Recollections of things schematic: Room schemas revisited.

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Abstract: In 2 experiments, the authors examined the effects of **schemas** on the subjective experience of remembering. Participants entered a **room** that was set up to look like a graduate student's office under intentional or incidental learning conditions. They later took a recognition memory test that included making remember-know judgments. In Experiment 1, they were tested during the same session; in Experiment 2 they were tested either during the same session or after a 48-hr delay. Consistent with the authors' predictions, memory for atypical objects was especially likely to be experienced in the remember sense. In addition, false remember judgments rose dramatically after the 48-hr delay, especially for participants in the incidental learning condition. Results are discussed in terms of **schema** theory, fuzzy-trace theory, and the distinctiveness heuristic. (PsycINFO Database Record (c) 2016 APA, all rights reserved)

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Recollections of Things Schematic: Room Schemas Revisited

Listen American Accent

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Schemas were introduced to modern psychology in the pioneering work of Sir Fredric Bartlett (1932). Bartlett believed that his contemporaries' work on memory for nonsense syllables missed an important aspect of the nature of memory. Bartlett believed that memory was a meaning-making system that helped individuals make sense of their world by interpreting events in terms of preexisting knowledge structures. The term ***schema*** is a generic term used to describe any knowledge structure that can guide attention and behavior, aid individuals in interpreting events, and influence the reconstruction of memories. Subsumed under this generic concept are a number of more specific proposals, including Schank and Abelson's (1977) notion of a *script* and Minsky's (1975) notion of a *frame,* as well as several other specific formulations.

In general, research on the effects of **schemas** on memory has produced two main results. First, participants tend to show especially good memory for events that violate **schematic** expectations. In addition, participants will often falsely recall and/or recognize **schema**-consistent items that were not actually a part of the original event. For instance, Bower, Black, and Turner (1979) asked participants to read six stories based on common themes (e.g., going to a doctor) and, 10 min later, they asked participants to recall the passages. They found that participants were better able to recall **schema**-inconsistent actions than **schema**-consistent actions. In the same series of experiments, they showed that participants sometimes falsely recalled and recognized **schema**-consistent actions that were never explicitly stated in the text.

In the 1980s, driven in part by calls for a more ecological science of memory (e.g., Neisser, 1978), researchers began applying the **schema** concept to memory for naturalistic settings. For instance, in one study (Brewer & Treyens, 1981), students were asked to wait for an experimenter in a **room** that was set up to look like a graduate student's office. The **room** included some objects that were consistent with the **schema** for a graduate student's office (e.g., stapler) and also included other objects that were inconsistent with the **schema** (e.g., a toy top). On later tests, both recall and recognition were significantly correlated with **schema** expectancy. However, participants also falsely recalled and recognized many nonpresented **schema**-consistent objects. In later work on **room schemas**, Pezdek, Whetstone, Reynolds, Askari, and Dougherty (1989) found that participants showed better overall recognition memory for objects that were inconsistent with the **schema** than for objects that were consistent with the **schema**.

Although much is known about the influence of **schemas** on memory, relatively little research has examined what effect **schemas** have on the subjective experience of remembering. This is surprising in that **schema** models appear to make clear predictions about how **schemas** should influence the subjective experience of remembering. One class of models claims that memories are organized around **schema**-based expectations and that violations of these expectations are given privileged status in memory (e.g. Graesser, Gordon, & Sawyer, 1979; Schank, 1982). In his dynamic memory model, Schank (1982, 1999) proposed that the episodic content of memories is stored in terms of the organizational framework of the knowledge structures used to process the original event and indexed in terms of how expectations generated by those knowledge structures were violated. Because the proposed indexing system in Schank's model organizes information in terms of expectation failures, it follows that the explicit episodic content of **schema**-inconsistent information should be more easily accessible than the explicit episodic content of **schema**-consistent information. As a result, this model predicts that **schema**-inconsistent information should be remembered in an especially vivid and detailed manner.

Schema-plus-correction models make similar predictions about the relative vividness of memories for typical and atypical events (Graesser et al., 1979). In **schema**-plus-correction models, **schema**-consistent information need not be explicitly stored because the participant can rely on knowledge of the underlying **schema** to reconstruct memories for those items at time of retrieval. Because it cannot be reconstructed from the underlying **schema**, **schema**-inconsistent information must be explicitly stored in episodic memory. Thus, **schema**-plus-correction models also make the strong prediction that **schema**-inconsistent information should be remembered in a more detailed and vivid form than **schema**-consistent information.

