ELLIE J. KYUNG and MANOJ THOMAS*

Does explicit recall help or hurt memory-based comparisons? It is often assumed that attempting to recall information from memory should facilitate—or at least not disrupt—memory-based comparisons. Using the domain of price comparisons, the authors demonstrate that memory-based price comparisons are less accurate when consumers first attempt to recall the past price versus when they do not try to do so. Attempting—and failing at—explicit price recall focuses attention on metacognitive experience, resulting in a feeling-of-not-knowing, which then blocks the implicit memory that people could otherwise use to make accurate price comparisons. Drawing attention to this metacognitive feeling-of-not-knowing increases the blocking effect of recall on implicit memory, whereas drawing attention away from the feeling reduces the blocking effect. The results identify a new type of memory blocking—metacognitive memory blocking—in which the feeling-of-not-knowing blocks implicit memory during judgments. They also provide further evidence of dual representations of price memory and demonstrate that most memory-based price comparisons are based on implicit memory and do not entail explicit recall of the reference price.

Keywords: memory, blocking, metacognition, price memory, price comparison

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When Remembering Disrupts Knowing: Blocking Implicit Price Memory

People often compare products or information encountered in the present with products or information they remember encountering in the past. They can make such memory-based comparisons with or without explicitly recalling the originally encoded information from memory. For example, when evaluating the price of potato chips in a store, a buyer could consider, "What was the price of this product last week?" and then compare the recalled price with the new price. Alternatively, the buyer might evaluate the new price relative to the old price without trying to explicitly recall that old price. Monroe and Lee (1999) refer to judgments that entail explicit recall as "remember" judgments (e.g., "the chips were $3.75 the last time") and those that do not as "know" judgments (e.g., "the price this week seems lower than last week's price"). The present research examines the effect of explicit recall on memory-based comparisons: How does attempting to explicitly recall past information from memory affect the accuracy of subsequent memory-based comparisons?

One reasonable assumption is that attempting to recall information from memory should aid—or at least not disrupt—subsequent memory-based comparisons. Consider the following thought experiment that highlights this somewhat counterintuitive relationship:

> Two consumers, A and B, who are equally price sensitive, are doing their weekly grocery shopping. Before making purchase decisions, both consumers try to judge whether the price for each product this week is higher or lower than its price last week. But they use different mental processes to compare each product's current price to its past price stored in their memory. Consumer A tries to explicitly recall each product's price last week before making price

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> comparisons. Consumer B, on the other hand, makes the price comparisons without attempting to explicitly recall last week's prices. Who is more likely to make correct judgments about relative price magnitude and why?

When this vignette was presented to 108 participants (average age: 33.6 years; 49% female) through an online survey, 97% indicated that Consumer A, who first attempts to recall the prices from memory, is more likely to make correct price comparisons. Consumers are not the only ones who hold this lay belief that recall attempts should facilitate subsequent memory-based judgments; researchers also share this belief. Several researchers studying consumers' price memory have designed studies based on the premise that conscious recall facilitates—or at least, does not undermine—price comparisons. In several studies of price memory, participants were first asked to recall the price of a product, and then asked to compare that price with a specified reference price (e.g., Dickson and Sawyer 1990; Mazumdar and Monroe 1990; Urbany and Dickson 1991; Vanhuele and Drèze 2002).

We propose that this lay belief that recall attempts should facilitate—or at least not disrupt—subsequent memory-based price comparisons is incorrect. This belief is pervasive because people are unaware of or overlook the role of metacognitive experience in memory-based comparisons. Previous research has demonstrated that memory-based judgments are influenced not only by recalled content but also by the metacognitive experiences engendered by the recall process (e.g., Koriat 2000; Menon and Raghubir 2003; Schwarz et al. 1991; Tybout et al. 2005; Wanke, Bohner, and Jurkowitsch 1997; Whittlesea 1993; for a review, see Schwarz 2004). We suggest that metacognitive experiences engendered by price recall attempts can sometimes generate a "feeling-of-not-knowing" that can reduce the accuracy of subsequent memory-based comparisons. We refer to this effect as "metacognitive memory blocking."

Metacognitive memory blocking is distinct from prior research on memory blocking. Psychologists, as well as marketing scholars, have demonstrated that recall attempts can block memory. Examples of such memory blocking include retrieval-induced forgetting (Anderson, Bjork, and Bjork 1994; Anderson and Neely 1996; Bjork 1975; Murayama et al. 2014), part-category cuing effect or part-list cuing effect (Alba and Chattopadhyay 1985; Roediger 1973), and the verbal overshadowing effect (Schooler and Engstler-Schooler 1990). Such memory-blocking effects are caused by changes to the content of information in memory or changes in the accessibility of the target relative to nontarget content. Metacognitive memory blocking, in contrast, is not caused by changes to memory or activation of competing targets: rather, the subjective experience of not knowing temporarily inhibits reliance on implicit memory. Through six experiments, we demonstrate that the feeling-of-not-knowing can temporarily block implicit memory and reduce the accuracy of memory-based comparisons. In contrast to the prior literature on blocking, which has demonstrated how attempting to recall information can block the recall of related information, our research is the first to demonstrate that attempting to recall information in one form (explicit) can block the ability to use that information in another form (implicit) because of the metacognitive experience that stems from recall failure. In other words, attempts at "remembering" can disrupt "knowing."

THEORETICAL FRAMEWORK

Types of Memory-Based Comparisons

When explaining the roles of different forms of memory in price evaluations, Monroe and Lee (1999) distinguish between "remember" judgments based on explicit memory and "know" judgments based on implicit memory. Explicit memory relies on conscious or intentional recollection of specific information, while implicit memory is of the type in which previous experiences aid in the performance of a task without conscious recollection of these previous experiences (Schacter 1987, 2001; Schacter and Graf 1986). Researchers now widely accept that people draw from both forms of memory to make everyday judgments, relying more on one form versus another depending on the task at hand (Roediger 1990). Previous research has demonstrated that people can make price comparisons by relying primarily on implicit memory without invoking explicit memory. For example, Adaval and Monroe (2002) demonstrate that consumer price judgments are influenced by exposure even to subliminally primed prices.

Our conceptualization draws on this distinction by examining how consumers who make only "know" judgments (what we refer to as "compare-only" judgments) perform against those who make "remember" and then "know" judgments (what we refer to as "recall-and-compare" judgments). Note that we do not suggest that compare-only judgments are based solely on implicit memory. Recall-and-compare judgments rely on explicit memory to a greater extent than compare-only judgments because recall-and-compare judgments necessarily rely on explicit memory; before comparing a new price with an old price in memory, people are first asked to consciously remember the specific previous price. However, compare-only judgments, where people are asked only to compare the new price with the old one, can be based on implicit memory or some combination of explicit and implicit memory. Even when a person is not trying to recall the previous price, it could come to mind spontaneously. Thus, recall-and-compare and compare-only judgments differ in the extent to which they rely on explicit versus implicit memory. In the subsection that follows, we describe how attempting to recall information from explicit price memory can block reliance on implicit price memory, which people could otherwise use to make accurate price comparisons.

Metacognitive Experience Can Block Memory

The notion that recall can sometimes have negative effects on memory has been acknowledged for several decades. Memory blocking refers to such negative effects of recall, whereby the act of retrieving some information blocks other information (Schacter 2001). The literature has documented several types of blocking (Alba and Chattopadhyay 1985; Anderson, Bjork, and Bjork 1994; Bjork 1975; Murayama et al. 2014; Roediger 1973; Schooler and Engstler-Schooler 1990; Van Osselaer 2008). For example, retrieval-induced forgetting is one of the most studied negative consequences of retrieval on memory. A typical experiment entails sequential learning, practice, and test phases (Anderson, Bjork, and Bjork 1994; Anderson and Neely 1996; for a recent review, see Murayama et al. 2014). During the learning phase, participants learn to associate a category cue with several exemplars (e.g., fruit:

orange, fruit: lemon). During the practice phase, participants are presented with the category cues (fruit: _____) and asked to recall the exemplars. The standard finding in this literature is that when participants practice and retrieve one pair (e.g., fruit: orange), their ability to recall another pair in a subsequent recall task (fruit: lemon) is inhibited. Another widely known detrimental effect of recall is the part-category cuing or part-list cuing effect, whereby recall cues inhibit subsequent recall. For instance, when consumers are asked to recall shampoo brand names, those who are offered a few brand names as cues paradoxically recall fewer brand names relative to those who are not given the cues (Alba and Chattopadhyay 1985).[1] Although previous research has offered several different explanations for such memory-blocking effects, these explanations attribute memory blocking to weakening of the association between the retrieval cue and the target, reduced accessibility of the target, or competitive interference from more accessible information. Thus, blocking effects demonstrated in the past have been ascribed to the effect of recall on the content or the organization and accessibility of the content in memory.

In this research, we identify a new type of memory blocking that is not caused by changes in memory but by metacognitive experience. Research in memory has shown that memory-based judgments are influenced not only by the content of stored information but also by the metacognitive experience associated with accessing this information (Biehal and Chakravarti 1983; Feldman and Lynch 1988; Koriat 2000; Menon and Raghubir 2003; Raghubir and Menon 1998; Schwarz et al. 1991). For example, people infer that they are less assertive if they have difficulty generating examples of their past assertive behavior (Schwarz et al. 1991) or consider themselves less vulnerable to health risks if they have difficulty remembering examples of past risky health behavior (Raghubir and Menon 1998). Similarly, Koriat (2000) shows that when people experience a "feeling-of-knowing," it increases their confidence in their ability to remember information.

