olson & Fazio, 2008; Rydell & McConnell, 2006). Further, in cases where people's self-beliefs are inconsistent with their actual experiences, people's memories of their past experiences should be more biased and less accurate to the extent that they use these beliefs to structure their memory in a top-down fashion, as opposed to using the concrete details of the specific situation to guide their memory in a bottom-up fashion.

Indeed, in many cases where people's self-beliefs are not accurate, their memories tend to be biased by their self-beliefs rather than reflect their past experience. For instance, people use gender stereotypes to recall their past emotions, even when there were no gender differences in people's actual past emotions (Robinson, Johnson, & Shields, 1998; Van Boven & Robinson, 2012). Similar biasing effects of self-beliefs also emerge in people's reports of their past likes and dislikes (Markus & Kunda, 1986; Ross & Buehler, 1994), traits and skills (Conway & Ross, 1984; McFarland & Ross, 1987), performance (Chatard et al., 2007; Ehrlinger & Dunning, 2003), and more (Robinson & Clore, 2002; Ross, 1989; Wilson & Ross, 2003). As such, this evidence suggests that if people reconstruct their past experiences of interest in a top-down fashion, their memories may be biased by their self-beliefs, even if their past experience was not.

Thus, when people's self-beliefs are at odds with their actual experience, reducing reliance on top-down processes should reduce bias in their recall. Further, increasing reliance on bottom-up processes may increase accuracy by making people more sensitive to the concrete details of the situation that influenced their past experience. The present research tested these predictions by manipulating a feature of visual imagery to vary people's processing style while recalling experiences of interest. The goal was to leverage imagery as a tool to limit people's reliance on self-beliefs and facilitate sensitivity to the concrete features of the situation that drove their past experience of interest.

Visual Imagery Perspective

When recalling events in their lives, people can use visual imagery to reconstruct and reexperience the event in their "mind's eye" (Rice & Rubin, 2009; Schacter, Addis, & Buckner, 2007). And, visual images of past events involving the self can be constructed from either one's own first-person visual perspective, or an external third-person visual perspective (Nigro & Neisser, 1983). The vast majority of people report that they spontaneously experience each perspective and are able to deliberately vary which perspective they use (Rice & Rubin, 2009). Further, as is the case with other features of mental imagery (Moulton & Kosslyn, 2011), visual perspective serves a cognitive function, shaping how people understand events.

One way that visual imagery perspective serves this function is by directing cognitive processing style. Specifically, third-person imagery facilitates a top-down processing style in which people understand an event by coherently integrating it with their belief systems. As such, picturing life events from the third-person (vs. first-person) perspective causes people's interpretation of an event to more closely correspond with their abstract self-beliefs about their traits, values, preferences, and developmental trajectories (Libby & Eibach, 2011; Libby, Valenti, Hines, & Eibach, 2014;

Marigold, Eibach, Libby, Ross, & Holmes, 2015; Niese, Libby, Fazio, Eibach, & Pietri, 2018). In contrast, first-person imagery facilitates a bottom-up processing style in which people's understanding of an event emerges by reconstructing their reactions to the concrete features of the pictured scene, unconstrained by the structure of abstract belief-systems. Accordingly, picturing life events from the first-person (vs. third-person) perspective causes people's interpretation of an event to more closely correspond with their associative evaluations of objects in the scene (Libby et al., 2014) and with chronic biases in the processes underlying their experiential reactions (Niese et al., 2018).

Converging evidence that these effects reflect a shift in processing style comes from experiments demonstrating that the effects of imagery perspective carry over to influence people's processing of subsequent unrelated information (Libby, Shaeffer, & Eibach, 2009; Shaeffer, Libby, & Eibach, 2015). For example, viewing a series of photographs that depict actions from the third-person (vs. first-person) perspective causes people subsequently to evaluate unrelated events more in line with their self-beliefs and less in line with chronic biases in their experiential processes (Niese et al., 2018). Such carryover effects provide evidence that imagery perspective initiates a general processing mode, rather than merely influencing the salience of information particular to stimuli in the initial task (e.g., Fujita, Trope, Liberman, & Levin-Sagi, 2006). Thus, a critical mechanism by which perspective changes the meaning of events is by changing the processing style people use to understand and interpret them.

The present research tests the implications of this perspective-induced processing style effect for people's ability to recall past experiences of interest that may not have been biased by self-beliefs at the time, but have the potential to be contaminated at recall. We investigate if, by changing the processing style people use to reconstruct their memory, imagery perspective can cause people's recollections to be less biased by their self-beliefs and align more closely with their actual past experience of interest. Specifically, unlike the top-down processing style evoked by third-person imagery in which people reconstruct their memory in relation to their self-beliefs, the processing style evoked by first-person imagery (vs. third-person) should cause people's recollections to be less biased by their self-beliefs. Additionally, because the processing style evoked by first-person imagery causes people to reconstruct their memory based on their reactions to concrete features of the event, first-person (vs. third-person) imagery should cause people's recollections of interest in an activity to better align with their actual past experience of feeling interested (or uninterested).

The Present Research

In the present experiments, participants completed an activity and later recalled their interest in the activity. The experimental procedure was designed to mirror situations in which people's self-beliefs are relatively unlikely to influence their immediate experience during an activity but still have the potential to bias their recollections of those experiences. The experiments measured (or manipulated) people's experienced interest as they completed an activity and also separately measured (or manipulated at the time of recall) people's self-beliefs about their interest in the domain. Then, the experiments manipulated imagery perspective while participants recalled their interest in the activity. Because the two imagery perspectives facilitate different processing styles, we expected that first-person imagery (vs. third-person) would cause people's memories to be less biased by their self-beliefs and more closely aligned with their actual past experience of feeling interested (or uninterested) in an activity.

On a theoretical level, this research sheds light on the recollection process by clarifying the processing style through which self-beliefs bias memories while also demonstrating a way to circumvent this bias by aligning people's recall with their reactions to the concrete features of the past situation that drove their experience of interest. This research also provides convergent evidence for the cognitive functions of the processing styles evoked by mental imagery. On a practical level, this research offers insights to how we might help people accurately recall activities that they felt interested in—an important early step to identifying domains and subjects that genuinely interest them. Further, these implications may be particularly crucial when cultural stereotypes bias people's self-beliefs (e.g., women in STEM), thereby discouraging them from pursuing domains that they may genuinely find interesting and in which they have the potential to make meaningful contributions.

Experiment 1

Experiment 1 tested the hypothesis that using the first-person (vs. third-person) perspective to recall doing a task can cause people's memories of interest in that task to be less biased by the top-down influence of their self-beliefs and better align with their actual past experience. As part of a mass prescreening, participants completed a measure of self-beliefs in which they self-reported their interest in logical reasoning activities. Then, during Part 1 of Experiment 1, participants completed 10 "thought puzzles" that consisted of a set of 10 logical reasoning questions. In order to reduce the likelihood that participants' self-beliefs about logical reasoning would influence their immediate experience (e.g., Critcher & Dunning, 2009), the procedure refrained from referring to the puzzles as a logical reasoning activity at this point. We indexed participants' experience of interest using two different implicit measures, one indexing participants' affective state after completing the first set of puzzles and the other indexing the amount of time they freely chose to spend working on additional, optional puzzles.

Two days later, we informed participants that the thought puzzles were a logical reasoning activity. We then manipulated the imagery perspective participants used to recall how interesting that task was. We predicted that first-person (vs. third-person) imagery would cause participants' memories to be less biased by the top-down influence of their self-beliefs about their interest in logical reasoning (as indexed by their self-reported interest in that domain). We also predicted that first-person (vs. third-person) imagery would cause participants' memories of their interest in the logical reasoning task to align better with their past experience of interest (as indexed by the implicit measures of experienced interest while completing the task).

Method

Participants. We posted experiment sessions on an online sign-up tool with the goal of obtaining about 50 participants per perspective condition.[1] Using this recruitment method, 115 undergraduates participated in Experiment 1 for course credit. The study required participants to complete a task online during Part 1 and then recall their experience during Part 2 in the lab. Thus, in order to test our hypothesis, it was necessary that participants complete Part 1 before attending the lab session. Eleven participants failed to do so and were therefore excluded, leaving data from 104 participants for analysis (61 female, 43 male; 52 first-person). Ethical approval for this experiment and all other experiments in this article was obtained from the Institutional Review Board at The Ohio State University.

Prescreening survey: Measuring self-beliefs about interest in logical reasoning. As part of a mass prescreening, participants self-reported their interest in logical reasoning activities by answering the following four questions on a fully labeled 7-point scale ranging from 1 = *very false* to 7 = *very true*: "Logical reasoning activities are enjoyable to me," "Compared with other things, logical reasoning activities are exciting to me," "I am more interested in logical reasoning activities than other people," and "I have a personal interest in logical reasoning activities." Participants' responses to the four items ($\alpha = .90$) were averaged to index self-beliefs about their interest in logical reasoning activities ($M = 4.44$, $SD = 1.16$).

Session 1: Measuring experienced interest while completing a logical reasoning activity.

Logical reasoning activity. We e-mailed participants a link to complete Part 1 of the experiment online 2 days before their scheduled lab session. The instructions informed participants that they would first complete a set of thought puzzles. The puzzles consisted of an adapted set of 10 LSAT questions that required participants to answer questions based on a set of rules and conditions in each problem (Ehrlinger & Dunning, 2003; Orton, 1993). The questions were labeled as thought puzzles (with no direct mention of logical reasoning) to reduce the likelihood that participants' self-beliefs about their interest in logical reasoning activities would influence their immediate experience of interest (e.g., Critcher & Dunning, 2009). Participants were given 1 min and 15 s per question.

Indexing participants' experienced interest.

Implicit affective measure of interest. After completing the 10 puzzles, participants completed the Implicit Positive and Negative Affect Test (IPANAT; Quirin, Kazén, & Kuhl, 2009). The IPANAT informed participants that they would be evaluating words from a novel language that are intended to express various moods. Participants were asked to read six different novel words and, for each one, use their intuition about how well each word conveys a variety of positive and negative feelings. Thus, this procedure encouraged participants to misattribute their current feelings to the novel words, thereby allowing the IPANAT to implicitly measure their affective experience in the moment.