In recent work on memory for extended discourse, we have demonstrated that these predictions are indeed supported (Lampinen, Faries, Neuschatz, & Toglia, 2000). Participants listened to a story about a character who performed several script-based activities (e.g., washing his car, attending a lecture). Participants were then tested on their memory for the stories using the remember–know distinction first introduced by Tulving (1985). In the remember–know task, participants indicate that they *remember* an item if they can consciously recollect explicit details of the item's presentation (e.g., thoughts, perceptual details, emotional responses). They indicate that they *know* an item was presented if they are sure that the item was presented but cannot recall any specific details of its presentation. As predicted, participants made more remember judgments for atypical information and more know judgments for typical information. The content of the remember judgments differed as well. For instance, remember judgments for atypical actions included more details about emotions than did remember judgments for typical actions. We interpreted these findings as being broadly consistent with both the dynamic memory and **schema**-plus-correction models.

Schemas are also known to produce false memories (see Hirt, Lynn, Payne, Krackow, & McCrea, 1999, for a review). The subjective experience of false memories in other paradigms has now been studied extensively (for reviews see Lampinen, Neuschatz, & Payne, 1998; Payne, Neuschatz, Lampinen, & Lynn, 1997). The common finding in those other paradigms has been that false memories are often experienced in a subjectively compelling form but that there are also subtle differences between true and false memories (e.g., Lampinen et al., 2000; Mather, Henkel, & Johnson, 1997; Norman & Schacter, 1997; Schooler, Gerhard, & Loftus, 1986).

The subjective experience of false memories appears to vary quite a bit across different paradigms. In research, using the word-learning paradigm—developed by Deese (1959) and further studied by Roediger and McDermott (1995; the DRM paradigm) and others (e.g. Israel & Schacter, 1997; Lampinen, Neuschatz, & Payne, 1999; McDermott, 1996; Payne, Elie, Blackwell, & Neuschatz, 1996; Read, 1996)—very high rates of false remember judgments are produced, often approaching the rate of veridical remember judgments. However, in other paradigms, the rate of false remember judgments, although still substantial, is considerably lower. For instance, using the misinformation paradigm, developed by Loftus (1979), Zaragoza and Mitchell (1996) found that false remember judgments occurred around 20% of the time, considerably lower than in the DRM paradigm. In the script memory work reported above, we also found that the rate of false remember judgments was around 20%, significantly lower than the rate of veridical remember judgments obtained in the same study (Lampinen et al., 2000).

False recollective experiences (i.e., false remember judgments) have recently been the subject of much theoretical work. One account is provided under the rubric of the fuzzy-trace theory (FTT; Reyna & Brainerd, 1995). According to the FTT, processing of items at study leads to the parallel extraction of verbatim and gist traces. Verbatim traces represent item level information, including information about the surface forms of items. Gist traces represent more general senses and meanings of the items. According to the FTT account, false recollective experiences (i.e., remember judgments) occur when there is an especially strong gist trace and when the lure on the test is an especially good match for that gist trace. Under those conditions, participants sometimes confabulate supporting details, resulting in what Brainerd, Wright, Reyna, and Mojardin (2001) have recently called “phantom **recollections**.”

One reason, then, why false memories in the DRM paradigm may be especially compelling is because the lists are constructed in such a way that the gist is repeatedly cued. However, this alone cannot explain the pattern of results that have been observed in the extant literature. For instance, Israel and Schacter (1997) found that fewer false memories overall and fewer false remember judgments in particular are produced for pictures than when the exact same list items are presented as words. In both the word and picture cases, the gist is being repeatedly cued. What appears to differ is the relative distinctiveness of the targets. Schacter, Israel, and Racine (1999) argued that participants use a distinctiveness heuristic. The distinctiveness heuristic is a metamemorial process whereby participants evaluate memories on the basis of how vivid they believe the memories should be under the circumstances. People do not expect that their memories for words will be especially vivid and hence it is relatively easy to produce false remember judgments under those conditions. People expect their memories for pictures to be vivid. For that reason, it is somewhat less likely that participants will be able to confabulate sufficient detail for them to be convinced that they are actually recollecting the items.

One could also account for these results under the rubric of FTT by assuming that the lower rate of false memories for pictures occurs because pictorial processing increases the rate of nonidentity judgments (Brainerd, Reyna, & Kneer, 1995; Brainerd, Reyna, & Mojardin, 1999). Nonidentity judgments occur when participants’ retrieval of verbatim memory traces for a target lead to suppression of false memories for related lures (e.g., “I know it wasn’t *cat*, it was *dog*”). Any manipulation that increases verbatim retrieval could, thus, hypothetically decrease false memories.