We suggest that the "feeling-of-not-knowing" can have the opposite effect. The feeling-of-not-knowing, in and of itself and outside of specifically recalled content, can block implicit memory. We hypothesize that if people attempt to explicitly recall a previous price from memory and have difficulty recalling that price, their attention will focus on the metacognitive experience of recall, and they are likely to infer that they do not have the information required to make the subsequent comparison judgment. Recall failures trigger heuristic inference about their knowledge: "If I don't know the past price, then I probably can't judge whether the new price is lower or higher than the past price." The ensuing feeling-of-not-knowing thwarts people's ability to rely on implicit memory by focusing attention on their inability to recall the explicit price information. This focus on their metacognitive experience then blocks their ability to rely on implicit memory, which they could have otherwise used to make a correct comparison if they were not focused on their memory failure.

[1]Blocking has also been discussed in the context of associative learning (e.g., Rescorla and Wagner 1972; Van Osselaer 2008). However, because such blocking happens during the learning phase and not during the retrieval phase, we do not review it here.

Figure 1
HOW RECALL ATTEMPTS BLOCK IMPLICIT MEMORY THROUGH THE FEELING-OF-NOT-KNOWING

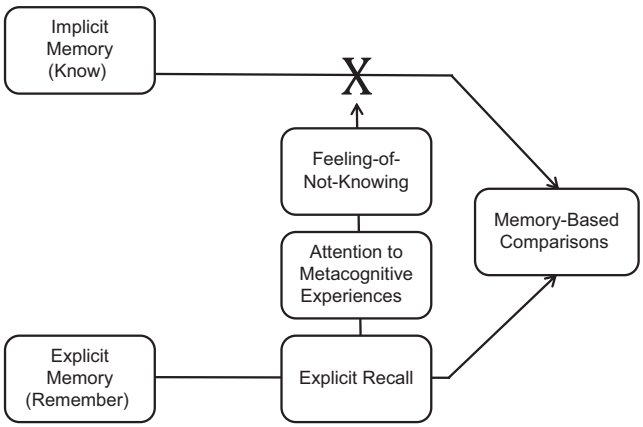


Figure 1 schematically depicts the mechanism underlying this feeling-based memory blocking, which we refer to as metacognitive memory blocking. Paradoxically, those making the same judgment without trying to explicitly recall the comparison standard are less likely to experience this feeling and, thus, tend to be more accurate. Stated formally, when the recall task is difficult,

H_1: Participants who explicitly attempt price recall before making price comparisons (recall-and-compare condition) make fewer accurate price comparisons than those who try to make the same judgment without attempting to do so (compare-only condition).

Central to our theorizing is the postulate that the feeling-of-not-knowing, inferred from the metacognitive experience of recall failure, is not caused by changes in the underlying content of information in memory. Previous research has demonstrated that recall attempts can cause "destructive updating of memory" if people recall incorrect information that can overwrite the originally encoded information (Loftus 1979; Loftus, Schooler, and Wagenaar 1985) or create an alternative memory trace based on an alternative mental representation (Adaval and Wyer 2004; Schooler and Engstler-Schooler 1990). In contrast, memory blocking caused by feeling-of-not-knowing manifests under conditions of recall failure—when people fail to recall any information. How can we know that recall-induced memory blocking is, indeed, caused by feeling-of-not-knowing and not by some other process such as memory overwriting or spillover from negative mood from failing at a task? To test the proposed conceptual model (Figure 1), we examine two key hypotheses about the underlying process.

First, we hypothesize that feeling-of-not-knowing entails a specific inference about memory based on the metacognitive experience of recall. This would suggest that the inference of feeling-of-not-knowing must be specifically about the memory task at hand and cannot be caused by any irrelevant metacognitive experience or negative mood that might spill over into unrelated judgments (Schachter and Singer 1962; Schwarz and Clore 1983). Second, we hypothesize that changing

attention to feeling-of-not-knowing can moderate the effect of metacognitive memory blocking. This would suggest that the effect is not based on memory overwriting, where the original memory trace is overwritten or altered and cannot be accessed in the future (Loftus 1979; Loftus, Schooler, and Wagenaar 1985). We detail these two hypotheses about the underlying mechanisms in the following subsections.

Inferring Feeling-of-Not-Knowing from Metacognitive Experience

Our theory suggests that recall-induced memory blocking is caused not by a general feeling of recall difficulty or negative mood that spills over into judgments (Schachter and Singer 1962; Schwarz and Clore 1983) but by a specific heuristic inference about the veracity of memory for the particular task at hand. Previous research has shown that although metacognitive inferences are heuristic in nature, the attribution process that underlies these inferences is quite sophisticated. Schwarz (2004) argues that once a metacognitive experience has been attributed to a particular cause, it is explained away and not used as a cue for another judgment. For example, if difficulty experienced when recalling a name is attributed to linguistic complexity ("the name is difficult to pronounce"), people are unlikely to use that same experience to make inferences about their own memory ("I am bad at recalling names").

In a similar vein, Whittlesea (1993) demonstrates that processing difficulty induced by perceptual features (e.g., a visual mask) influences judgments of perceptual familiarity but does not affect judgments about conceptual familiarity, because people realize, at a subconscious level, that perceptual difficulty is not relevant to judgments of conceptual similarity.[2] Similarly, in their accessibility-diagnosticity framework, Feldman and Lynch (1988) suggest that accessibility experiences do not influence judgments when they are not perceived as diagnostic. Following this logic, we hypothesize that recall-induced memory blocking is task specific: consumers can distinguish between a feeling-of-not-knowing engendered by relevant (e.g., failing to recall the previous price) versus irrelevant (e.g., failing to recall the name of the store manager) metacognitive experiences. If they experience metacognitive difficulty from a domain that is clearly irrelevant to the subsequent judgment, they will infer that the feeling-of-not-knowing is not relevant to the judgment at hand. More formally,

H_2: The feeling-of-not-knowing induced by recall failures does not reduce the accuracy of memory-based price comparisons when the feeling is unrelated to the price comparison judgment.

Attention to Metacognitive Experience

How can we be sure that the disruptive effect of attempting recall is caused by blocking from the feeling-of-not-knowing, inferred from metacognitive experience, and not by overwriting the original memory trace? If recall attempts block implicit memory through the feeling-of-not-knowing inferred from the metacognitive experience of recall failure, as opposed to overwriting the original memory trace (see Figure 1), then altering attention to metacognitive experience should alter the resulting inference and moderate the effect of feeling-of-not-knowing. Thus,

H_{3a}: Increasing attention to metacognitive experience by generating a feeling-of-not-knowing, even in the absence of attempting recall, reduces the accuracy of memory-based comparisons.

H_{3b}: Reducing attention to metacognitive experience, even when attempting recall, reduces the feeling-of-not-knowing and increases the accuracy of memory-based comparisons.

Note that in an experimental setting, it is much easier to increase attention to the feeling-of-not-knowing than to reduce attention to it. Attention to the feeling-of-not-knowing can be increased by directly instructing participants to focus on the extent to which they feel that they know or do not know the past prices, even if they do not attempt price recall. However, such direct manipulations cannot be used to draw attention *away* from the feeling-of-not-knowing. Directly asking participants *not* to focus on their feeling-of-not-knowing is likely to backfire by making them more sensitive to their metacognitive feelings. Wegner et al. (1987) demonstrate that direct thought-suppression instructions often have an opposite effect because the attentional processes initiated to suppress forbidden thoughts ironically increase their salience. Thus, in our experiments, we used an indirect way to reduce attention to feeling-of-not-knowing: manipulating construal mindset.

Recent research has suggested that an abstract construal mindset can reduce attention to the metacognitive experience of difficulty and increase reliance on implicit memory. In a concrete mindset, people are "how" oriented (i.e., focused on process and the low-level aspects of a task; e.g., how to do it); in an abstract mindset, people are "why" oriented (i.e., focused on outcomes and the higher-level aspects of a task; e.g., why they do it) (Trope and Liberman 2010; Vallacher and Wegner 1989). Drawing on this premise, Trope and Liberman (2010) postulate that construal mindset can moderate the effect of task difficulty on confidence: task difficulty is more likely to reduce confidence under a concrete versus abstract mindset. This postulate is consistent with Strack, Martin, and Stepper's (1988) proposal that people are more likely to rely on feelings to make judgments when they focus on "how" they feel (concrete mindset) rather than "why" the feeling occurred (abstract mindset).

Consistent with these theorizations, Thomas and Tsai (2012) demonstrate that an abstract construal level can reduce attention to metacognitive difficulty. Participants' decisions are less influenced by the metacognitive experience of choice difficulty when they are in a why (abstract) versus how (concrete) mindset. Similarly, processing difficulty caused by difficult-to-read font, difficult thought generation, and decision-making trade-offs (Goodman and Malkoc 2012; Tsai and Thomas 2011) all influence participants less in an abstract than a concrete mindset. From this literature, we propose that concrete mindsets increase metacognitive monitoring and reliance on explicit memory,

[2]Whittlesea (1993, p. 1249) argues that the metacognitive "inferential process is highly sophisticated, taking into account the specific demands of the judgment to be made, the type of experience provided by the task, and the likely effects of various kinds of earlier experience on later processing. Consequently, the heuristic is applied selectively, under circumstances in which it is normatively appropriate."

whereas abstract mindsets reduce metacognitive monitoring and increase reliance on implicit memory. Thus, in our experiments, we use construal mindset as a way to manipulate attention to metacognitive experience. An abstract mindset should reduce attention to the experience of recall difficulty and thus reduce the feeling-of-not-knowing. Therefore, recall failures or recall difficulty should not disrupt implicit memory-based comparisons under an abstract mindset, and we demonstrate that construal mindsets can moderate memory blocking effects.