Participants used a fully labeled 4-point scale ranging from 1 = *doesn't fit at all* to 4 = *fits very well* to indicate how well each novel word (e.g., SAFME) expressed three negative feelings (helpless, tense, inhibited) and three positive feelings (happy, energetic, cheerful). We also adapted the measure to include two positive feeling words directly related to interest (interested, curious). Participants' responses to the five positive feelings ($\alpha = .81$) were averaged in order to implicitly measure their positive affect in the moment ($M = 2.08$, $SD = 0.36$). Thus, this measure indexes the extent to which participants experienced positive affect as they completed the logical reasoning activity.

Implicit behavioral measure of interest. After participants completed the logical reasoning activity and the affective measure of interest, we informed them that they had an opportunity to work on more thought puzzles like the ones they had just completed. Specifically, we told participants that we were testing out questions for future studies and would appreciate if they would work on a few additional puzzles "*until you are tired of it*." The additional puzzles followed the same format as the previous ones, but they were self-timed and allowed participants to stop at any point. Participants were shown the first additional puzzle and could continue completing additional puzzles until they checked a box indicating they were finished and wanted to advance to the end of Part 1 of the study. We measured the time interval from when participants were presented with the first additional puzzle until the point they indicated that they wished to stop ($M = 223.55$ s, $SD = 255.04$). We log transformed time spent on the additional puzzles because of the strong positive skew in the raw time data (Howell, 2012; Manikandan, 2010). We used this behavioral measure of the amount of (log-transformed) time participants freely chose to spend working on the additional puzzles to index their experienced interest. That is, the more interested in the activity participants were, the more time they should have spent working on the additional puzzles when they were free to stop at any point (e.g., Renninger, 1990).

Combined index. We z-scored participants' responses on the two implicit measures of experienced interest, $r(104) = -0.11$, $p = .28$,[2] and averaged them to create a composite index of participants' experience of interest in the task ($SD = 0.67$).

Session 2: Manipulating imagery perspective while recalling interest in the logical reasoning activity.

Imagery perspective manipulation. Upon entering the lab 2 days later for the second session, participants were informed that the task they had completed online in Part 1 was a logical reasoning activity. Then, instructions directed participants to recall themselves completing the logical reasoning puzzles in the first session of the study. Critically, participants were randomly assigned to receive one of two versions of these instructions, which differed only in the imagery perspective the instructions specified. The instructions directed participants in the first-person condition to "*Imagine the scene from your own visual perspective, in other words, you are looking out at your surroundings through your own eyes*" and directed participants in the third-person condition to "*Imagine the scene from an observer's visual perspective, in other*

[1] We aimed to collect about 50 participants per perspective condition because this number is consistent with the sample sizes of other similar experiments investigating imagery perspective's moderating role on implicitly- versus explicitly-measured constructs (e.g., Libby et al., 2014).

[2] It is worth noting that the two implicit measures of experienced interest that we combined to form a composite index of participants' experienced interest did not correlate with one another either, which may suggest that the two measures tapped into different facets of participants' immediate experience. Although we used the combined index for the primary analyses, see Footnote 6 for analyses using each implicit measure separately.

words, you can see yourself in the image, as well as your surroundings." Participants used a fully labeled 7-point scale from −3 = *very difficult* to 3 = *very easy* (M = 1.55, SD = 1.39) to rate how easy it was to form their mental image, as well as a fully labeled 5-point scale from 0 = *no image at all* to 4 = *perfectly clear and as vivid as normal vision* (M = 2.98, SD = 0.80) to rate how vivid their mental image was.[3]

Recalled interest. While holding the image in their mind from the specified perspective, participants recalled their interest in the logical reasoning activity by answering: "*How interesting did you find the puzzles to be?*"; "*How engaging did you find the puzzles to be?*"; and "*How enjoyable did you find the puzzles to be?*" on fully labeled 7-point scales ranging from 1 = *very uninteresting/unengaging/unenjoyable* to 7 = *very interesting/engaging/enjoyable*. Participants' responses to the three items (α = .73) were averaged to index their recalled interest in the task (M = 4.55, SD = 1.26).[4]

Results

We predicted that first-person (vs. third-person) imagery would cause participants' recollections to be less biased[5] by the top-down influence of their self-beliefs about their interest in logical reasoning. Additionally, we predicted that first-person (vs. third-person) imagery would cause participants' recollections of their interest in the logical reasoning task to better align with their past experienced interest. To test these predictions, we used a single linear regression model to predict participants' recollections of interest in the logical reasoning activity from their self-beliefs about their interest in logical reasoning (as indexed by the self-report measure, sample-mean-centered) and their experience of interest while completing it (as indexed by the composite of the implicit measures assessing participants' experienced interest), as well as imagery perspective (−1 = first-person, 1 = third-person) and its interactions with each of the other two variables. See Table 1 for the regression statistics.

As hypothesized, imagery perspective determined whether participants' recollections aligned with their self-beliefs about their interest in logical reasoning activities ($b = 0.31$, $\beta = 0.29$, $t(98) = 3.12$, $p < .01$). Recollections of interest significantly corresponded with self-beliefs when participants used the third-person perspective ($b = 0.45$, $\beta = 0.41$, $t(98) = 3.46$, $p < .01$), but not the first-person perspective ($b = -0.18$, $\beta = -0.17$, $t(98) = 1.17$, $p = .24$).

Table 1
Statistics From a Single Linear-Regression in Experiment 1 Predicting Recalled Interest From the Composite of Participants' Experienced Interest and Self-Beliefs About Interest in the Domain (Sample-Mean Centered), as Well as Imagery Perspective (−1 = First-Person, 1 = Third-Person) and Its Interaction With Each of the Other Two Measures

Predictor	b	β	$t(98)$	p
Perspective	.08	.06	.71	.48
Experienced Interest	.29	.15	1.70	.09
Perspective × Experienced Interest	−.55	−.29	3.24	<.01
Self-Beliefs	.13	.12	1.33	.19
Perspective × Self-Beliefs	.31	.29	3.12	<.01

Additionally, as hypothesized, imagery perspective had the opposite effect in determining whether participants' recollections aligned with their experience of interest in the task ($b = -0.55$, $\beta = -0.29$, $t(98) = 3.24$, $p < .01$). Participants' recollections significantly corresponded with their experienced interest with first-person imagery ($b = 0.85$, $\beta = 0.45$, $t(98) = 3.48$, $p < .01$), but not third-person imagery ($b = -0.26$, $\beta = -0.14$, $t(98) = 1.10$, $p = .28$; see Figure 1).[6,7]

Discussion

Imagery perspective shifted the basis for people's recollections of their interest in a task. Specifically, people's recollections aligned with their self-beliefs about their interest in logical reasoning with third-person imagery, but not first-person. In contrast, people's recollections aligned with their past experience of interest with first-person imagery, but not third-person. Thus, Experiment 1 provides initial evidence consistent with the possibility that first-person imagery (vs. third-person) can be used to evoke a processing style that reduces the bias of people's self-beliefs on their recall, while also better aligning people's recall with their past experience of interest. Experiment 1 did so by relying on measures of people's preexisting self-beliefs and experienced interest. To extend these findings, we sought to replicate the results while manipulating self-beliefs (in Experiment 2) and manipulating experienced interest (in Experiments 3 and 4) to demonstrate their causal roles in shaping people's recollections with third-person and first-person imagery, respectively.

Experiment 2

Experiment 2 sought to replicate the conceptual pattern of results from Experiment 1 while manipulating, rather than simply measuring, participants' self-beliefs about their interest in logical reasoning activities. Participants completed the same logical reasoning activity (again described as a set of "thought puzzles") as in

[3] There was no significant effect of perspective on imagery ease ($t(102) = 0.77$, $p = .44$) or vividness ($t(102) = 0.73$, $p = .47$).

[4] Finally, for exploratory purposes, participants answered questions about how well they believed they performed on the logical reasoning activity by answering: "Thinking back to the logical reasoning puzzles, how difficult did you feel they were?" (1 = *very difficult* to 7 = *very easy*; M = 3.30, SD = 1.32); "Relative to other participants taking the test, how well do you believe you performed?" (1 = *well below average* to 7 = *well above average;* M = 3.88, SD = 1.36); and "Of the 10 questions on the test, how many do you believe you got correct?" (M = 5.74, SD = 1.75).

[5] Participants' self-beliefs about their interest in logical reasoning activities did not correlate with the implicit measures of participants' experience of interest in the task—implicit affective measure (IPANAT): $r(104) = 0.07$, $p = .47$; implicit behavioral measure (log time): $r(104) = 0.03$, $p = .77$; combined: $r(104) = 0.08$, $p = .45$.

[6] The pattern of findings is consistent if either the implicit affective measure (perspective interaction p-value = 0.06) or the implicit behavioral measure (perspective interaction p-value = 0.03) is used individually rather than together as a composite.

[7] We also used the same single linear regression model to predict participants' recollections of how difficult they found the logical reasoning activity to be. To do so, we created a composite from the z-scores of the three exploratory difficulty questions (α = 0.82) to use as the dependent measure. Neither the perspective by self-beliefs interaction nor the perspective by immediate experience of interest interaction was significant ($ps > 0.50$).