In two experiments, we examined the effect of **room schemas** on the subjective experience of remembering. Although previous studies have explored the effects of **room schemas** on memory (Brewer & Treyens, 1981; Pezdek et al., 1989), these studies did not provide evidence concerning the subjective experience of those memories. Using the remember–know paradigm (Tulving, 1985), we investigated the experiential qualities of participants’ memories. Consistent with both the dynamic memory and **schema**-plus-correction models, we predicted that people would have more remember hits for atypical items than for typical items. We also predicted that there would be substantially more false memories for typical items than for atypical items. However, based on the distinctiveness heuristic, we expected that relatively few false memories for this real-world scene would be experienced as remember judgments.

In addition, we compared the subjective experience of participants’ memories under intentional and incidental learning instructions. In Pezdek et al.’s (1989) study, recognition for items in the **room** was greater when participants were given intentional instructions rather than incidental instructions. Because remember judgments are influenced by attentional resources (Gardiner & Parkin, 1990), it is likely that there will be a greater overall level of remember judgments in the intentional as opposed to incidental learning conditions (see Carter, as cited in Gardiner & Java, 1993).

Experiment 1

Method

Participants

Forty-eight general psychology students from the University of Arkansas participated in this study in exchange for course credit.

Materials and procedure

A small **room** in the psychology department building was prepared to look like a graduate student’s office. Two different versions of the **room** were created for counterbalancing purposes, each containing 10 atypical items and 10 typical items. A sample of 16 undergraduate students provided normative information for a list of 70 randomly listed items. Half of the items were office oriented (e.g., stapler), and half of the items were not found in most offices (e.g., toy car). The students rated the likelihood that each item would appear in a “typical graduate student’s office” on a scale from 1 (*extremely unlikely*) to 7 (*extremely likely*). The 20 most typical items and the 20 least typical items were used as stimuli. The 20 most typical items ($M = 6.71$) were rated as being significantly more likely to be found in a graduate student’s office than the 20 least typical items ($M = 2.12$), $t(15) = 20.43$, $p < .01$. These items are shown in the Appendix.

Each version of the **room** contained 10 of the typical items and 10 of the atypical items. In addition to these items, the office included several noncritical items (e.g., plant, posters, computer, filing cabinet, photos, journal articles, candle) to suggest authenticity. To balance the stimulus items for placement in the **room**, we divided the **room** into a 2 × 4 grid. First, the typical items were placed in areas that seemed most natural. Then, for each typical item, an atypical item was placed within the cell so that there were an equal number of typical and atypical items in each cell. All items were clearly visible from the perspective of where the participant was seated. However, it was unavoidable that some objects would be closer to the participant than other objects. To control for this, we arranged all items so that atypical items were in front of typical items as often as typical items were in front of atypical items.

During the first phase of testing in which the stimulus items were presented, participants were seated in the office for 1 min. Although there was a chair pushed up to the desk in the **room**, participants sat in a second chair directly behind it. From this viewpoint they were able to see all 20 critical items in the **room**. Participants were randomly assigned to an incidental or intentional instruction condition. Before closing the door, the experimenter informed participants in the intentional condition that a memory test for items within the **room** would ensue. Participants in the incidental condition were simply told, “You can wait in here for a minute. Just have a seat.” After 1 min, the experimenter opened the door announcing that someone was running another experiment and that they would have to perform the experiment elsewhere.

Next, participants began the training phase. The purpose of this portion of testing was to make sure that participants understood the remember–know distinction (see Lampinen et al., 1998). First, the experimenter read a list of 12 words at intervals of 3 s per word. Participants completed a memory-orienting task (Craik & Lockhart, 1972; Craik & Tulving, 1975) while listening to the speaker. Six of the words required nonsemantic processing as participants circled *yes* or *no* if the word contained the letters *e* or *g*. Six of the words required semantic processing as participants rated their pleasantness on a scale from 1 (*extremelyunpleasant*) to 5 (*extremelypleasant*).