OVERVIEW OF THE EXPERIMENTAL PARADIGM

Next, we describe the general paradigm employed for all our experiments. Each experiment entailed two parts. The first part was a shopping study in which participants were exposed to the prices of 20 items from a grocery store in the guise of market research. The second part was a memory-based price comparison task that participants were not forewarned about. Because participants were shown a large number (i.e., 20) of products in the first part of the experiment, and because they were not aware of the ensuing second part, they could not have memorized the 20 prices shown in the first part. Therefore, they had to rely on their implicit memory to respond to the second part. We examine the effect of recall attempts on these implicit memory-based price comparisons.

Shopping Study: Encoding Task

All participants first responded to a shopping study, ostensibly designed to study customer preferences. The actual purpose of the study was to expose participants to the reference prices for each product. Participants were told that a large retail grocery chain interested in opening a store in their neighborhood was conducting a simulated shopping task to assess their preferences. Participants saw 20 frequently purchased grocery items (e.g., oatmeal, chips, cookies) and indicated whether they would purchase the product. Each product was presented one at a time on the computer screen, which included the product's name, picture, and price. Web Appendix A lists the items and their prices. Participants indicated their purchase decision by clicking on one of the two buttons at the bottom of the screen: "Add to Cart" or "Do Not Add to Cart" (see Web Appendix B.1). The order of presentation was randomized for each participant.

Comparison Study: Memory-Based Task

Participants were then presented with an unanticipated task: making memory-based price comparisons. They were told that they would see the same set of products again, but with new prices that could be lower than, higher than, or the same as the previously encountered price. For half of the 20 products, the new prices were \$1 lower than the original prices, and for the other half, the new prices were \$1 higher (see Web Appendix A). Participants were randomly assigned to one of two between-subjects conditions: compare-only (price comparison task only) or recall-and-compare (price recall before each price comparison). All participants saw the same 20 products as in the shopping study, one at a time, with the name, picture, and new price for each.

Compare-only condition. Participants assigned to the compare-only condition were asked to indicate whether the new price was (1) lower than, (2) the same as, or (3) higher than the previous price by clicking on one of three response buttons presented below the product and price information (see Web Appendix B.2).

Recall-and-compare condition. The price comparison task was identical for participants in both conditions. The only difference was that those in the recall-and-compare condition were first asked to engage in price recall before making price comparisons (see Web Appendix B.3). Participants were asked to try to recall the previous price, if they could do so, and enter it in an open-ended response box above the price comparison task. Importantly, if they could not recall the previous price, they could leave the response box blank and proceed with the price comparison. Note that the participants in all of our experiments were not forced to recall the prices; they were merely encouraged to recall the price if they could. Our interest was in studying the disruptive effect of merely attempting price recall. We followed this basic paradigm for all experiments, with minor modifications.

EXPERIMENT 1A: DISRUPTING IMPLICIT MEMORY OVERNIGHT

We designed the first experiment with two objectives. The first was to test whether people can rely on implicit memory to make price comparisons. To test this, participants were given the encoding task on one day and then engaged in an explicit recall task the following day. Most people are unable to memorize 20 product prices after one brief exposure to each, particularly when they are not warned that there is an upcoming memory task. Thus, after a full day has passed since the encoding task, participants must rely more on implicit memory (than on explicit memory) to make the price comparisons (Jacoby et al. 1989; Skurnik et al. 2005). Second, and more importantly, we test the hypothesis that merely attempting price recall can block this implicit memory (H_1). We examined the difference in accuracy for price comparisons between those participants asked to make only price comparisons (compare-only condition) and those asked to try to recall the previous prices before making a price comparison (recall-and-compare condition).

Method

The study was completed in two stages using the Amazon Mechanical Turk (MTurk) worker pool. In part 1, all participants completed the encoding task described in the experimental paradigm within a four-hour time frame and were paid \$1. These participants were then asked to complete part 2 the following day within the same four-hour time frame and were paid \$2. In part 2, participants were randomly assigned to the compare-only or the recall-and-compare condition, as outlined in the description of the experimental paradigm. The encoding task was completed by 193 participants, and 143 of these participants (average age: 36.5 years; 46% female) completed the recall task on the following day.

Results and Discussion

In all experiments, we removed those participants whose total experiment time was more than three standard deviations

from the mean of all participants to ensure that the results did not depend on respondents who spent excessive time on the encoding or recall tasks. Although we did this as a measure of abundant caution, none of the main results changed with this removal. In this experiment, two respondents were removed. In the interest of brevity, we report these removals for all remaining experiments in Web Appendix C.

For ease of comprehension, we report the average percentage of responses (correct price comparisons, recall failures, and correct recall) by condition for all experiments. However, we conducted all of the analyses empirically testing the significance of the results using a mixed model with SAS PROC GLIMMIX, conducting repeated-measures logistic regressions that both capture the subject-specific effect and correct for any heterogeneity in variance.

Price comparison judgments. A mixed-model repeated-measures logistic regression with comparison type as the predictor (compare-only = −1, recall-and-compare = 1) and accuracy of price comparisons as the dependent measure (incorrect = 0, correct = 1) revealed that participants in the recall-and-compare condition made significantly fewer accurate price comparisons (M_{RC} = 52.0%) than those in the compare-only condition (M_{CO} = 56.9%; $\beta = -.10$, $t = -2.66$, $p < .01$; for a summary, see Table 1; for a graph, see Figure 2).

Price recall responses. On average, those in the recall-and-compare condition failed to generate a response 72.0% of the time and recalled prices correctly only 4% of the time, suggesting that participants experienced a feeling-of-not-knowing during the price recall task. Note that our theory does not suggest that attempting recall will always result in feeling-of-not-knowing and undermine comparison judgments; the feeling-of-not-knowing stems from recall failure. When participants actually recall the correct price, they should be more likely to make correct price comparisons. To test this prediction, we conducted an additional repeated-measures logistic regression with correct price recall as the predictor (incorrect = 0, correct = 1) and correct price comparison as the dependent measure (incorrect = 0, correct = 1). Web Appendix D reports the results of these analyses for all experiments, which show that in those few instances in which participants correctly recalled the price, they were more likely to make a correct price comparison.

This experiment provides initial evidence for metacognitive memory blocking. Attempting price recall reduces the accuracy of price comparisons—participants who explicitly attempted price recall were approximately 9% less accurate in their price comparisons than those who did not attempt price recall, in support of H_1. Our theorizing suggests that this disruptive effect of recall arises because consumers experience a feeling-of-not-knowing from attempting price recall that carries over into the subsequent price comparison judgment, blocking their ability to rely on implicit memory. Because of the 24-hour delay between the encoding and recall tasks, participants are more likely to rely on implicit memory when making price comparisons. The next experiment specifically tests whether attempting recall generates a feeli ng-of-not-knowing.

EXPERIMENT 1B: ATTEMPTING RECALL INCREASES FEELING-OF-NOT-KNOWING

In Experiment 1b, we test whether merely attempting price recall (vs. not) actually increases participants' feeling-of-not-knowing for related price comparison judgments, leading to metacognitive memory blocking. This experiment is nearly identical to Experiment 1a, but it differs in that it offers participants a "don't know" option for price comparison judgments. We again predict that participants in the recall-and-compare condition will make fewer accurate price comparisons than those in the compare-only condition, and that they are more likely to select a "don't know" response, indicating a feeling-of-not-knowing. To confirm the validity of our results, this experiment was conducted in a laboratory with a student population rather than an online panel. In addition, unlike in Experiment 1a, the two parts of Experiment 1b (the shopping study and the comparison study) were administered in the same session. Thus, this experiment aims to confirm that recall will disrupt comparisons even when the comparison task immediately follows the encoding stage.

Method

Participants and procedure. This experiment was programmed in Adobe Authorware and administered on computers in a laboratory to groups of three to eight participants. One hundred undergraduate and graduate students (average age: 20.1 years; 70% female) at a U.S. university participated in this and other unrelated studies in exchange for one course credit.

Encoding and recall tasks. The encoding task was similar to that of Experiment 1a, with the exception of slight visual differences as a result of the different software used to program the experiment (for screenshots, see Web Appendix E). The recall task differed in offering a "don't know" button as a response option for the price comparison judgments.

Results and Discussion

Price comparison judgments. Because there were three response options for each product, we conducted three separate mixed-model repeated-measures logistic regressions with comparison type as the predictor (compare-only = −1, recall-and-compare = 1) and correct, incorrect, and don't know as three sets of dummy-coded responses. The analysis revealed that, consistent with Experiment 1a, participants in the recall-and-compare condition made fewer accurate price comparisons (M_{RC} = 37.7%) relative to those in the compare-only condition (M_{CO} = 46.2%; $\beta = -.17$, $t = -3.81$, $p < .01$), though they were equally likely to make an incorrect response (M_{RC} = 34.2% vs. M_{CO} = 33.4%; $\beta = .02$, $t = .39$, $p = .69$). Most importantly, those in the recall-and-compare condition were more likely to select a "don't know" response (M_{RC} = 28.1%) relative to those in the compare-only condition (M_{CO} = 20.4%; $\beta = .21$, $t = 3.95$, $p < .01$; see Table 1 and Figure 2), providing evidence for the role of the feeling-of-not-knowing.[3]

Price recall responses. On average, those in the recall-and-compare condition failed to generate a response 83.5% of the time and recalled prices correctly 7.7% of the time. This experiment replicates the disruptive effect of attempting price recall on the accuracy of price comparisons, again in support of H_1, and provides evidence that merely

[3]We also fitted a multinomial model to the data using PROC CATMOD. The results from this analysis corroborated the reported results.