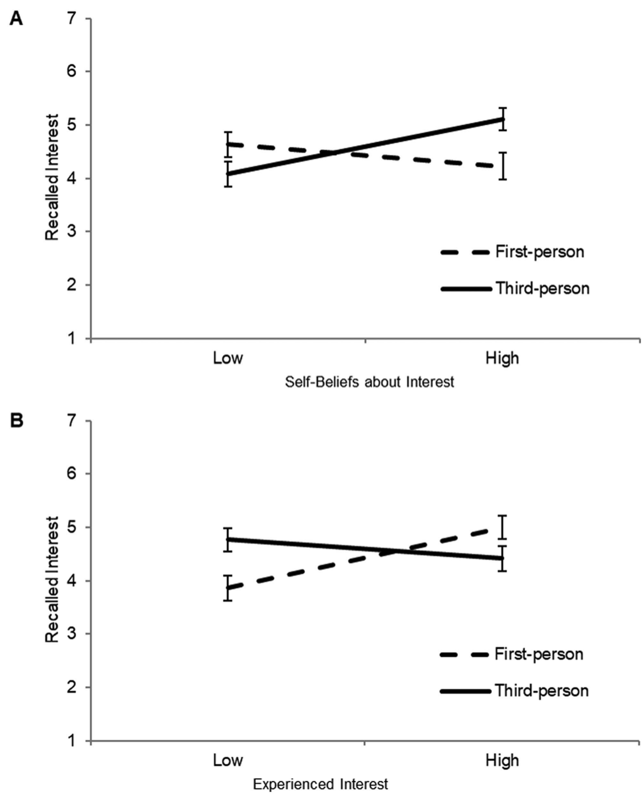

Figure 1. Recalled interest in a logical reasoning task in Experiment 1, depending on imagery perspective and self-beliefs about interest in the domain (Panel A) and imagery perspective and the composite measure of experienced interest (Panel B). Values are plotted within each perspective condition at one standard deviation above and below sample means of the self-beliefs measure and the experienced interest measure, with standard error bars. Both interaction effects come from a single model predicting recalled interest from self-beliefs and experienced interest, as well as imagery perspective and its interaction with each of the other two measures.

Experiment 1. Then, we indexed participants' experienced interest using the implicit behavioral measure from Experiment 1, in which we measured the time they freely chose to work on additional, optional puzzles. Two days later, participants read one of two versions of an article that motivated them to believe that they were the type of person who likes (or who dislikes) logical reasoning activities (see Kunda, 1990). Then, we informed participants that the thought puzzles in the first session were a logical reasoning activity before we manipulated the imagery perspective participants used to recall completing the puzzles and report how interesting the puzzles were. We predicted that first-person imagery (vs. third-person) would cause participants' recollections to be less biased by their manipulated self-beliefs and better align with their past experience of interest.

Method

Participants. Experiment 2 used the same recruitment strategy as Experiment 1, and 125 undergraduates participated in the study for course credit. As in Experiment 1, Experiment 2 required participants to complete a task in Part 1 online before recalling it during the lab session. Again, in order to test our hypothesis, it was necessary that participants completed Part 1 online before attending the lab session. Twenty-one participants failed to do so and were therefore excluded, leaving data from 103 participants for analysis (74 female, 29 male; 25 first-person and interest-valuable article, 25 first-person and disinterest-valuable article, 28 third-person and interest-valuable article, 25 third-person and disinterest valuable).

Session 1: Measuring experienced interest while completing a logical reasoning activity. We used the same logical reasoning activity and implicit behavioral measure of participants' experienced interest as in Experiment 1: Participants first completed 10 "thought puzzles" and then had the opportunity to complete additional puzzles until they were tired of the task. Participants were shown the first additional puzzle and could continue completing the additional puzzles until they checked a box indicating they were finished and wanted to advance to the end of Part 1 of the study. We measured the time interval from when participants were presented with the first additional puzzle until the point they indicated that they wished to stop (M = 218.51 s, SD = 240.00). As in Experiment 1, we log-transformed time spent on the additional puzzles because of the strong positive skew in the raw time data (Howell, 2012; Manikandan, 2010), and used this behavioral measure of the amount of (log-transformed) time participants freely chose to spend working on the additional puzzles to serve as our index of their experienced interest (e.g., Renninger, 1990).

Session 2: Manipulating self-beliefs and imagery perspective while recalling interest in the logical reasoning activity.

Self-beliefs manipulation. Upon entering the lab 2 days later for the second session, participants sat at individual computer cubicles to complete a questionnaire on the computer. Instructions explained that participants would first read a background article about recent research that found college students' interest in logical reasoning activities was linked to a variety of life outcomes. Participants were randomly assigned to read an article claiming either that liking or disliking logical reasoning activities was valuable because it is associated with a variety of positive outcomes such as making more friends, earning a higher GPA, and being more likely to land a job after college. Thus, the manipulation was designed to motivate participants to view themselves as the type of person who either likes or dislikes logical reasoning activities (see Kunda, 1990).[8]

Imagery perspective manipulation. After participants read the article, the procedure and materials for the second session were identical to those in Experiment 1. Participants were informed that the task they had completed during the online portion was a logical

[8] To validate that this manipulation influences self-beliefs, a separate set of 121 undergraduates were randomly assigned to read either the article claiming that liking or disliking logical reasoning activities is associated with positive outcomes before reporting their interest in logical reasoning activities (using the same 7-point, self-report questions from the Experiment 1 presurvey). An independent-samples t-test revealed that the articles significantly impacted participants' self-beliefs about their interest in logical reasoning activities, $t(119) = 3.41$, $p < .01$. Participants who read that it was valuable to be interested in logical reasoning activities reported more interest in them ($M = 4.62$, $SD = 1.18$) than did participants who read that it was valuable to be disinterested in logical reasoning activities ($M = 3.80$, $SD = 1.44$).

reasoning activity and were then randomly assigned a set of instructions that directed them either to use the first-person or third-person imagery perspective to recall themselves completing the logical reasoning activity. Again, participants used a fully labeled 7-point scale from −3 = *very difficult* to 3 = *very easy* ($M = 1.58$, $SD = 1.47$) to rate how easy it was to form the mental image, as well as a fully labeled 5-point scale from 0 = *no image at all* to 4 = *perfectly clear and as vivid as normal vision* ($M = 3.09$, $SD = 0.64$) to rate how vivid their mental image was.[9]

Recalled interest. Participants received the same three questions as in Experiment 1 about how interesting the logical reasoning task was, and they answered using the same fully-labeled 7-point scales. Participants' responses to the three items ($\alpha = .82$) were averaged to index their recalled interest in the task ($M = 3.96$, $SD = 1.50$).[10]

Results

We expected to replicate the patterns from Experiment 1. Specifically, we predicted that first-person (vs. third-person) imagery would cause participants' memories of their interest in the logical-reasoning task to be less biased by their manipulated self-beliefs that they are interested or disinterested in logical reasoning activities and align better with their past experience of interest. To test these predictions, we used a single linear-regression model to predict participants' recollections of interest from the article they read (−1 = disinterest-valuable, 1 = interest-valuable), their experienced interest while completing the logical reasoning activity (as indexed by time spent on the additional puzzles, log-transformed, sample-mean-centered), as well as imagery perspective (−1 = first-person, 1 = third person) and its interaction with each of the other two variables. See Table 2 for the regression statistics.

Critically, as hypothesized, imagery perspective determined whether recollections of interest in the task were biased by the self-beliefs manipulation ($b = 0.30$, $\beta = 0.20$, $t(97) = 2.26$, $p = .03$). The self-beliefs manipulation biased recollections with third-person imagery ($b = 0.55$, $\beta = 0.37$, $t(98) = 2.95$, $p < .01$), but not with first-person imagery ($b = -0.05$, $\beta = -0.03$, $t(98) = 0.27$, $p = .79$).[11]

Additionally, imagery perspective appeared to have the opposite effect in determining how well participants' recollections of interest in the task aligned with their experienced interest, although the interaction did not quite reach conventional standards of significance ($b = -0.39$, $\beta = -0.16$, $t(97) = 1.81$, $p = .07$). The results were directionally consistent with Experiment 1, such that recollections of interest appeared to correspond with participants' past experience of interest more with first-person imagery ($b = 1.35$, $\beta = 0.56$, $t(98) = 4.22$, $p < .001$) than third-person imagery ($b = 0.57$, $\beta = 0.24$, $t(98) = 1.97$, $p = .05$; see Figure 2).

Table 2

Statistics From a Single Linear-Regression in Experiment 2 Predicting Recalled Interest From the Participants' Experienced Interest (Log-Transformed, Sample-Mean Centered) and the Self-Manipulation (−1 = Disinterest Valuable, 1 = Interest Valuable), as Well as Imagery Perspective (−1 = First-Person, 1 = Third-Person) and Its Interaction With Each of the Other Two Variables

Predictor	*b*	β	*t*(97)	*p*
Perspective	.05	.04	.40	.69
Experienced Interest	.96	.40	4.45	<.01
Perspective × Experienced Interest	−.39	−.16	1.81	.07
Self-Beliefs Manipulation	.25	.17	1.87	.06
Perspective × Self-Beliefs Manipulation	.30	.20	2.26	.03

Discussion

Experiment 2 provided convergent evidence that imagery perspective shifted the basis for people's recollections. Critically, and central to the purpose of Experiment 2, imagery perspective moderated the impact of the self-beliefs manipulation on participants' recollections of their interest. Recollections were biased by the self-beliefs manipulation with third-person imagery, but this biasing effect was eliminated with first-person imagery. Additionally, the pattern of data was consistent with Experiment 1 such that participants' recollections while using first-person imagery (vs. third-person) appeared to more closely align with their experienced interest in the task. Thus, Experiment 2 replicated the patterns of results in Experiment 1 while providing stronger evidence for the causal role that self-beliefs play in shaping people's recollections with third-person imagery, as well as first-person imagery's ability to circumvent this potential source of bias.

Experiment 3

Experiment 3 sought to conceptually replicate the results from Experiments 1 and 2 while manipulating, rather than simply measuring, participants' experience of interest in a task. Participants completed one of two versions of an anagram task that were designed to be interesting or not. Then, the procedure manipulated imagery perspective before participants reported how interesting they found the anagram task. Thus, Experiment 3 sought to directly manipulate people's experienced interest in a task in order to test its causal role in guiding people's recollections with first-person imagery.

Experiment 3 also sought to provide evidence that the current effects operate by shifting processing style. To do so, Experiment 3 manipulated perspective using photographs of actions unrelated to the anagram task, rather than using internally generated imagery

[9] Imagery ease, $t(101) = 0.79$, $p = .43$, and vividness, $t(101) = 0.72$, $p = .47$, did not differ by perspective condition.