Following the levels-of-processing study phase, participants were instructed on how to make remember–know judgments. Participants were instructed to follow along as the experimenter read an instruction sheet (adapted from Rajaram, 1993) explaining the distinction between remember and know judgments. Then, participants explained the distinction between the two types of judgments in their own words. If necessary, the experimenter dispelled any confusion by providing further examples of remembering and knowing. Participants then performed a practice recognition test composed of 24 words. Half of these words had been presented during the levels-of-processing orienting task; six had received deep processing and six had received shallow processing. Participants indicated whether they believed each item was explicitly *stated* or *unstated.* If they decided that the word was stated, they made remember–know judgments.

Semantic processing appears to increase the rate of remember judgments without increasing the rate of know responses (Gardiner, 1988; Rajaram, 1993). This task was included to train participants on making remember–know judgments and also as a manipulation check. If participants in our experiment understood the remember–know instructions, as participants in prior research have, then we should replicate the findings of these prior studies. Consistent with this prediction, deep processing ($M = 0.71$) increased the rate of remember judgments relative to shallow processing ($M = 0.55$), $t(47) = 3.31$, $p < .01$. Also consistent with previous research (Rajaram, 1993), deep processing ($M = 0.23$) decreased know responses relative to shallow processing ($M = 0.35$), $t(47) = -3.22$, $p < .01$. As in prior research, relatively few false alarms were experienced in the remember sense ($M = 0.03$), and although more were experienced in the know sense ($M = 0.08$), $t(47) = 2.78$, $p < .01$, false alarms on the whole were rather rare. Given that these results replicate what has been reported in the literature, they support the idea that participants in our experiments understood the remember–know instructions in ways that are similar to how participants in other experiments have understood the instructions.

On completion of the practice test, the experimenter reviewed the answers asking participants to explain why they indicated *remember* and what types of details came to mind when considering this judgment. If the participant did not justify their remember judgments by providing at least one specific detail they remembered about the item, the experimenter explained the remember–know distinction further. The participant was told that a subjective sense of certainty by itself did not constitute grounds for making a remember judgment. Participants were told that remember judgments should only be made when they could remember at least one specific detail of the item's presentation. After the training phase, participants appeared to have a clear understanding of the remember–know distinction.

During the final phase of the experiment, the experimenter presented the **room**-recognition test, composed of all 40 stimulus items. Twenty of these items had been in the **room** viewed by the participant and 20 had not been in the **room**. Of the 20 items that had been in the **room**, half were typical and half were atypical. Similarly, of the 20 items that had not been in the **room**, half were typical and half were atypical. Following the instructions, a brief review of the remember–know distinction was provided for the participant. For each item, participants either indicated whether they believed the item had been *present* or *not present* in the **room**, and if they believed it had been present they made a remember–know judgment.

Results

The goal of this experiment was to investigate the effects of **room schemas** on the subjective experience of memories for typical and atypical objects encountered in a naturalistic environment. Unless noted otherwise, all results reported were significant at $p < .05$.

Overall recognition

To compare our results with those of previous studies, we first performed a 2 (Typicality: typical, atypical) × 2 (Instructions: intentional, incidental) mixed-factorial analysis of variance (ANOVA) on the overall recognition data for veridical memories. The means for each condition are shown in Table 1. This analysis revealed a main effect of instructions, with more veridical memories (i.e., correct target recognition) occurring for participants who had been given intentional learning instructions than for participants who had been given incidental learning instructions, $F(1, 46) = 7.32$, $MSE = 0.07$. Next, we performed the same analysis on false memories (i.e., distractors). This analysis revealed that more false memories occurred for **schema**-consistent objects than for **schema**-inconsistent objects, $F(1, 46) = 121.05$, $MSE = 0.04$. No other effects were significant at conventional levels (i.e., $p < .05$).

Table 1

Mean Proportion of Objects Recognized in Experiment 1

Item type and instructions	Overall	Remember	Know
Veridical memories/intentional			
Typical	.63	.25	.38
Atypical	.61	.57	.04
Veridical memories/incidental			
Typical	.51	.13	.38
Atypical	.44	.40	.04
False memories/intentional			
Typical	.49	.11	.38
Atypical	.05	.02	.03
False memories/incidental			
Typical	.52	.08	.43
Atypical	.07	.02	.05

Mean Proportion of Objects Recognized in Experiment 1

To compare the effects of **schema** consistency and instructions on overall sensitivity, we next performed a signal-detection analysis on the data by calculating A′ for each condition within each participant (Snodgrass & Corwin, 1988). These values are shown in Table 2. A′ for typical items is based on the hit rate and false-alarm rate for typical items; A′ for atypical items is based on the hit rate for atypical items and the false-alarm rate for atypical items. A′ is a measure of sensitivity that varies between 0 and 1, with higher values indicating greater sensitivity. A′ is equal to 0.5 when hit rates and false-alarm rates are equal. Because these values are not defined when the proportions equal 0.0 or 1.0, we used the correction procedure described by Snodgrass and Corwin (1988).