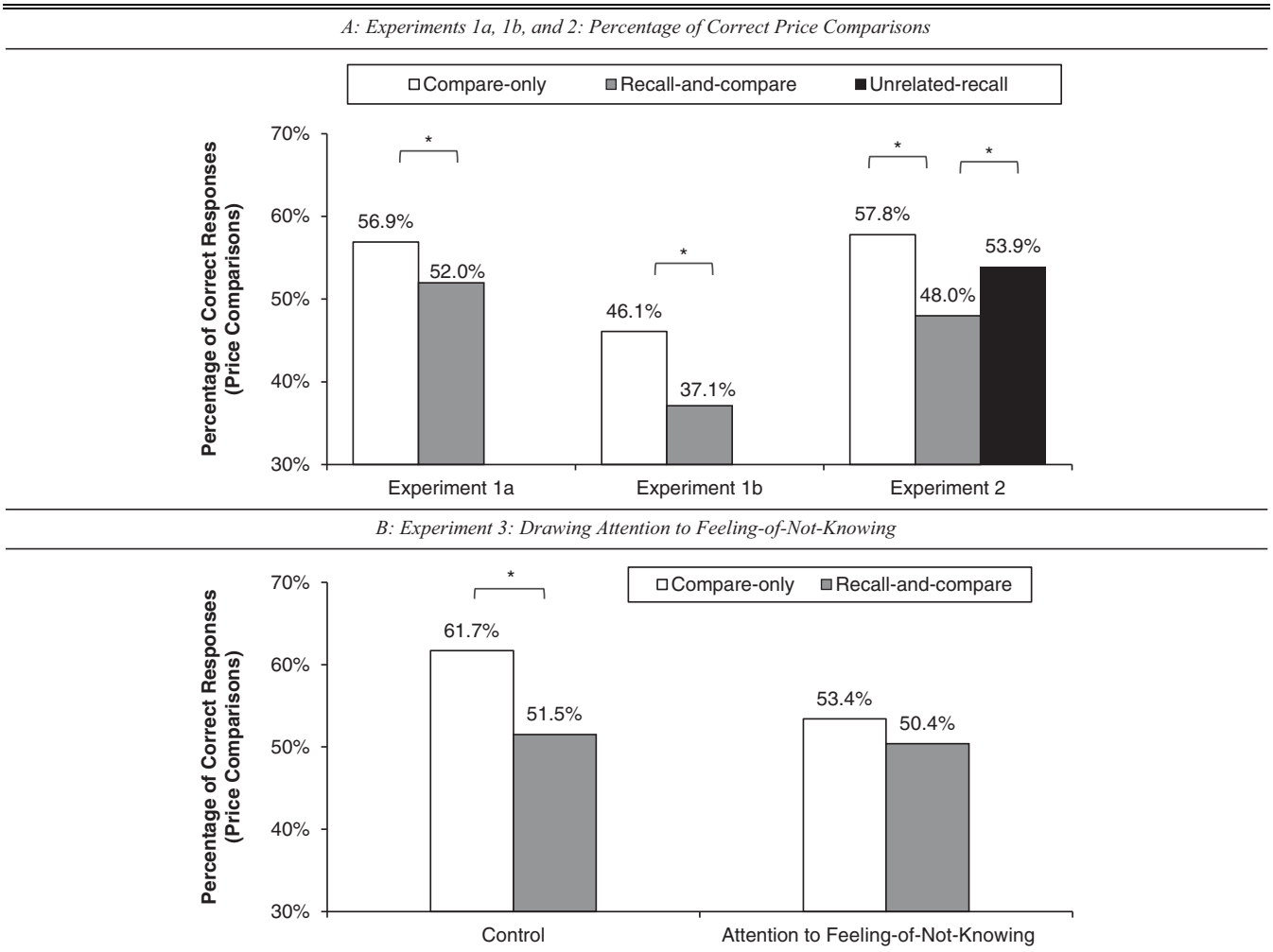
Table 1
SUMMARY OF RESULTS

	Comparisons				*Recall*	
	Correct	*Incorrect*	*Don't Know*	*Feeling-of-Not-Knowing Measure*[a]	*Recall Failures*	*Correct Recall*
Experiment 1a: Price Recall Disrupts Price Comparisons						
Compare-only	56.9%	43.1%	—	—	—	—
Recall-and-compare	52.0%	48.0%	—	—	72.0%	4.0%
Experiment 1b: Attempting Recall Increases the Feeling-of-Not-Knowing						
Compare-only	46.2%	33.4%	20.4%	—	—	—
Recall-and-compare	37.7%	34.2%	28.1%	—	83.5%	7.7%
Experiment 2: Relevance of Metacognitive Experiences						
Compare-only	57.8%	42.2%	—	—	—	—
Recall-and-compare	48.0%	52.0%	—	—	80.9%	7.1%
Unrelated-recall-and-compare	53.9%	46.1%	—	—	73.6%	9.5%
Experiment 3: Drawing Attention to Feeling-of-Not-Knowing						
Control						
Compare-only	61.7%	38.3%	—	43.9%	—	—
Recall-and-compare	51.5%	48.5%	—	52.5%	76.4%	6.3%
Attention to Feeling-of-Not-Knowing						
Compare-only	53.4%	46.6%	—	51.8%	—	—
Recall-and-compare	50.4%	49.6%	—	48.9%	72.6%	8.2%
Experiment 4a: Reducing Feeling-of-Not-Knowing Through Construal Mindset						
Concrete (How) Mindset						
Compare-only	59.6%	40.4%	—	39.9%	—	—
Recall-and-compare	51.6%	48.4%	—	55.3%	73.0%	9.9%
Abstract (Why) Mindset						
Compare-only	60.4%	39.6%	—	41.2%	—	—
Recall-and-compare	58.7%	41.3%	—	46.0%	73.8%	11.4%
Experiment 4b: Reducing Feeling-of-Not-Knowing Through Chronic Construal Mindset[b]						
Concrete (How) Mindset						
Compare-only	56.6%	43.4%	—	—	—	—
Recall-and-compare	46.6%	53.4%	—	—	79.7%	6.2%
Abstract (Why) Mindset						
Compare-only	53.0%	47.0%	—	—	—	—
Recall-and-compare	51.8%	48.2%	—	—	79.8%	6.5%

[a]Feeling-of-not-knowing measure = 1 − [participant estimate of correct number of response/20 total responses]. Higher numbers indicate greater feeling-of-not-knowing.

[b]Values are expected values at 1 SD above (abstract) and 1 SD below (concrete) the mean of chronic construal level. We include the spotlight analysis to demonstrate correspondence with results from Experiment 4a; for the results of the floodlight analysis, see Web Appendix H.

Figure 2
RESULTS OF EXPERIMENTS 1A, 1B, 2, AND 3



*$p < .05$.
Notes: The brackets above the bars indicate which conditions are being compared.

attempting price recall increases participants' feelings-of-not-knowing in their subsequent price comparison judgments. The proportion of incorrect responses was the same between conditions (M_{CO} = 33.4%, M_{RC} = 34.2%), while the proportion of "don't know" responses was greater for those participants who first attempted price recall. This result shows that asking participants to engage in explicit price recall increased their uncertainty in their ability to make subsequent price comparisons. Comparing this result with that of Experiment 1a suggests that when given a "don't know" option, participants may choose it even when they can make an accurate price comparison by relying more on implicit memory. That is, providing "don't know" as a response option seems to prompt participants to rely more on "remember" judgments based on explicit memory rather than on "know" judgments based on implicit memory. Because our interest is in studying "know" judgments, we return to the format without the "don't know" option in the experiments that follow so as not to mask any potentially correct responses participants might make by relying more on their implicit memory. For the remaining experiments, the recall task immediately followed the encoding task to avoid issues related to losing participants between the two phases.

EXPERIMENT 2: RELEVANCE OF METACOGNITIVE EXPERIENCES

Our theory suggests that metacognitive memory blocking is not a spillover of negative mood from recall failures. Rather, we posit that it is a specific inference about the veracity of memory and that people can differentiate between the feeling-of-not-knowing from relevant versus irrelevant metacognitive experiences for subsequent judgments. If this is the case, an inability to recall information that is completely unrelated to price comparisons should not disrupt memory-based price comparisons in the same way (H_2). To test this hypothesis, we added another unrelated encoding and recall task to the experiment. The first encoding task was identical to that of the previous experiment (shopping study). Next, under the pretext of a

name evaluation task, all participants received a second encoding task consisting of 20 names combining the most common first and last names in the United States according to the U.S. Census Bureau. They were asked to rate how much they liked these names and were not forewarned of a future recall task. Finally, participants were assigned to one of three conditions for the recall task. The first two conditions were the compare-only and recall-and-compare conditions of the previous experiment. In the third, new condition (unrelated-recall-and-compare), rather than asking participants to recall a price, we asked them to recall the last name that matched with the first name they had seen during the name encoding task before making the price comparison. Although we believe participants in this condition will experience a rate of memory recall failure similar to that of participants in the recall-and-compare condition, they should not experience the same disruptive effect on their price comparison judgments, because the feeling-of-not-knowing they experience is irrelevant for the subsequent judgment.