[10] Finally, for exploratory purposes, participants answered questions about how well they believed they performed on the logical reasoning activity by answering: "Thinking back to the logical reasoning puzzles, how difficult did you feel they were?" (1 = *very difficult* to 7 = *very easy*; $M = 2.74$, $SD = 1.36$); "Relative to other participants taking the test, how well do you believe you performed?" (1 = *well below average* to 7 = *well above average;* $M = 3.18$, $SD = 1.32$), and "Of the 10 questions on the test, how many do you believe you got correct?" ($M = 4.95$, $SD = 1.96$).

[11] We also used the same single linear regression model to predict participants' recollections of how difficult they found the logical reasoning activity to be. To do so, we created a composite from the z-scores of the three exploratory difficulty questions ($\alpha = 0.86$) to use as the dependent measure. As in Experiment 1, neither the perspective by self-beliefs interaction nor the perspective by experienced interest interaction was significant ($ps > .45$).

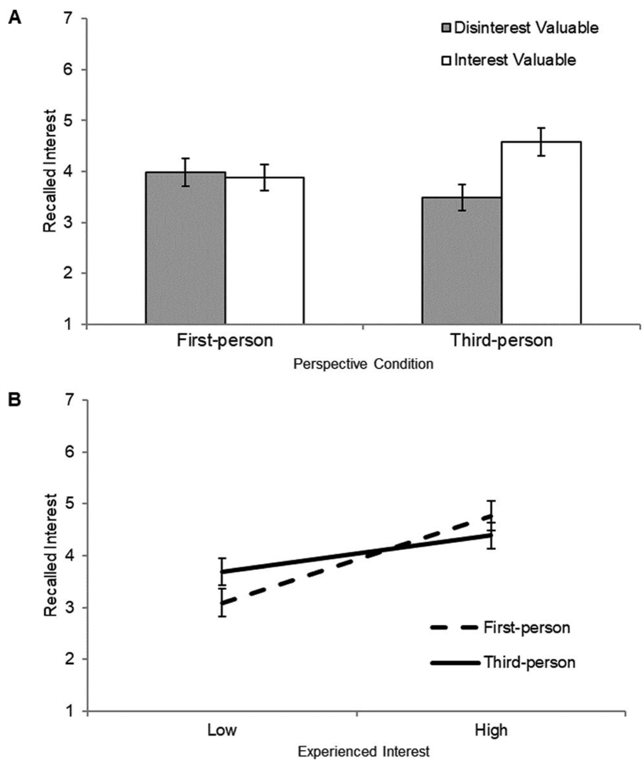

Figure 2. Recalled interest in a logical reasoning task in Experiment 1, depending on imagery perspective and a manipulation of self-beliefs about interest in logical reasoning activities (Panel A) and imagery perspective and the measure of experienced interest (Panel B). In Panel A, values are plotted at the adjusted cell means with standard error bars; in Panel B, values are plotted within each perspective condition at one standard deviation above and below sample means of the experienced interest measure with standard error bars. Both interaction effects come from a single model predicting recalled interest from self-beliefs manipulation condition and the measure of experienced interest, as well as imagery perspective and its interaction with each of the other two variables.

of the anagram task itself. Specifically, after completing the anagram task, participants viewed one of two versions of a series of photographs depicting hands carrying out common everyday actions unrelated to the anagram task (e.g., wiping up a spill). The two versions of action photographs differed only in whether they depicted the actions from a first-person or third-person perspective; for each action, the objects depicted in the image, distance to the action, and camera angle remained constant regardless of perspective. Participants were randomly assigned to view either the first-person or third-person version of the photographs before going on to report their experiences of interest in the anagram task.

Previous research has used this method of manipulating perspective to replicate effects from experiments that manipulate perspective using internally generated imagery relevant to the target judgments (Shaeffer et al., 2015). Converging results across these two methods validate the role of visual imagery in producing the effects of mental imagery perspective manipulations, isolate the effect of perspective apart from other factors that may covary with it when individuals construct their own mental images, and corroborate a processing style mechanism. If the manipulation of perspective in the action photographs carries over to influence unrelated judgments, perspective is operating by changing the processing style rather than changing the visual salience of information specific to a given image. We predicted such a carryover effect in Experiment 3 such that the manipulation of perspective in the unrelated action photos would have the same effect on the basis for participants' recollections of interest as emerged in Experiments 1 and 2 using internally generated imagery of the target experience.

Experiment 3 also sought to extend the previous findings by testing these effects in a different domain (anagrams vs. a logical reasoning task) while beginning to explore the possibility that imagery perspective might moderate gender stereotypes' biasing impact on people's recollections of their experiences (e.g., Aronson & Steele, 2005; Baron et al., 2014; Chatard et al., 2007). We expected that individuals' self-beliefs would, on average, reflect the gender-stereotype that women are more interested in language-related activities than men are (e.g., Guimond & Roussel, 2001; Lightbody, Siann, Stocks, & Walsh, 1996).[12] To the extent that this gender stereotype shapes recollections via top-down processes, imagery perspective should moderate its effect. Specifically, third-person imagery should cause people's recollections to align more with biases in relevant gender stereotypes, whereas first-person imagery should reduce (or even eliminate) their biasing impact.

Method

Participants. We determined sample size for Experiment 3 based on the average interaction effect size between perspective and experienced interest across Experiments 1 and 2 ($f^2 = 0.056$). We aimed to recruit at least 222 participants in order to detect the effect with 95% power (Faul, Erdfelder, Lang, & Buchner, 2007), and 246 Amazon Mechanical Turk workers participated in the main study in exchange for $0.30 (167 female, 79 male; 63 first-person and interesting task condition, 58 first-person and boring task condition, 62 third-person and interesting task condition, 63 third-person and boring task condition).

Procedure.

Manipulation of experienced interest (modeled after Zunick, Fazio, & Vasey, 2015, Exp. 4). Participants first completed an anagram task in which they were shown a string of letters that they needed to rearrange to form words. Each participant received 12

[12] To test the assumption that the population for our sample holds self-beliefs that conform to gender-stereotypes in this domain, we measured a separate set of seventy Amazon MTurk workers' self-beliefs about their interest in the anagram task. Participants read a brief description of the anagram task, but did not get the experience of actually completing it. After reading the description, participants used a fully-labelled scale from 1 = *strongly disagree* to 7 = *strongly agree* to report how strongly they agreed with the statement "I am the type of person who likes tasks like this." They also used fully-labelled 7-point scales to answer three questions modeled after the dependent measure in Experiments 1 and 2 about how interesting, engaging, and enjoyable they find tasks like this. Responses to the four items ($\alpha = 0.96$) were averaged to serve as an index of participants' self-beliefs about their interest in the anagram task ($M = 5.39$, $SD = 1.28$). Finally, participants reported their gender. As predicted, participants' self-beliefs conformed to gender stereotypes: Women believed they would be more interested in the anagram task ($M = 5.68$, $SD = 1.25$) than men did ($M = 4.97$, $SD = 1.22$), $t(68) = 2.34$, $p = .02$.

anagrams to solve, one at a time. Critically, the procedure manipulated how interesting the task was by randomly assigning participants to complete one of two versions of the anagram task. Specifically, for half of the participants, the task was calibrated to their ability: If they answered anagrams incorrectly, they received easier subsequent anagrams; if they answered anagrams correctly, they received more difficult subsequent anagrams. Participants in the other condition simply received 12 easy anagrams to complete. Building from work that suggests people become engaged in tasks that match their ability (i.e., are not too difficult or too easy; Csikszentmihalyi & Massimini, 1985; Silvia, 2001, 2006), we expected participants in the calibrated condition to feel more interested while completing the anagrams. Thus, this task created a relatively more interesting experience when it calibrated (vs. did not calibrate) to a participant's ability.[13]

Imagery perspective manipulation (Shaeffer et al., 2015). After the anagram task, the procedure used a previously validated method for manipulating imagery perspective by presenting photographs unrelated to the main (anagram) task. The procedure informed participants that they would be viewing a series of images one at a time and that they should pay attention to each one and try to form an impression of it in their mind, as they would be asked questions about the images later. Participants viewed a series of 12 images one at a time for 3.5 s each. The images themselves each depicted hands performing a common action (e.g., wiping a spill) that only differed in whether the photograph was taken from the first-person or third-person perspective. The objects in the image and distance to the action were held constant across the photographs. Participants were randomly assigned either to view images all taken from the first-person perspective or from the third-person perspective.

Recalled interest. After viewing the imagery perspective prime, participants answered the same three questions as in Experiments 1 and 2 on fully labeled seven-point scales to recall how interesting the anagram puzzles were. Participants' responses to the three items ($\alpha = .92$) were averaged to index recalled interest in the anagram task ($M = 5.16$, $SD = 1.47$).[14]

Gender. Finally, as part of a battery of demographic questions, participants reported their gender at the end of the study.

Results

We expected to conceptually replicate the effects from Experiments 1 and 2. Specifically, we predicted that first-person imagery (vs. third-person) would cause participants' reports to be less influenced by gender-stereotypical beliefs about the task. Additionally, we predicted that first-person (vs. third-person) imagery would cause participants' memories to be sensitive to their past experience, as manipulated by whether the task was interesting or not. To test these predictions, we used a single linear-regression model to predict participants' recollections of interest from their gender (-1 = man, 1 = woman) and the manipulation of their experienced interest while completing the anagram task (-1 = boring task version, 1 = interesting task version), as well as imagery perspective (-1 = first-person, 1 = third person) and its interaction with each of the other two variables. See Table 3 for the regression statistics.