Table 2

Mean Measures of Sensitivity (A′) and Response Bias (B″) in Experiment 1

Instruction and typicality	A′ Overall	A′ Remember	B″ Overall	B″ Remember
Intentional				
Typical	0.60	0.63	−0.06	0.30
Atypical	0.83	0.82	0.33	0.39
Incidental				
Typical	0.50	0.57	−0.05	0.25
Atypical	0.77	0.78	0.22	0.57

Mean Measures of Sensitivity (A′) and Response Bias (B″) in Experiment 1

Consistent with previous research (i.e., Pezdek et al., 1989), participants showed greater sensitivity (i.e., A′) for atypical objects than for typical objects, $F(1, 46) = 49.38$, $MSE = 0.03$. In addition, participants showed greater sensitivity under intentional learning instructions than under incidental learning instructions, $F(1, 46) = 4.94$, $MSE = 0.03$. One should recall that A′ will equal 0.5 when the hit rate equals the false-alarm rate. Inspection of Table 2 shows that participants have difficulty discriminating between presented and nonpresented objects that match their **schema**, especially when they are in the incidental learning condition.

To analyze response bias, we calculated B″ (Snodgrass & Corwin, 1988) for each condition within each participant. B″ values vary between −1 and 1, with positive values indicating a conservative decision criterion and negative values indicating a liberal decision criterion. The analysis revealed a main effect of typicality with participants using a more conservative decision criterion for atypical objects than for typical objects $F(1, 46) = 99.33$, $MSE = 0.05$. No other results were significant at conventional levels.

Remember judgments for objects in the room

The same analyses were performed on participants' remember judgments. Again, means are presented in Table 1. One should recall that we predicted that participants would have greater levels of remember judgments for atypical targets than for typical targets, under intentional instructions rather than incidental instructions, and that relatively few false memories would be experienced in the remember sense.

The analysis of veridical memories revealed that there were significantly more veridical remember judgments for atypical objects than for typical objects, $F(1, 46) = 38.73$, $MSE = 0.05$. This finding is consistent with our prior research (Lampinen et al., 2000), with the predictions of **schema**-plus-correction models (e.g., Graesser et al., 1979), and with the dynamic memory model (Schank, 1982, 1999). Instructional condition also produced a main effect, with participants who were given intentional learning instructions producing more veridical remember judgments than participants given incidental learning instructions, $F(1, 46) = 4.99$, $MSE = 0.09$.

Analysis of the false memory data revealed that there were more false remember judgments for typical objects than for atypical objects, $F(1, 46) = 10.39$, $MSE = 0.02$. However, in accordance with our prediction based on the distinctiveness heuristic, the overall level of false remember judgments for typical objects was substantially lower than that reported in other false memory paradigms (Lampinen et al., 1998).

To compare the effects of **schema** consistency and instructions on the sensitivity and response bias of participants' remember judgments, we performed a signal-detection analysis on the data by calculating A′ for the remember judgments in each condition. These results are shown in Table 2. As expected, participants' remember judgments showed greater sensitivity for atypical objects than for typical objects, $F(1, 46) = 46.34$, $MSE = 0.03$. No other effects were significant at conventional levels.

Then we calculated B″ as a measure of response bias for remember judgments. As can be seen from Table 2, participants had a more conservative response bias for atypical objects than for typical objects, $F(1, 46) = 15.46$, $MSE = 0.06$. In addition, there was a significant interaction between typicality and condition, $F(1, 46) = 4.94$, $MSE = 0.03$. This appeared to reflect the fact that the difference in response bias for typical and atypical objects was greater in the incidental learning condition than in the intentional learning condition.

Know judgments for objects in the room

We next analyzed the veridical know judgments. These results are reported in Table 1. A 2 (Typicality: typical, atypical) × 2 (Instructions: intentional, incidental) mixed ANOVA on participants' veridical know judgments demonstrated that there were significantly more veridical know judgments for typical objects than for atypical objects, $F(1, 46) = 79.21$, $MSE = 0.03$. The same analysis conducted on false know judgments revealed the same pattern. There were significantly more false know judgments for typical objects than for atypical objects, $F(1, 46) = 80.38$, $MSE = 0.04$.