Method

Participants and procedure. The experiment was programmed using Adobe Flash and administered online. Two hundred twenty-three members of the MTurk worker pool participated in the online computer study (average age: 33.5 years; 62% female) for $1.50. Participants were randomly assigned to one of three recall task conditions: compare-only, recall-and-compare, or unrelated-recall-and-compare. They were told they would complete a series of three studies, each described in detail in the following subsections. They were not forewarned that any of the studies would entail a memory-related task.

Price encoding task. All participants completed the "Shopping Study" described in the overview of the experimental paradigm.

Unrelated encoding task. All participants then completed the "Name Preference Study." They were told that we were seeking their opinion on names to use in future studies and were asked to rate each of the 20 names according to how much they liked them (1 = "not at all," and 9 = "very much"). We constructed the names by randomly combining 20 of the 21 most common first names and the 20 most common last names in the United States according to the U.S. Census Bureau. One of the 20 most common first names was not used because it was also among the 20 most common last names.[4] We wanted to ensure that each first and last name had only one exposure during the encoding task. Participants were not forewarned of the ensuing recall task.

Recall task. The price comparison tasks for the compare-only and the recall-and-compare conditions were identical to those described in the experimental paradigm. The screen for the unrelated-recall-and-compare condition was very similar to that of the recall-and-compare condition, with one difference: rather than being asked to recall the previous price before making the price comparison, participants were encouraged to try to recall the last name that went with the first name they had seen earlier (see Web Appendix F). As with the recall-and-compare conditions, participants could leave the box for the name recall task blank. The names were presented in randomized order (see Web Appendix G).

Results and Discussion

Recall responses in the recall-and-compare and unrelated-recall-and-compare conditions. First, we examined whether the recall tasks were relatively evenly matched. On average, those in the price recall-and-compare condition failed to generate a response 80.9% of the time and recalled a correct price 7.1% of the time (see Table 1). Those in the unrelated-recall-and-compare condition failed to generate a response 73.6% of the time and recalled a correct name 9.5% of the time. A mixed-model repeated-measures logistic regression with condition as the predictor (recall-and-compare = 0, unrelated-recall-and-compare = 1) and recall failure as the dependent measure (recall attempt = 0, recall failure = 1) revealed no significant difference between the recall-and-compare and unrelated-recall-and-compare conditions ($\beta = -.42$, $t = -1.61$, $p = .11$). A similar mixed-model repeated-measures logistic regression with correct recall as the dependent measure (incorrect recall = 0, correct recall = 1) revealed no significant difference between the two recall conditions ($\beta = .32$, $t = 1.29$, $p = .20$).

Price comparison judgments. We conducted a mixed-model repeated-measures logistic regression with two condition dummy variables, one variable with the recall-and-compare condition coded as 1 and another variable with unrelated-recall-and-compare condition coded as 1. The compare-only condition served as the reference condition.[5] The accuracy of price comparisons was the dependent measure. As in Experiments 1a and 1b, participants in the recall-and-compare condition made significantly fewer accurate price comparisons ($M_{RC} = 48.0\%$) than those in the compare-only condition ($M_{CO} = 57.8\%$; $\beta_{RC} = -.39$, $t = -3.02$, $p < .01$; see Figure 2), but those in the unrelated-recall-and-compare condition ($M_{URC} = 53.9\%$) were not significantly less accurate than those in the compare-only condition ($\beta_{URC} = -.16$, $t = -1.43$, $p = .15$). In addition, a follow-up analysis with recall-and-compare coded as the reference category confirmed that participants in the unrelated-recall-and-compare condition made significantly more accurate price comparisons than those in the recall-and-compare condition ($\beta_{URC\ vs.\ RC} = .24$, $t = 2.09$, $p = .04$).

Effect of recall failure relevance on price comparisons. To evaluate the effect of recall failures on the accuracy of price comparisons, we conducted a mixed-model repeated-measures logistic regression within each condition (recall-and-compare and unrelated-recall-and-compare) with recall failure as the predictor (recall attempted = 0, recall failure = 1) and the accuracy of each price comparison as the dependent measure (incorrect = 0, correct = 1). In the recall-and-compare condition, the effect of recall failure on the accuracy of price comparisons was significant ($\beta = -.28$, $t = -2.08$, $p = .04$): a greater number of recall failures predicted a lower number of accurate price comparisons. However, in the unrelated-recall-and-compare condition, the effect of recall failure on the

[4]Incidentally, this name was also the last name of one of the coauthors. One of the coauthors was more excited than the other about this discovery.

[5]We used dummy coding for this analysis rather than effect coding so that each coefficient represented the difference between that condition and the reference (compare-only) condition and not the grand mean.

accuracy of price comparisons was not significant ($\beta = -.06$, $t = -.48$, $p = .63$): failing to recall names did *not* predict the accuracy of price comparisons.

Posttest comparison of perceived task difficulty. To ensure that participants did not simply find the name recall task easier than the price recall task, we conducted a posttest of each of the recall tasks without the price comparison task and asked participants how easy or difficult they found the recall task (1 = "very easy," and 9 = "very difficult"). A one-way analysis of variance revealed the participants found the name recall task significantly more difficult ($M_{name} = 7.61$) than the price recall task ($M_{price} = 4.69$, $F(1, 118) = 56.88$) even through the rates of recall failure across both tasks were similar ($M_{name} = 65.6\%$ vs. $M_{price} = 73.0\%$; $F(1, 118) = 2.26$, $p = .14$). Thus, the results from this study cannot be attributed to participants finding the name recall task less difficult.

These results support H_2 and suggest that metacognitive difficulty caused by an irrelevant recall task does not reduce the accuracy of price comparisons to the same extent as attempting price recall. People are able to discern between the feeling-of-not-knowing inferred from relevant versus irrelevant metacognitive experiences. The feeling-of-not-knowing that results from relevant tasks is most detrimental in blocking memory. Furthermore, this experiment also provides evidence that the effect does not stem simply from distraction (e.g., any difficult task would undermine judgments). Note that we do not suggest that an unrelated recall task would never undermine price comparison judgments. In some cases, failing at some unrelated recall task could cause a person to conclude more generally, "My memory is quite poor—I must not know the answer." Rather, we suggest that both the metacognitive experience and the inference drawn from this experience together influence judgments.

Together, Experiments 1a, 1b, and 2 provide evidence that merely attempting to recall prices causes people to be less accurate in subsequent price comparisons. In our theorizing, we suggest that this is because attempting price recall draws attention toward metacognitive experience and thus increases the likelihood of inferences related to the feeling-of-not-knowing. If this is the case, then drawing attention to people's metacognitive experience by generating a feeling-of-not-knowing, even when they are not attempting price recall, should have a similar blocking effect on price comparisons.

EXPERIMENT 3: DRAWING ATTENTION TO FEELING-OF-NOT-KNOWING

If attempting price recall directs attention to metacognitive experience and results in an inference of feeling-of-not-knowing, then increasing attention to metacognitive experience by generating feeling-of-not-knowing, even in the absence of price recall, should have the same detrimental blocking effect on comparison judgments (H_{3a}). We predict that when participants are asked to question their metacognitive experience while making price comparisons, participants in the compare-only condition will be as inaccurate as those in the recall-and-compare condition because they will also infer a feeling-of-not-knowing, and their attention is drawn to their metacognitive experience. Furthermore, we explicitly test the mediating role of feeling-of-not-knowing on the accuracy of price comparison judgments.

Method

Participants and procedure. The experiment was programmed using Adobe Flash and administered online. One hundred ninety-eight members of the MTurk worker pool participated in this online computer study (average age: 31.4 years; 59% female) in exchange for $1.50. Participants were randomly assigned to one of four recall task conditions in a 2 (comparison type: compare-only vs. recall-and-compare) × 2 (attention: control vs. attention to feeling-of-not-knowing) between-subjects design.

Manipulating attention to feeling-of-not-knowing. The encoding task was identical to that described in the overview of the research paradigm. The recall task was largely identical, except that participants in the attention-to-feeling-of-not-knowing conditions read the following instructions before making any recall judgments:

> For this study, we are interested in understanding the extent to which you feel you know or do NOT know the answers when making price judgments. Please focus on these feelings while making the price evaluations on the following screens.

To ensure that participants read the instructions, they were then asked to indicate their agreement with the statement: "I will focus on my feelings of knowing and not knowing the answers while evaluating the prices on the following screens" (1 = "disagree," and 9 = "agree").

Feeling-of-not-knowing measure. After completing the recall task, as a measure of feeling-of-not-knowing, all participants were asked, "For the questions where you were asked whether the new price was higher, lower, or the same as the previous price, how many of your 20 answers do you think were correct?" They then entered a number between 0 and 20 in the answer box. Participants were asked how many questions they believed they answered correctly—as opposed to incorrectly—so that the question itself did not engender a feeling-of-not-knowing. This question was asked after the price comparison judgments because asking the question before making judgments would have increased focus on metacognitive experience.