As hypothesized, imagery perspective determined whether recollections of interest in the task aligned with the top-down influence of gender stereotypes ($b = 0.28$, $\beta = 0.19$, $t(240) = 2.91$, $p < .01$). Recollections conformed to gender-stereotypes with third-person imagery ($b = 0.49$, $\beta = 0.31$, $t(240) = 3.66$, $p < .001$), but not with first-person imagery ($b = -0.07$, $\beta = -0.04$, $t(240) = 0.50$, $p = .62$).[15]

Table 3
Statistics From a Single Linear-Regression in Experiment 3 Predicting Recalled Interest From the Manipulation of Participants' Experienced (−1 = Boring, 1 = Interesting) and Gender (−1 = Men, 1 = Women), as Well as Imagery Perspective (−1 = First-Person, 1 = Third-Person) and Its Interaction With Each of the Other Two Variables

Predictor	b	β	$t(240)$	p
Perspective	.04	.03	.40	.69
Experienced Interest Manipulation	.27	.19	3.05	<.01
Perspective × Experienced Interest Manipulation	−.24	−.16	2.65	.01
Gender	.21	.13	2.19	.03
Perspective × Gender	.28	.19	2.91	<.01

Additionally, conceptually replicating Experiments 1 and 2, imagery perspective determined whether participants' recollections were affected by whether they completed a version of the task that was interesting or not ($b = -0.24$, $\beta = -0.16$, $t(240) = 2.65$, $p = .01$). The task version participants actually experienced significantly affected their recalled interest with first-person imagery ($b = 0.51$, $\beta = 0.35$, $t(240) = 3.99$, $p < .01$), but not with third-person imagery ($b = 0.04$, $\beta = 0.02$, $t(240) = 0.28$, $p = .78$; see Figure 3).

Discussion

Imagery perspective determined the basis for peoples' recalled interest in a task. Experiment 3 provided evidence that first-person imagery, but not third-person, eliminated the top-down bias of

[13] To validate that this manipulation influenced people's experienced interest in the task, a separate set of 50 Amazon MTurk workers were randomly assigned to complete the calibrated or noncalibrated version of the anagram task before using the same three questions as in Experiments 1 and 2 to rate on fully-labelled seven-point scales how interesting, engaging, and enjoyable the (anagram) puzzles were. Participants' responses to the three items ($\alpha = 0.90$) were averaged to index interest in the task ($M = 5.55$, $SD = 1.21$). As predicted, participants found the calibrated version of the anagram task to be significantly more interesting ($M = 5.88$, $SD = 0.96$) than the noncalibrated version ($M = 5.18$, $SD = 1.36$), $t(48) = 2.13$, $p = .04$.

[14] For exploratory purposes, participants answered questions about how well they believed they performed by answering: "How difficult did you feel the anagrams were?" (1 = *very difficult* to 7 = *very easy*; $M = 5.12$, $SD = 1.66$), "Relative to other participants completing the puzzles, how well do you believe you performed?" 1 = *well below average* to 7 = *well above average,* ($M = 4.91$, $SD = 1.36$), and "Of the 12 total anagrams, how many do you believe you answered correctly?" ($M = 10.45$, $SD = 2.22$).

[15] We also used the same single linear regression model to predict participants' recollections of how difficult they found the logical reasoning activity to be. To do so, we created a composite from the z-scores of the three exploratory difficulty questions ($\alpha = 0.78$) to use as the dependent measure. As in Experiments 1 and 2, neither the perspective by self-beliefs interaction nor the perspective by task calibration manipulation interaction was significant ($ps > .50$).

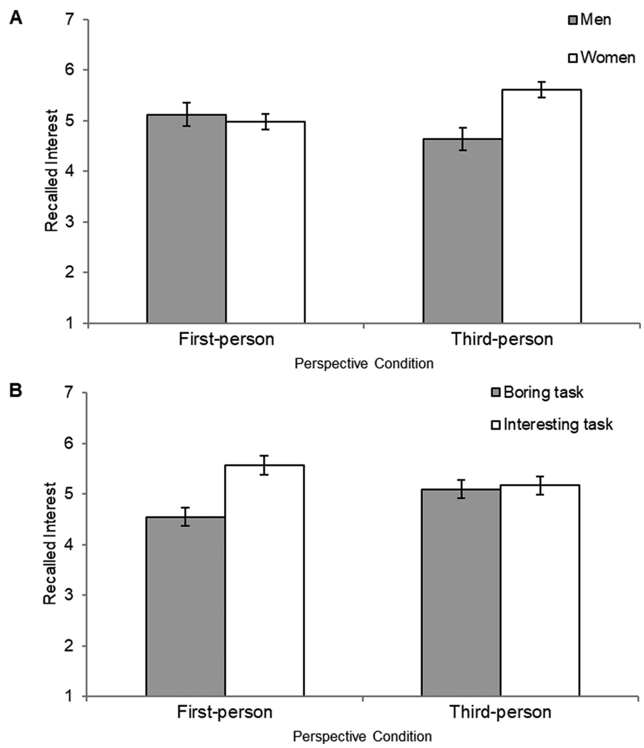

Figure 3. Recalled interest in an anagram task in Experiment 3, depending on imagery perspective and gender (Panel A) and imagery perspective and the manipulation of experienced interest (Panel B). Values are plotted at the adjusted cell means with standard error bars. Both interaction effects come from a single model predicting recalled interest from gender and experienced interest manipulation condition, as well as imagery perspective and its interaction with each of the other two variables.

gender-stereotypical self-beliefs about the task. Further, replicating and extending Experiments 1 and 2, Experiment 3 demonstrated that participants' recollections of their interest corresponded with manipulations of their experienced interest in a task with first-person imagery, but not third-person imagery.

Finally, Experiment 3 provided novel evidence that imagery perspective produces the current effects by shifting processing style. Experiment 3 manipulated imagery perspective with photograph primes that were unrelated to the anagram task and only differed in whether they were taken from the first-person or third-person perspective. Because this manipulation produced carryover effects on the basis for participants' subsequent recalled interest in the anagrams, Experiment 3 provides evidence that imagery perspective differentially shifts the basis for people's recollections by changing their processing style, as opposed to merely changing the salience of different information in a visualized scene. Further, these results validate that the mental imagery instructions operate by influencing mental imagery and isolate the effect of first-person versus third-person imagery, as opposed to other dimensions on which internally generated imagery may tend to vary depending on perspective, such as scope or distance.

Experiment 4

Experiment 4 sought to conceptually replicate the results from Experiments 1 through 3 while testing the broader implications of these effects. We recruited undergraduate women and, prior to the main study, measured their self-beliefs about their interest in science. During the main study, participants learned they would complete a task using an ecosystem simulation program, and participants completed one of two versions of the task that were designed to be interesting or not. Next, as in Experiment 3, the procedure manipulated imagery perspective by randomly assigning participants to view photographs depicting unrelated actions from either the first-person or third-person imagery perspective. Instructions then referred to the ecosystem simulator activity as a science task and participants completed the measures indexing how interesting they found the science task to be. Finally, to test if these effects produced downstream consequences on participants' future interest in science more generally, we measured participants' interest in taking science courses offered by STEM departments at the university and provided participants an opportunity to learn more about other science-related activities on campus. Thus, Experiment 4 sought to conceptually replicate Experiments 1 through 3, and extend those findings, with some important modifications.

First, Experiment 4 sought to conceptually replicate Experiment 3 while using a different procedure to manipulate experienced interest. In particular, rather than manipulate people's experience by calibrating the task to their ability (Csikszentmihalyi & Massimini, 1985), Experiment 4 manipulated the extent to which each version of the task afforded participants autonomy, an important component of interest and engagement (Deci & Ryan, 1985).

Experiment 4 also focused on a more ecologically valid domain that people might naturally form stronger self-beliefs about (i.e., their interest in science vs. their interest in logical reasoning activities or anagram puzzles). Further, the recruited participants (i.e., women) completed a task in a domain for which a negative cultural-stereotype exists (e.g., Chatard et al., 2007; Ehrlinger & Dunning, 2003) that might form the basis for their recall, rather than the features of the situation that drove their actual experience of interest.

Finally, Experiment 4 also extended the current effects by testing how aligning people with their past experience of interest (or their self-beliefs) while recalling a specific task might produce downstream consequences on their future interest to pursue similar activities in that domain. Specifically, we measured participants' interest in taking STEM courses to fulfill a newly proposed general education requirement for the university. We also gave participants an opportunity to add their e-mail address to a list so that they could be contacted to participate in future science-related activities like the task they completed in the study.

We predicted that first-person imagery (vs. third-person) would reduce the bias of participants' self-beliefs and align participants' memories with their (manipulated) experience of interest in the science task. Finally, we predicted that these effects on participants' recalled interest in the specific science task would produce downstream consequences on their interest in pursuing future science courses and related activities.

Method

Participants. We determined the minimum sample size for Experiment 4 using the same strategy as Experiment 3, and 264 undergraduate women participated in the study on their own computers online for course credit. The study used an in-browser ecosystem simulator as the primary task that participants completed and recalled their interest in. However, 11 participants reported at the end of the study that the simulator failed to load in their browser. Because they were therefore unable to complete the task, these participants were excluded, leaving data from 253 participants for analysis (70 first-person and interesting task condition, 58 first-person and boring task condition, 53 third-person and interesting task condition, 72 third-person and boring task condition).

Pre-study survey: Measuring self-beliefs about interest in science. In an online survey 2 days prior to the main study, participants used fully labeled 7-point scales ranging from 1 = *very false* to 7 *very true* to report their self-beliefs about their interest in science by answering the four self-belief questions used in Experiment 1, but modified to be about science (e.g., *"I have a personal interest in science"*). Responses to the four items (α = .95) were averaged to create an index of participants' self-beliefs about their interest in science (M = 4.82, SD = 1.61).

Main study procedure: Manipulating experienced interest and manipulating imagery perspective during recall.

Manipulation of experienced interest. Participants began the study by completing an ecosystem simulation task (Wilensky, 1997, 1999). In the task, participants worked to create a balanced ecosystem that consisted of grass, sheep, and wolves by altering the starting number of sheep and wolves as well as how quickly the grass regrew and the sheep and wolves reproduced. In the interesting condition, participants were given full autonomy in choosing parameter settings to run in each simulation as they tried to determine which parameters were important for creating a balanced ecosystem. They were also given the ability to make cosmetic changes to the simulation (e.g., to choose if they wanted to run each simulation using butterflies and humans rather than sheep and wolves). While running the simulation, participants were able to watch cartoon versions of the organisms interact in the ecosystem over time. The simulation stopped if the population of sheep or wolves reached zero, at which point participants were able to change the settings and rerun the simulation. Participants used the ecosystem simulator for 10 min, and their goal during that time was to determine which settings were important to create an ecosystem that could sustain itself.

Participants in the boring condition also worked to create a balanced ecosystem that consisted of grass, sheep, and wolves. However, rather than choosing the settings themselves (or being able to make cosmetic changes), they ran through a series of predetermined settings (e.g., in Trial 1, the grass regrew slowly, the sheep repopulated slowly, and the wolves repopulated quickly). After running each trial, participants in this condition recorded whether the settings created a balanced ecosystem or not. Thus, these modifications across the interesting and boring task conditions were implemented to give participants a more (or less) autonomous experience.[16]

Imagery perspective manipulation (Shaeffer et al., 2015). After the ecosystem simulator, using the same materials and procedure to manipulate imagery perspective as in Experiment 3, the instructions informed participants that they would be viewing a series of images one at a time and that they should pay attention to each one and try to form an impression of it in their mind. Participants viewed a series of 12 images one at a time for 3.5 s each. The images themselves each depicted an everyday action (e.g., wiping a spill) that only differed in whether the photograph was taken from the first-person or third-person perspective. Participants were randomly assigned to view images either all taken from the first-person perspective or from the third-person perspective.

Recalled interest. After viewing the imagery perspective photograph primes, participants read instructions referring to the ecosystem simulator as a science task and answered the same three questions as in Experiments 1, 2, and 3 (modified to be about science) on fully labeled 7-point scales to report how interesting the task was. Participants' responses to the three items (α = .94) were averaged to index recalled interest in the science task (M = 4.09, SD = 1.72).

Downstream consequences on future interest in science.

Interest in future science courses. Next, participants were asked to imagine that the university was adding a new general education requirement on "*Diverse Groups and Shared Spaces*." To fulfill this requirement, students would need to take a course from a set of six options. Participants then viewed the departments and names of the six course options; critically, three of the options were science courses offered from STEM departments (e.g., *Environmental Engineering: Science, Engineering, and Public Policy*) and three were not (e.g., *English: English Studies and Global Human Rights*). After reviewing this information, participants used a fully labeled 5-point scale ranging from 1 *not interested* to 5 *very interested* to report how interested they would be in taking each course. Participants' responses to the three STEM-related courses (α = .73) were averaged to serve as an index of their interest in taking science courses (M = 2.50, SD = 1.00).

Interest in future science-related activities. Finally, at the end of the study, participants provided their university e-mail address so that we could track their participation and award them credit. On this page, we also offered participants three future "*opportunities to do more things like the science task you completed today*" and asked them to indicate for each one if they wanted us to use their e-mail to contact them with information about it (modeled after Ehrlinger & Dunning, 2003). Specifically, participants indicated whether or not they were interested in the following opportunities: participating in future studies using other science simulator programs like the one they used in the current study, learning about student organizations on campus that engage students with science-related activities like the one they completed in the current study, and/or competing in a university-hosted science activity challenge that awards prizes to winners. Because treating these responses as a continuous measure creates a skewed and nonnormal distribution, we followed the procedure used by Ehrlinger and Dunning (2003) of coding responses as whether or not participants expressed interest in any of the three options. If a participant

[16] To validate that this manipulation influenced people's experienced interest, a separate set of 64 female undergraduates were randomly assigned to complete the high-autonomy or low-autonomy version of the science task before using the same three items as Experiments 1, 2, and 3 to rate how interesting, engaging and, enjoyable it was. Participants' responses to the three items (α = 0.94) were averaged to index interest in the task (M = 4.22, SD = 1.55). As predicted, participants found the high-autonomy version of the science task to be significantly more interesting (M = 4.65, SD = 1.41) than the low-autonomy version ((M = 3.77, SD = 1.58), $t(62)$ = 2.33, p = .02).

answered "yes" to any option, she was coded as interested; if a participant answered "no" to all three options, she was coded as not interested (128 interested, 125 not interested).

Results

We expected to conceptually replicate the effects from Experiments 1, 2, and 3. Specifically, we predicted that first-person imagery (vs. third-person) would cause participants' memories to be less biased by the top-down influence of their self-beliefs about their interest in science. Additionally, we predicted that first-person (vs. third-person) imagery would cause participants' memories to be sensitive to their past experience, as manipulated by whether the task was interesting or not. Finally, we expected to extend the effects from Experiments 1, 2, and 3 by demonstrating downstream consequences on participants' intentions to pursue future courses and activities in the domain.

Predicting recalled interest in the science task. We first tested the prediction that imagery perspective would differentially moderate the extent to which participants' recollections aligned with their self-beliefs and their experienced interest. To do so, we used a single linear-regression model to predict participants' recollections of interest from their self-beliefs about their interest in science (sample-mean-centered) and their manipulated experienced interest in the task (-1 = boring task version, 1 = interesting task version), as well as imagery perspective condition (-1 = first-person, 1 = third-person) and its interactions with each of the other two variables. See Table 4 for the regression statistics.

Conceptually replicating Experiments 1 through 3, imagery perspective determined the extent to which participants' recollections aligned with their self-beliefs about their interest in science ($b = 0.14$, $\beta = 0.13$, $t(247) = 2.15$, $p = .03$). Recollections of interest significantly corresponded with participants' self-beliefs with third-person imagery ($b = 0.33$, $\beta = 0.31$, $t(247) = 3.44$, $p < .01$), but not with first-person imagery ($b = 0.05$, $\beta = 0.05$, $t(247) = 0.61$, $p = .54$).

Also conceptually replicating the previous experiments, imagery perspective determined whether participants' recollections of interest were affected by whether participants were assigned to experience the interesting or boring version of the task ($b = -0.25$, $\beta = -0.14$, $t(247) = 2.42$, $p = .02$). Participants' recollections were significantly affected by this manipulation of experienced interest in the first-person imagery condition ($b = 0.68$, $\beta = 0.40$, $t(247) = 4.76$, $p < .01$), but not the third-person imagery condition ($b = 0.19$, $\beta = 0.11$, $t(247) = 1.27$, $p = .21$). Specifically, first-person condition participants recalled greater interest when they actually experienced an interesting (vs. boring) version of the task, whereas third-person condition participants' recollections of interest were unaffected by the version of the task they actually experienced (see Figure 4).

Table 4
Statistics From a Single Linear-Regression in Experiment 4 Predicting Recalled Interest From the Manipulation of Participants' Experienced Interest (−1 = Boring, 1 = Interesting) and Self-Beliefs About Interest in the Domain (Sample-Mean Centered), as Well as Imagery Perspective (−1 = First-Person, 1 = Third-Person) and Its Interaction With Each of the Other Two Variables

Predictor	*b*	β	*t*(247)	*p*
Perspective	.09	.05	.89	.37
Experienced Interest Manipulation	.43	.25	4.23	<.01
Perspective × Experienced Interest Manipulation	−.25	−.14	2.42	.02
Self-Beliefs	.19	.18	2.96	<.01
Perspective × Self-Beliefs	.14	.13	2.15	.03

Predicting downstream consequences on future interest in science. Next, we tested if these effects on participants' recalled interest in the science task would predict downstream consequences on participants' interest in future engagement with science (as measured separately by their interest in science courses and interest in future science-related activities). Specifically, future interest in science should reflect self-beliefs as a function of recalled interest with third-person imagery (but not first-person). In contrast, future interest in science should reflect the task manipulation as a function of recalled interest with first-person imagery (but not third-person). We used the computational tool PROCESS (Model 10, Hayes, 2012) to test if the interaction between perspective (-1 = first-person, 1 = third-person) and self-beliefs (-1 *SD* from the mean = low, $+1$ *SD* from the mean = high) and the interaction between perspective and task version (-1 = boring task version, 1 = interesting task version) had indirect effects on future interest in science through the effects on their recalled interest in the science task. We ran the analysis twice, first using interest in science courses as the dependent measure and then again using interest in future science-related activities as the dependent measure. Because the significant pattern of results for the two dependent measures are consistent with one another, they are presented in tandem below.

To test if imagery perspective moderated the effects of self-beliefs and task version on future interest in science by influencing recalled interest in the task, we estimated conditional indirect effects for each imagery perspective condition. We calculated bias-corrected bootstrap CI with 10,000 samples to test if the indirect effects of self-beliefs and the indirect effects of task version differed across imagery perspective conditions and if each was significantly different from zero. Doing so revealed evidence of two significant moderated mediation pathways predicting responses on each dependent measure.

Imagery perspective moderated the mediation path of self-beliefs on future interest in science through recalled interest in the task (science courses as Dependent Variable: point estimate = 0.02, *SE* = 0.01, 95% CI [0.002, 0.05]; science-related activities as DV: point estimate = 0.06, *SE* = 0.03, 95% CI [0.01, 0.14]). Follow-up analyses indicated that there was a significant indirect effect of self-beliefs for participants in the third-person imagery condition (science courses as DV: point estimate = 0.05, *SE* = 0.02, 95% CI [0.02, 0.09]; science-related activities as DV: 0.15, *SE* = 0.06, 95% CI [0.07, 0.28]). This result provides evidence that, for participants in the third-person imagery condition, high (vs. low) self-beliefs led to greater future interest in science, as a function of increasing their recalled interest in the science task. In contrast, there was not a significant indirect effect of self-beliefs for participants in the first-person imagery condition (science courses as DV: point estimate = 0.01, *SE* = 0.01, 95% CI [−0.02,

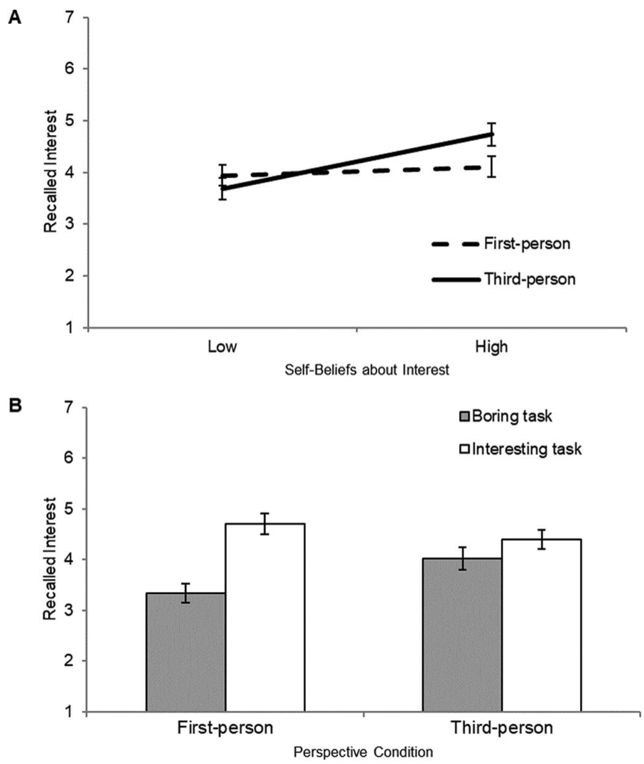

Figure 4. Recalled interest in a science task in Experiment 4, depending on imagery perspective and self-beliefs about interest in the domain (Panel A), and imagery perspective and the measure of experienced interest (Panel B). In Panel A, values are plotted within each perspective condition at one standard deviation above and below sample means of the self-beliefs measure with standard error bars; in Panel B, values are plotted at the adjusted cell means with standard error bars. Both interaction effects come from a single model predicting recalled interest from self-beliefs and experienced interest manipulation condition, as well as imagery perspective and its interaction with each of the other two variables.