Manipulation check. As a manipulation check, participants were asked, "To what extent do you agree or disagree with the following statement: When evaluating the prices, I focused on my feelings of knowing and not knowing the answers when making judgments" (1 = "strongly disagree," 9 = "strongly agree").

Results and Discussion

Manipulation check. A two-way analysis of variance revealed only a significant main effect of attention to feeling-of-not-knowing: participants in the attention-to-feeling-of-not-knowing conditions focused more on their feelings of knowing the answers when making their judgments ($M = 8.19$) than those in the control conditions ($M = 6.47$; $F(1, 192) = 60.9$, $p < .01$).

Price comparison judgments. A mixed-model repeated-measures logistic regression with the accuracy of price comparisons as the dependent measure and comparison type (compare-only = −1, recall-and-compare = 1), attentional orientation (control = −1, focus on feeling-of-not-knowing = 1), and their interaction as the predictors

revealed significant effects of comparison type ($\beta = -.13$, $t = -4.14$, $p < .01$) and attentional orientation ($\beta = -.10$, $t = -2.96$, $p < .01$), and, more importantly, a significant interaction between the two ($\beta = .075$, $t = 2.32$, $p = .02$). Consistent with the previous experiments, planned comparisons revealed that in the control conditions, participants in the recall-and-compare condition made significantly fewer accurate price comparisons ($M_{control:\ RC} = 51.5\%$) than those in the compare-only condition ($M_{control:\ CO} = 61.7\%$; $\beta = -.72$, $t = -3.47$, $p < .01$; for a summary of means, see Table 1; for a graphical representation of results, see Figure 2). However, when attention was focused on feeling-of-not-knowing, participants in the compare-only condition ($M_{attn:\ CO} = 53.4\%$) were as inaccurate as those in the recall-and-compare condition ($M_{attn:\ RC} = 50.4\%$; $\beta = -.12$, $t = -1.31$, $p = .20$).

Price recall responses in the recall-and-compare conditions. In the recall-and-compare conditions, participants in the control ($M_{control} = 76.4\%$) and attention-to-feeling-of-not-knowing ($M_{attn} = 72.6\%$) conditions experienced similar rates of recall failure ($\beta = -.10$, $t = -.59$, $p = .56$) and accuracy for price recall judgments ($M_{control} = 6.3\%$ vs. $M_{attn} = 8.2\%$; $\beta = .15$, $t = .92$, $p = .36$). These analyses, like the previous analyses, were conducted with mixed-model repeated-measures logistic regression.

Moderated mediation by feeling-of-not-knowing. To test the hypothesized role of the feeling-of-not-knowing underlying the recall-induced blocking effect, we conducted a moderated mediation analysis using the PROCESS macro Model 8 (Hayes 2013; Preacher, Rucker, and Hayes 2007). We operationalized feeling-of-not-knowing for each participant as 20 minus the estimated number of correct price comparisons reported by that participant.[6] This measure—the subjective estimate of incorrect responses reported by each participant—reflects the feeling-of-not-knowing experienced during the price comparison task; the higher the score, the greater the feeling-of-not-knowing. We predicted that feeling-of-not-knowing would mediate the effect of comparison type (compare-only vs. recall-and-compare) on the actual accuracy of price comparison judgments (total number of correct judgments) in the control conditions, but not in the attention-to-feeling-of-not-knowing conditions. We used a 5,000-draw bootstrapping sample to examine the significance of the direct and indirect effects of comparison type on the accuracy of price comparison judgments depending on attention to feeling-of-not-knowing. As we predicted, the conditional direct effect of comparison type on the accuracy of price comparisons was significant in the control conditions (direct effect = −.80, $CI_{95\%} = [-1.42, -.18]$) but was not significant when attention was drawn to feeling-of-not-knowing (direct effect = −.37, $CI_{95\%} = [-.97, .23]$. Furthermore, the indirect effect through feeling-of-not-knowing was significant in the control conditions (indirect effect = −.22, $CI_{95\%} = [-.51, -.029]$), but not when attention was drawn to feeling-of-not-knowing (indirect effect = .076, $CI_{95\%} = [-.15, .37]$). Importantly, the index of moderated mediation, the test of significance of moderation of the indirect effect by the moderator, was statistically significant (index = .30, $CI_{95\%} = [.0018, .74]$).

[6]Note that 20 is the maximum number of correct responses in the price comparison task.

Experiment 3 provides further evidence behind why attempting price recall can block price comparison judgments: attempting price recall draws attention to metacognitive experience and inferences of feeling-of-not-knowing, which in turn blocks reliance on implicit memory. Asking participants to question their metacognitive experience creates feeling-of-not-knowing that undermines the accuracy of price judgments, regardless of the comparison type. Even those participants in the compare-only condition who were not asked to attempt price recall were less likely to make correct price comparisons, in support of H_{3a}. The moderated mediation analysis provides evidence that participants' feeling-of-not-knowing mediated the effect of comparison type, but only for those participants in the control conditions. The final set of experiments explores the underlying role of the feeling-of-not knowing by examining whether drawing attention away from metacognitive experience and the feeling-of-not-knowing inferred from this experience can restore the accuracy of price comparison judgments, even for those who attempt price recall.

EXPERIMENT 4A: REDUCING THE FEELING-OF-NOT-KNOWING—CONSTRUAL MINDSET

If the feeling-of-not-knowing, generated by attempting recall, blocks the use of underlying implicit memory as opposed to overwriting the original memory trace, then drawing attention away from metacognitive experience should attenuate the effect of recall on price comparison judgments. As described in our theorizing, one method that has been experimentally shown to draw attention away from metacognitive experiences is to induce people with a more abstract, "why"-oriented mindset that is focused more on the outcome (vs. process) of making judgments. Thus, we hypothesize that metacognitive memory blocking will be attenuated when participants are primed to adopt an abstract mindset that draws attention away from metacognitive experience caused by the judgment process (H_{3b}).

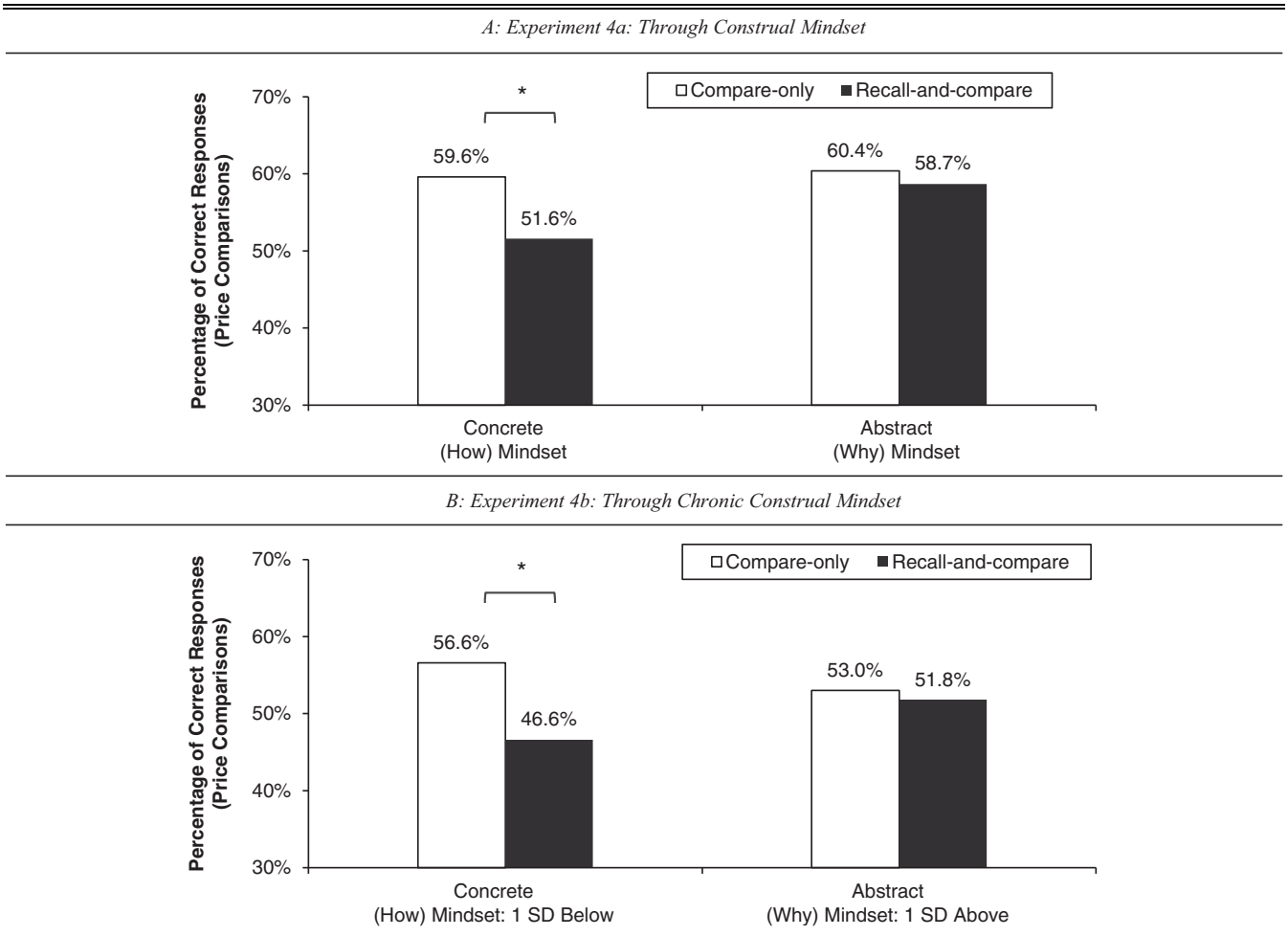
Method

Participants and procedure. The experiment was programmed using Adobe Flash and administered online. Three hundred seventy-six members on MTurk participated in this online computer study (average age: 32.2 years; 43% female) in exchange for $1.50. We employed a 2 (comparison task: compare-only vs. recall and compare) × 2 (construal mindset: abstract vs. concrete) between-subjects design and randomly assigned participants to one of the four conditions. They were told they would complete a series of three studies but were not informed that any of the studies would entail a memory-related task.