0.03]; science-related activities as DV: 0.02, *SE* = 0.04, 95% CI [−0.06, 0.11]).

Imagery perspective also moderated the mediation path of task version on future interest in science through recalled interest in the task (science courses as DV: point estimate = −0.07, *SE* = 0.04, 95% CI [−0.15, −0.01]; science-related activities as DV: point estimate = −0.23, *SE* = 0.12, 95% CI [−0.49, −0.04]). Follow-up analyses indicated that there was a significant indirect effect of task version for participants in the first-person imagery condition (science courses as DV: point estimate = 0.09, *SE* = 0.03, 95% CI [0.04, 0.18]; science-related activities as DV: point estimate = 0.31, *SE* = 0.10, 95% CI [0.15, 0.55]). This result provides evidence that, for participants in the first-person imagery condition, completing the interesting (vs. boring) version of the task led to greater future interest in science, as a function of increasing their recalled interest in the science task. In contrast, there was not a significant indirect effect of task version for participants in the third-person imagery condition (science courses as DV: point estimate = 0.03, *SE* = 0.02, 95% CI [−0.01, 0.08]; science-related activities as DV: point estimate = 0.08, *SE* = 0.07, 95% CI [−0.04, 0.25]).[17]

Discussion

Imagery perspective determined the basis for women undergraduates' recalled interest in a science task. Replicating the findings from Experiments 1 through 3, participants' recollections corresponded with their self-beliefs about their interest in the domain with third-person imagery, but not first-person imagery. Additionally, participants' recollections of their interest corresponded with manipulations of their experienced interest with first-person imagery, but not third-person imagery. Using a different manipulation of experienced interest (via autonomy), these results conceptually replicate the findings from Experiments 1 through 3 that participants' recollections were more contingent on their bottom-up experience of completing an interesting (vs. boring) version of the task with first-person imagery, but not third-person imagery. As in Experiment 3, Experiment 4 also manipulated imagery perspective using photograph primes that created carryover effects on people's subsequent recollections. Thus, this experiment replicates the evidence from Experiment 3 that imagery perspective produces the current effects by shifting processing style.

Finally, Experiment 4 demonstrated the potential real-world value of these effects by conceptually replicating Experiments 1 through 3 in a more ecologically valid domain (interest in science) in which our recruited pool of participants (undergraduate women) traditionally face negative cultural stereotypes. Experiment 4 extended the effects in the current experiments by demonstrating downstream consequences on participants' interest in taking science courses and their decisions to sign-up (or not) to receive additional information about science-related activities on campus. As such, these findings hold implications for interventions aimed at helping underrepresented groups have more positive experiences in STEM environments (e.g., Walton & Cohen, 2011). Specifically, the current results suggest that these interventions have the potential to become even more efficacious if paired with a manipulation (e.g., first-person imagery) that could help attune people to these positive experiences and counteract the influence of potential negative self-beliefs.

General Discussion

Across four experiments, imagery perspective determined the extent to which people's memories were biased by their self-beliefs and the extent to which their memories aligned with their past experienced interest. Peoples' recollections were biased by

[17] Analyses of the downstream consequences on participants' interest in science courses remain significant when controlling for interest in the nonscience courses. Additionally, using interest in nonscience courses as the dependent variable in this model provided no evidence of a moderated mediation path of pre-existing self-beliefs (point estimate < 0.01, *SE* = 0.01, 95% CI [−0.01, 0.02]) or task version (point estimate = −0.01, *SE* = 0.02, 95% CI [−0.05, 0.04]). Thus, imagery perspective influenced participants' recalled interest in the science task by moderating the impact of pre-existing beliefs and task condition about interest in science, which then influenced their interest in future science classes and activities, but not unrelated nonscience classes.

their self-beliefs with third-person imagery, but not first-person imagery. Experiment 2 provided evidence for the causal role of self-beliefs with third-person imagery by manipulating self-beliefs prior to recall. Experiment 2 also provided evidence for first-person imagery's ability to circumvent this potential source of bias. Experiment 3 also demonstrated that self-beliefs that are based in cultural stereotypes bias people's recollections with third-person imagery, but not first-person imagery. Additionally, peoples' recollections aligned with their actual past experiences of interest with first-person imagery, but not third-person imagery. Experiments 3 and 4 provided evidence that manipulating the concrete features of a task to make it more or less interesting causally influenced people's recall with first-person imagery, but not third-person imagery. Further, by manipulating imagery perspective with photographs unrelated to the target task, Experiments 3 and 4 offered converging evidence that imagery perspective shifted the basis for people's recall by changing processing style. Experiment 4 found that imagery perspective shifted whether people's interest in pursuing future similar activities reflected their actual experience of interest or their self-beliefs, as a function of shifting the basis for their recalled interest in a specific task. Finally, Experiment 4 did so in a domain (science) for which the participants (undergraduate women) face negative cultural stereotypes about their interest.

These findings shed light on the conditions under which self-beliefs are likely to exert their influence and bias people's recollections of their experiences. The current findings also demonstrate a way to circumvent this bias while aligning people's recall with their past experiences. This research also provides convergent evidence for the cognitive functions of the processing styles evoked by mental imagery. Finally, this research offers some insight into the process of how people can identify domains and subjects that genuinely interest them, as well as demonstrates a potential barrier (preexisting beliefs) that may get in the way.

Understanding When Self-Beliefs Will Bias Recall

People develop self-beliefs that they can use to inform their judgments, expectations, behaviors, and recollections (Markus, 1977; Swann & Buhrmester, 2012). However, because people's self-beliefs are not necessarily accurate, they can be a source of bias (Swann & Buhrmester, 2012; Wilson & Dunn, 2004). Indeed, a host of research demonstrates that people's self-beliefs often bias their judgments about the past (Bartlett, 1932; Fischhoff, 1975; Ross, 1989; Wilson & Ross, 2003).

The current findings provide evidence in line with previous work suggesting that people's self-beliefs can bias their recall. However, the current findings uniquely contribute to this literature by shedding light on a specific mechanism through which these beliefs bias recall: when other factors (in this case, third-person vs. first-person imagery) cause people to engage in top-down processing. Further, the current experiments demonstrated this effect by manipulating the visual perspective of people's internally generated mental imagery (in Experiments 1 and 2) and by manipulating the visual perspective of externally viewed images (in Experiments 3 and 4), providing convergent evidence for the notion that third-person imagery (vs. first-person) increased reliance on self-beliefs by evoking a top-down processing style.

Traditional accounts have argued that self-beliefs bias recall because it becomes harder to recall concrete details of an event as time passes (see Kruglanski & Higgins, 2013). As people forget the concrete details of a past event, they use their current beliefs as a starting point and then adjust depending on their lay theories and abstract belief systems in order to recall their experience (Ross, 1989; Wilson & Ross, 2003). Indeed, previous research has demonstrated that people's judgments conform more to their self-beliefs for temporally distant (vs. proximal) events (Ross, 1989; Semin & Smith, 1999; Wakslak, Nussbaum, Liberman, & Trope, 2008).

However, the current results highlight an additional mechanism for understanding how these effects occur: Rather than merely being a tool to "fill in the gaps" as people forget concrete details over time, the tendency to process information more abstractly for temporally distant (vs. proximal) events may itself increase the influence of people's self-beliefs on their recall (Conway, 2001; Kruglanski & Higgins, 2013; Trope & Liberman, 2010). The current studies provide support for this interpretation, as imagery perspective determined the influence of people's self-beliefs while holding constant the amount of time that had passed between the activity and participants' recall of it. Indeed, in Experiments 3 and 4, these effects occurred when mere minutes had passed between when people completed the task and when they recalled it.

Thus, these results suggest that variables that shift processing style (in this case, visual imagery perspective) can influence the extent to which people's memories are biased by their self-beliefs. And, to the extent that other variables (such as abstract construal level; Wakslak et al., 2008) similarly increase reliance on top-down processing, people's memories should become more biased by their self-beliefs. Further, the current set of findings suggests a way to help circumvent this bias. Specifically, to the extent that other variables cause people not to engage in top-down processing, recall should be less biased by people's self-beliefs. Indeed, in the current experiments, first-person imagery caused people's memories *not* to be biased by their self-beliefs. Building from this evidence, other situational variables that increase people's reliance on bottom-up processing (e.g., Gawronski & LeBel, 2008; Jordan, Whitfield, & Zeigler-Hill, 2007; Kendrick & Olson, 2012; Koole, Govorun, Cheng, & Gallucci, 2009; Wilson et al., 1993) might also reduce the biasing influence of their self-beliefs during recall. Further, exploring other situational factors that shape people's processing style during recall may be particularly valuable when applying the current findings among specific populations that might have difficulty with any one manipulation (e.g., people who have difficulty forming mental images; Farah, Levine, & Calvanio, 1988; Kosslyn, Brunn, Cave, & Wallach, 1984).