Encoding and recall tasks. The encoding and recall tasks were the same as those outlined in the overview of the experimental paradigm. At the end of the recall task, participants answered the same question as in Experiment 3 that served as the feeling-of-not-knowing measure.

Construal mindset manipulation. Between the encoding and recall tasks, participants completed a modified version of the Freitas, Gollwitzer, and Trope (2004) "how versus why" construal mindset manipulation, presented as an ostensibly unrelated study. This study was titled "**HOW** [*WHY*] Do You Make Price Comparisons?" for participants in a concrete [*abstract*] mindset, with the following instructions

Figure 3
REDUCING THE FEELING-OF-NOT-KNOWING



*$p < .05$.

(instructions for the concrete mindset are in boldface and those for the abstract mindset are in italics):

> Many consumers compare prices in their everyday life. There are many **ways in which** [*reasons why*] you might do this. For this next study, we are interested in understanding the process of **HOW** [*WHY*] consumers compare prices for products. Take a moment and think about **HOW** [*WHY*] you compare prices for products. On the next screen, we will ask you to describe **how you compare prices for products in three ways** [*three reasons why you compare prices for products*].

Participants were then presented with the following question, followed by three numbered, blank boxes on which to write their responses: "**HOW** [*WHY*] do you go about comparing the prices for products? Please give three **ways in which** [*reasons why*] you do this."

Results

Price comparison judgments. A mixed-model repeated-measures logistic regression with comparison type (compare-only = −1, recall-and-compare = 1), construal mindset (concrete = −1, abstract = 1), and their interaction as predictors and the accuracy of price comparisons as the dependent measure revealed a significant effect of comparison type ($\beta = -.10$, $t = -4.22$, $p < .01$) and construal mindset ($\beta = .081$, $t = 3.43$, $p < .01$) and, most importantly, a significant interaction between the two ($\beta = .063$, $t = 2.69$, $p < .01$). Planned contrasts revealed that under a concrete mindset, those in the compare-only condition made a greater proportion of correct judgments ($M_{concrete:\ CO} = 59.6\%$) than those in the recall-and-compare condition ($M_{concrete:\ RC} = 51.6\%$; $\beta = -.58$, $t = -3.87$, $p < .01$). This result replicates the disruptive effect of recall on price comparisons demonstrated in the prior experiments (see Table 1 and Figure 3).

However, when participants were under an abstract mindset, planned contrasts revealed that the difference between the compare-only ($M_{abstract:\ CO} = 60.4\%$) and recall-and-compare ($M_{abstract:\ RC} = 58.7\%$) conditions was not significant ($\beta = -.072$, $t = -1.09$, $p = .28$), which provides support for H_{3b}. Participants in an abstract mindset were better able to overcome

the feeling-of-not-knowing that stems from price recall failure and rely more on implicit memory.

Price recall responses in the recall-and-compare conditions. To test the prediction that participants in both abstract and concrete mindsets experienced recall failure to the same extent, we conducted mixed-model repeated-measures logistic regressions with recall failure (recall attempt = 0, recall failure = 1) as the dependent measure and construal mindset as the predictor (concrete = −1, abstract = 1). In the recall-and-compare conditions, participants in the concrete ($M_{concrete}$ = 73.0%) and abstract ($M_{abstract}$ = 73.8%) conditions experienced similar recall failure rates ($\beta = .019$, $t = .16$, $p = .87$). A similar analysis with accuracy rate as the dependent variable (incorrect = 0, correct = 1) revealed no difference in accuracy rates for price recall judgments ($M_{concrete}$ = 9.9% vs. $M_{abstract}$ = 11.4%; $\beta = .079$, $i = .60$, $p = .55$). This suggests that there was no difference in the rate of recall failure or correct recall by construal mindset: participants in both mindsets were equally likely to experience recall failure. However, when attention was drawn away from metacognitive experience, participants in an abstract mindset did not experience the same detrimental effect of attempting price recall on price comparisons.

Moderated mediation by feeling-of-not-knowing. To test the hypothesized role of the feeling-of-not-knowing underlying this recall-induced blocking effect, we again conducted a moderated mediation analysis using the PROCESS macro Model 8 (Hayes 2013). Specifically, we predicted that the feeling-of-not-knowing (estimated number of correct judgments) would mediate the effect of comparison type on the accuracy of price comparison judgments (total correct judgments) in the concrete mindset conditions, but not in the abstract mindset conditions. Although participants in the abstract mindset, recall-and-compare condition experience recall failure, their attention is drawn away from the feeling-of-not-knowing, attenuating the direct effect of comparison type on the accuracy of price comparisons.

We used a 5,000-draw bootstrapping sample to examine the significance of the direct and indirect effects of comparison type on the accuracy of price comparison judgments depending on construal mindset. As we predicted, the conditional direct effect of comparison type on the accuracy of price comparisons was significant in the concrete mindset conditions (direct effect = −.44, $CI_{95\%}$ = [−.87, −.01]) but was not significant in the abstract mindset conditions (direct effect = −.06, $CI_{95\%}$ = [−.47, .35]. Furthermore, the indirect effect through the feeling-of-not-knowing was significant in the concrete mindset conditions (indirect effect = −.36, $CI_{95\%}$ = [−.59, −.22]), but not in the abstract mindset conditions (indirect effect = −.11, $CI_{95\%}$ = [−.29, .02]). The index of moderated mediation was statistically significant (index = .25, $CI_{95\%}$ = [.05, .50]).

EXPERIMENT 4B: REDUCING THE FEELING-OF-NOT-KNOWING—CHRONIC CONSTRUAL MINDSET

To test the robustness of the moderating effect of construal mindset on metacognitive memory blocking, we tested H_{3b} using chronic construal level in a follow-up experiment. Previous research has shown that people can adopt a more chronically concrete versus abstract mindset, measured through the Behavior Identification Form (BIF, Vallacher and Wegner 1989). In this experiment, the BIF was administered after the encoding task, which was the same for all participants, and before assigning participants to different recall conditions. We predict that, as in Experiment 4a, the effect of metacognitive memory blocking will be attenuated for those participants with a more chronically abstract-oriented mindset.

Two hundred eighty-four members on MTurk participated in this online computer study (average age: 31.1 years; 46% female) in exchange for $1.50. Participants were randomly assigned to the compare-only or recall-and-compare condition, and chronic construal level was measured. They were told that they would complete a series of three studies and were not informed that any of the studies would entail a memory-related task. The encoding and recall tasks were identical to those outlined in the overview of the experimental paradigm.

Between the encoding and recall tasks, participants completed an ostensibly unrelated study ("Understanding Actions") that consisted of 20 of the 25 items from Vallacher and Wegner's (1989) BIF. Following Liberman and Trope (1998), we excluded five activities that would have been less familiar to participants from urban locations. We summed scores from the 20 items into an index (0–20), in which higher scores indicated greater chronic propensity to have an abstract, "why" orientation rather than concrete, "how" orientation.

Results

Price comparison judgments. We conducted a mixed-model repeated-measures logistic regression with the predictors comparison type (compare-only = −1, recall-and-compare = 1), chronic construal level (mean centered), and their interaction, and the dependent measure was the accuracy of price comparisons. The results revealed a significant effect of comparison type ($\beta = -.11$, $t = -4.11$, $p < .01$), where those participants who attempted price recall were significantly less accurate in their judgments than those who were not asked to do so. More importantly, the interaction between comparison type and chronic construal level was significant ($\beta = .018$, $t = 2.99$, $p < .01$). A follow-up contrast for those participants with a chronically more concrete construal level (1 SD below the mean) revealed a significant effect of comparison type ($\beta = -.19$, $t = -4.91$, $p < .01$). However, a follow-up contrast for those participants with a chronically more abstract construal level (1 SD above the mean) revealed that this effect was not statistically significant ($\beta = -.03$, $t = -.79$, $p = .43$). For the predicted values from the spotlight analyses, see Table 1 and Figure 3. Thus, in support of H_{3b}, the disruptive effect of price recall is attenuated for participants with a more chronically abstract mindset in which attention is drawn away from the feeling-of-not-knowing. In addition, a floodlight analysis (Spiller et al. 2013) confirmed that metacognitive memory blocking persists for most people but is attenuated for people who have a more chronically abstract-oriented mindset; the Johnson–Neyman point (i.e., where the effect of comparison type is no longer significant) is at point 15 on the BIF scale (see Web Appendix H).

Price recall responses in the recall-and-compare conditions. We conducted two separate mixed-model repeated-measures logistic regressions. They confirmed that chronic construal level

did not have a significant effect on either recall failure or correct recall (coded as in Experiment 4a, $p = .96$ and $p = .54$, respectively).