Implications for Understanding the Cognitive Function of Imagery

Research on mental imagery has traditionally focused on the functional value of its depictive format for representing and manipulating concrete information (vs. abstract information represented by propositional thought; Paivio, 1969; Pearson & Kosslyn, 2015). However, the present research contributes to a growing body of work that suggests a qualitatively distinct cognitive function that imagery can serve: shaping processing style. In this case, the mechanism by which imagery operates depends not on the content that is depicted, but on the perspective from which that content is depicted, as demonstrated in the current Experiments 3 and 4 (Niese et al., 2018; Shaeffer et al., 2015).

The present research also validates and further specifies the proposed nature of processing that occurs according to imagery perspective. In particular, previous research suggests that third-person (vs. first-person) imagery facilitates a top-down processing style that helps people connect their past, present, and future selves into a coherent narrative (Libby et al., 2011; Macrae et al., 2017), thereby causing people to rely more on their self-beliefs when making judgments (Libby & Eibach, 2011; Libby et al., 2014; Marigold et al., 2015; Niese et al., 2018; Vasquez & Buehler, 2007). The current results provide convergent evidence for this account by demonstrating how people's self-beliefs about their interest in a domain shape their recall with third-person (but not first-person) imagery. Further, Experiment 2 extends beyond the majority of this previous research by experimentally manipulating self-beliefs to demonstrate their causal role with third-person imagery (see also, Libby, Eibach, & Gilovich, 2005).

Previous research also suggests that first-person imagery facilitates a bottom-up processing style that causes people to base their judgments in their implicit preferences (Libby et al., 2014), typical experiential reactions (Niese et al., 2018), and a host of embodied sensory experiences (Christian, Parkinson, Macrae, Miles, & Wheatley, 2015; Macrae et al., 2016; Macrae, Raj, Best, Christian, & Miles, 2013). The current results provide convergent evidence for this account by measuring and manipulating people's actual experience of interest in a task and demonstrating that people reconstruct their memories in a way that aligns with these past experiences with first-person (but not third-person) imagery.

Further, the current findings extend beyond previous work by providing a stronger test of the functional role of first-person and third-person imagery. Specifically, previous research has demonstrated the effects of manipulating imagery perspective on how people construct and judge hypothetical events (Libby & Eibach, 2011), possible future events (Libby et al., 2014; Niese et al., 2018), or events from the distant past (Marigold et al., 2015; Libby, Valenti, Pfent, & Eibach, 2011). For instance, imagery perspective shifts whether people's expectations about upcoming events align with their chronic tendency to have positive (or negative) bottom-up reactions to ambiguity or their optimistic (or pessimistic) self-beliefs (Niese et al., 2018). Unlike this prior research in which participants made judgments about relatively unconstrained events, the current experiments tested participants' recall for an event they had recently experienced. The fact that third-person imagery (vs. first-person) caused people to process a scene in relation to their self-beliefs for such recent past events suggests that the processing style effects of imagery perspective are not bound to situations in which people are constructing a hypothetical scene or recalling distant past events for which their memory of specific information has faded. Indeed, in Experiments 3 and 4, the effect of third-person imagery (vs. first-person) on how people process a past event was strong enough to shift people's recollections almost immediately afterward. Further, by including measures (or manipulations) of people's actual experiences during the event, the current experiments were able to go beyond past work to not only test if the two imagery perspectives shifted people's judgments, but to also make inferences about the accuracy of those judgments.

Finally, the fact that the predictions in the current experiments were derived from the broader theory that imagery perspective shifts processing style suggests that the current effects should not be limited to people's recollections of their experienced interest. Rather, the current findings suggest that invoking a bottom-up processing style via first-person imagery may help in other areas in which people's self-beliefs interfere with their ability to accurately recall their past behavior (e.g., automatic vs. deliberative attitudes (Gawronski & Bodenhausen, 2007; Olson & Fazio, 2008; Rydell & McConnell, 2006), impulsive vs. reflective partner trust (Murray et al., 2011), aversive racism (Dovidio & Gaertner, 2004)). Indeed, one study provides initial evidence for this possibility (Libby et al., 2014): when imagining an interracial interaction (as opposed to recalling), first-person imagery (vs. third-person) caused people to forecast emotional reactions more in line with their implicitly measured racial attitudes. As such, by contributing to growing evidence for a novel function of mental imagery—to guide processing style—the current findings pave the way for future research in domains where it may be beneficial to attune people's recall to the concrete features of the situation that drove their past experiences and be less biased by their self-beliefs.

Helping People Identify Genuine Interests

People can use their past experiences of feeling interested to develop beliefs about the domains that tend to interest them (Silvia, 2006; cf. Fouad, Smith, & Zao, 2002; Lent, Brown, & Hackett, 2002). Specifically, when people have an experience of feeling interested, they are able to reason about what is causing it (Russell, 2003; Seager, 2002), and once people form a causal attribution about the source of their interest (e.g., the course material in a science class), this belief shapes their expectations (e.g., expecting to feel interest while taking future science classes; Weiner, 1986) and guides their behaviors (e.g., seeking out science classes in the future; Duval & Silvia, 2001; Heider, 1958). Further, if similar future activities continue to create experiences of interest, people can develop more elaborate belief systems about their personal interest in the domain (Silvia, 2006; Tomkins, 1987, 1991). However, the current findings highlight the fact that a host of biases can interfere with an early step in this process. In particular, people's preexisting self-beliefs about their interest in a domain, which may be based on faulty sources of information such as cultural stereotypes, can bias their recollections of whether they felt interested in an activity. And, as demonstrated in Experiment 4, this can have downstream consequences for the next step in the process—people's motivation and decisions to pursue activities in the domain in the future.

Given that pursuing domains that one is genuinely interested in is important for well-being and productivity (Peterson, 2006; Ryan & Deci, 2000; Swan & Carmelli, 1996), eliminating the biasing influence of people's self-beliefs may be an important step in helping people identify the domains that they actually experience as interesting. Previous research highlights how self-beliefs can bias people's experiences in the moment (Critcher & Dunning, 2009). The current research demonstrates how, even in instances when self-beliefs do not bias people's actual experiences, those self-beliefs can still bias recall and introduce a barrier to identifying activities that one experienced as interesting. Thus, the current research suggests that the positive impact of approaches that reduce the negative impact of self-beliefs and cultural stereotypes on people's immediate experiences (e.g., Spencer et al., 1999; Steele & Aronson, 1995; Walton & Cohen, 2011) may be limited if the biasing impact of self-beliefs is not also addressed during recall. As such, the current research suggests that the benefit of these interventions could be amplified if paired with interventions that attune people to their actual bottom-up experience (e.g., first-person imagery) when reflecting on their past experience.

Clarifying Questions and Future Directions

The current experiments were designed to mirror situations in which people's self-beliefs are unlikely to influence their immediate experience but might still bias people's recollections of those experiences. In such cases, decreasing reliance on top-down processes, and increasing reliance on bottom-up processes, by using first-person (vs. third-person) imagery should make people recall their experiences of interest more accurately. However, there may be times when first-person (vs. third-person) imagery would not lead to more accurate recall.

For example, when people's experiences *are* shaped by self-beliefs (Critcher & Dunning, 2009; Ehrlinger & Dunning, 2003), increasing reliance on those beliefs during recall via top-down processing might improve accuracy during recall. That is, in such situations, third-person (vs. first-person) imagery might cause people's recollections to be more accurate by helping them apply a (in this case, correct) theory of what was driving their past experience of interest.

In addition, even when people's experiences were not influenced by their self-beliefs, it is still possible that first-person imagery (vs. third-person) might not increase the accuracy of people's recollections if people hold accurate self-beliefs (Ross, 1989), in which case, both perspectives may lead to similar levels of recalled interest. However, even if the theory-based route leads to a similar recollection as the route of simulating the concrete features of the situation that drove one's past experience, there may still be important downstream consequences for how people arrived at the recollection (e.g., differences in the strength of the conclusions people draw about those memories, whether they integrate the event with their broader narrative, etc.).

Finally, it is worth considering that there may also be times when it would be unhelpful to accurately attune people to their past experiences. For instance, if a female student who has already developed the belief that she is interested in science takes a class with a sexist professor, the student may have a negative experience in the class—not because she is uninterested in science, but because of a negative peripheral feature of the situation (i.e., the specific professor in this class). In this situation, third-person imagery may actually be a useful tool to help *not* attune people to negative experiences that were created by the concrete peripheral features of a situation that may not be indicative of their typical interest in the domain.

Conclusion

People are more productive and experience greater life satisfaction when they pursue careers and activities that genuinely interest them (Peterson, 2006; Ryan & Deci, 2000). However, people's self-beliefs can bias their memories of their past experiences (Ehrlinger & Dunning, 2003; Ross, 1989; Wilson & Ross, 2003), thereby hindering their ability to identify the domains that they actually tend to experience as interesting. By manipulating an integral element of episodic memory—visual perspective in mental imagery—that plays a functional role in cognition (Libby & Eibach, 2011), the present experiments illuminate how self-beliefs can bias recall through top-down influences, while providing a tool (i.e., imagery from the first-person perspective) to help circumvent this bias and promote accuracy. Thus, this research offers insights to how we might help people be less biased by their self-beliefs when recalling their past experiences of interest. Further, this research may be particularly useful when applied to reducing the psychological barrier to diversity posed by self-beliefs that are based in cultural stereotypes. As such, the current findings might be applied in these contexts to improve societal outcomes by helping people pursue domains that they find interesting and in which they have the potential to make meaningful contributions.

Context of the Research

The research presented in this article includes work that will comprise the first author's dissertation, as well as work from the last author's undergraduate senior thesis. The hypotheses tested here stem from programmatic efforts in our labs to understand the functional role that imagery perspective plays in supporting cognition. We have found that, by shifting processing style, imagery perspective affects people's judgments, decisions, and behaviors across a variety of domains. Given that visual perspective is an integral element of the mental imagery that people often use when recalling past events in their lives, our work seemed a promising tool for circumventing the biasing impact that people's self-beliefs often have on their memories. Specifically, we reasoned that by evoking a processing style that facilitates bottom-up processes, first-person (vs. third-person) imagery should help people better recall their experiences of feeling interested in a task and be less biased by their preexisting self-beliefs about their interest in the domain.

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