Discussion of Experiments 4a and 4b

These results suggest that even when participants experience recall failure, a mindset that draws attention away from metacognitive experience mitigates the effect of metacognitive memory blocking. Under an abstract, "why"-oriented mindset, participants in the recall-and-compare condition are just as accurate as those in the compare-only condition—the accuracy of their judgments is restored when their attention is drawn away from metacognitive experience and the associated feeling-of-not-knowing, in support of H_{3b}. Note that this is the case even though participants with a more abstract, "why"-oriented mindset experience the same rate of recall failure as those in a concrete mindset. When their attention is drawn away from metacognitive experience, these recall failures do not have the same detrimental effect on judgments. If participants' underlying memory were overwritten or distorted by attempting price recall, then drawing attention away from the feeling-of-not-knowing could not have restored the accuracy of these judgments. This provides further support that feeling-of-not-knowing itself, without any change in memory content, can block reliance on implicit memory.

META-ANALYSIS

We conducted a meta-analysis to test the robustness of the effect of attempting price recall on price comparisons across six studies (five studies in this article with the same compare-only and recall-and-compare conditions, and one additional study; for details, see Web Appendix I). A total of 903 participants were included in this analysis. As recommended by Lipsey and Wilson (2001), we utilized the raw data to determine the effect size because all of the studies measured the dependent measure on the same scale rather than conducting an analysis using summary statistics from the experiments. We used a mixed model with SAS PROC GLIMMIX, taking into account heterogeneity across conditions and studies, with the total number of correct price comparisons as the dependent measure (0–20) and judgment type (compare-only = −1, recall-and-compare = 1) as the independent measure. The analysis revealed a significant effect of judgment type on the accuracy of price comparisons (M_{CO} = 57.6% vs. M_{RC} = 50.7%; $\beta = -.68$, $t = -6.42$, $p < .01$). Using the adjusted degrees of freedom from the model (d.f. = 787), this result reveals a Cohen's d of .46, consistent with a medium effect size (Cohen 1988).

GENERAL DISCUSSION

Across six experiments, we provide evidence that merely attempting recall can disrupt the accuracy of memory-based price comparisons through metacognitive memory blocking and, thus, that "remembering" can disrupt "knowing." Experiment 1a documented this effect, wherein participants who merely attempted to recall previous prices were less accurate in making price comparisons than those who did not attempt to do so, and demonstrated that this effect relies on implicit memory by spacing the encoding and recall portions of the study over a 24-hour period. We replicated this effect in Experiment 1b, which also explicitly demonstrated that price recall generates a feeling-of-not-knowing. Experiment 2 demonstrated the sophisticated heuristic inferencing process that underlies the effect of price recall on price comparisons: clearly irrelevant metacognitive experiences do not lead to the feeling-of-not-knowing that undermines price comparisons. Underscoring the role of the feeling-of-not-knowing, Experiment 3 demonstrated that generating a feeling-of-not-knowing and drawing greater attention to metacognitive experiences reduces the accuracy of memory-based comparisons, even when participants do not attempt price recall. Furthermore, feeling-of-not-knowing mediates the effect of comparison type on the accuracy of memory-based comparisons when attention is not drawn to the feeling-of-not-knowing. Similarly, drawing attention away from metacognitive experience through a primed (Experiment 4a) or measured (Experiment 4b) construal mindset decreases inferences of the feeling-of-not-knowing and attenuates the effect of recall-induced memory blocking. Even after attempting recall, drawing attention away from the feeling-of-not-knowing reduces the detrimental effect of attempting recall on memory-based comparisons. The experiments also rule out distraction (Experiment 2), spillover from a general feeling of difficulty (Experiment 3), and memory overwriting (Experiments 4a and 4b) as possible alternative explanations for the effect.

THEORETICAL IMPLICATIONS

Memory Blocking and Metacognitive Experience

Our research combines the rich streams of research in memory blocking (Alba and Chattopadhyay 1985; Anderson, Bjork, and Bjork 1994; Bjork 1975; Murayama et al. 2014; Roediger 1973; Schooler and Engstler-Schooler 1990; Van Osselaer 2008) with research exploring how metacognitive experiences influence memory-based judgments (Koriat 2000; Menon and Raghubir 2003; Raghubir and Menon 1998; Schwarz et al. 1991) to identify a new form of memory blocking that stems from metacognitive experience: metacognitive memory blocking. For judgments in which people have both explicit and implicit memory they can draw on to make comparisons, merely attempting to recall explicit information from memory can draw attention to a difficult metacognitive experience. This causes people to infer a feeling-of-not-knowing, which in turn can block reliance on implicit memory that they could otherwise use to make correct judgments. Although the previous blocking literature has demonstrated that some memory can block the recall of a related memory, our research is the first to demonstrate that attempting to recall memory in one form (explicit) can block memory for the same information in another form (implicit) because of a feeling-of-not-knowing.

We used the domain of price comparisons to initially explore the effect of attempting memory recall on memory-based comparisons because it is a domain in which these two types of judgments—"remember," based more on explicit memory, and "know," based more on implicit memory—are well established and because research has previously shown that people are able to make judgments on the basis of implicit memory, without invoking explicit memory (Adaval and Monroe 2002; Monroe and Lee 1999). Further research could examine the extent to which invoking explicit memory can disrupt reliance on implicit memory in other domains in which underlying, specific

information at encoding fades more quickly, while less precise, generalized representations remain—for example, frequency judgments or memory-based evaluations of products with many features. We would not expect feeling-of-not-knowing-based memory blocking in domains in which people experience very low rates of recall failure or for people who are highly motivated to encode information and experience low rates of recall failure. Furthermore, we also found that drawing attention away from metacognitive experience restored the accuracy of comparative judgments. Further research could also explore other forms of memory blocking whereby drawing attention away from metacognitive experience might restore the accuracy of judgments.

Forms of Price Memory

Our research provides a more nuanced understanding of the mental processes that underlie price comparisons, a topic that has attracted the attention of many marketing scholars (Adaval 2013; Adaval and Monroe 2002; Briesch et al. 1997; Cheng and Monroe 2013; Coulter 2013; Estelami and Lehmann 2001; Estelami, Lehmann, and Holden 2001; Gaston-Breton and Raghubir 2013; Kalyanaram and Winer 1995; Lee 2013; Rajendran and Tellis 1994; Rao 2013; Winer 1986). It is consistent with previous work suggesting that there are explicit and implicit forms of price memory (Monroe and Lee 1999) that draw from dual representations (Adaval and Monroe 2002; Mazumdar and Monroe 1990; Vanhuele and Drèze 2002). In spite of the low rate of correct price recall, participants' price comparison accuracy was well above chance levels, indicating that people can make correct price judgments relying on implicit price memory, even without recalling specific prices. Our research also provides further convergent evidence that prices are encoded in multiple formats; although specific price representations fade quickly in memory, the generalized representations endure. In addition, our work suggests that explicit price recall and implicit price comparisons rely on separate memory processes that can influence each other through metacognitive experience: explicit price recall is not only unnecessary for, but can actually disrupt, memory-based price comparisons.

To better isolate the interaction between forms of price memory, our research utilized a paradigm most likely to invoke explicit price memory (i.e., remember the exact price) and more likely to involve implicit memory (i.e., determine if the new price is higher or lower than the old price). In addition, participants were not forewarned of an upcoming recall task. Further research could examine moderating effects such as soliciting price recall as a range rather than point estimate or forewarning participants of the upcoming recall task and more explicitly test for implicit memory alone by utilizing classic stem-completion type paradigms (Tulving, Schacter, and Stark 1982).

Construal Level and Memory

Recent commentaries by both Adaval (2013) and Rao (2013) have underscored the importance of understanding the relationship between processing and price judgments, whether in terms of unconscious versus conscious judgments, regulatory focus, or construal level. In contrast to other work related to price and construal level that has shown the effect of construal level on the interpretation of the price-quality inference (Bornemann and Homburg 2011; Yan and Sengupta 2011) or how the presence versus absence of price influences construal level (Lee and Zhao 2014), our work illustrates how abstract construal mindsets can actually improve the accuracy of price comparisons by encouraging reliance on implicit memory. Our results suggest that concrete mindsets increase metacognitive monitoring and reliance on explicit memory, whereas abstract mindsets reduce metacognitive monitoring and increase reliance on implicit memory. Thus, changes in construal mindset can actually attenuate memory-blocking effects.

Price Knowledge Measurement

Previous research has demonstrated the importance of measuring price memory (Dickson and Sawyer 1990; Krishna, Currim and Shoemaker 1991; Le Boutillier, Le Boutillier, and Neslin 1994; Wakefield and Inman 1993), but previous studies measuring multiple dimensions of price knowledge have typically measured price recall before comparative judgments of price memory (Dickson and Sawyer 1990; Mazumdar and Monroe 1990; Urbany and Dickson 1991; Vanhuele and Drèze 2002). Our research suggests that measuring price recall before comparisons underestimates consumers' true price knowledge because merely attempting price recall can disrupt the accuracy of price comparisons. Future studies should examine other domains in which merely attempting remembering can disrupt knowing.

Thus, as researchers reflect on the implications of our research after reading this article, we urge that they do not forget about this "remember" versus "know" distinction. We recommend that they internalize the findings and rely on their implicit knowledge but not try *too* hard to remember all the explicit details—as such recall attempts could block their ability to use their implicit knowledge effectively.

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