It is interesting to note that participants judged more of the typical items that they recognized to be know items rather than remember items. Although this finding is unusual, it is understandable in light of the fact that the materials were highly scripted. More specifically, both the dynamic memory model (Schank, 1982) and the script-plus-correction model (Graesser et al., 1979) predict that the memory traces of script consistent information or typical information should not include much experimental content.

Experiment 2

The findings of Experiment 1 provide important insights into how **room schemas** influence the subjective experience of remembering. The results are straightforward. For presented items, memories for atypical objects are more likely to be experienced as conscious **recollections** (i.e., remember judgments) than are typical objects. However, memories for typical objects are more likely to be experienced as a subjective sense of familiarity (i.e., know judgment). Consistent with Carter's findings (as cited in Gardiner & Java, 1993), intentional learning instructions increased the overall rate of conscious **recollection**. In addition, consistent with the distinctiveness heuristic, relatively few false memories were experienced in the remember sense.

The phantom **recollection** account (Brainerd et al., 2001) claims that false memories are gist based and should not decline across a delay, whereas veridical **recollections** are verbatim based and should decline across a delay. Indeed, because nonidentity judgments are more likely at a short delay than at a long delay, it is even possible for false memories to increase across a delay. FTT also makes the counterintuitive predictions that false memories may be experienced as more perceptually rich after a long retention interval. Reyna and Titcomb (1996) suggested that gist verbatim traces quickly decompose into component parts if nothing is done to preserve original trace. These fractional traces include experiential details, such as perceptual and contextual information, that may become integrated with gist traces, resulting in a memory trace that is a mixture of gist and verbatim components. Thus, it is possible to have gist-based memories that are phenomenologically rich. One would expect that the decomposition of verbatim traces would increase with time, which would lead to the prediction that false memories should be more phenomenologically rich as retention intervals increase. This might even lead to the number of false remember judgments increasing over time. However, other research has shown that false memories sometimes decline as rapidly as true memories across a delay (Lampinen & Schwartz, 2000; Thapar & McDermott, 2001). In Experiment 2, we examined these competing predictions by manipulating retention interval. More specifically, some participants were tested shortly after being in the experimental **room**, while others were tested after a 48-hr retention interval.

In addition, we were interested in the particular types of experiential details participants claim to be recollecting when they make remember judgments. In a way, remember judgments are kind of a place holder. It is clear from the instructions that are provided to participants in remember–know studies that remember judgments are cases in which particular details are being recollected in relation to the item being tested. Thus, it is interesting to ask in any remember–know experiment what the specific details are that participants are relying on. To address this, we asked participants to indicate whether their memory for the object included perceptions, thoughts, emotions, or contextual information (PTEC). PTEC is similar to the memory characteristics questionnaire developed by Johnson and colleagues (Johnson, Foley, Suengas, & Raye, 1988; Mather et al., 1997) and has been used in our own previous work (Lampinen et al., 2000). We used it in the present research for consistency with our previous work and to allow for greater cross-experimental comparison with the body of work we are developing.

Method

Participants

Seventy-nine students from the University of Arkansas participated in Experiment 2 as partial fulfillment of a course requirement for laboratory or library research. Participants were randomly placed into one of eight conditions on the basis of a 2 (Attention: full, divided) × 2 (Delay: immediate, 48 hr) × 2(**Room**: A, B) design. Each of these eight conditions had 10 participants, except for the delayed testing, full attention, **Room** B condition, which had 9 participants.

Materials and procedure

We used the same materials and procedures as in Experiment 1, with two modifications. First, in addition to making remember–know judgments, participants who made remember judgments were asked to indicate the type of detail they were recollecting. Participants were instructed to circle *p* if the remember judgment was based on perceptual details. If the judgment was based on thoughts evoked on encountering the item, participants were instructed to circle *t*. If the memory was based on emotions, they were instructed to circle *e*; for contextual memories, they were instructed to circle *c*. The instructions stated that it was permissible to circle more than one option if they experienced more than one of these detail types (see Lampinen et al., 2000, for details of the PTEC instructions).

In addition, approximately half ($n = 40$) of the participants were tested during the same session as the acquisition phase, and approximately half ($n = 39$) were tested 48 hr after the acquisition phase. Participants in the delay condition performed the levels-of-processing orienting task after viewing the

room. During the second session, 2 days later, they were trained on making the remember–know distinction, took the levels-of-processing test, were instructed on how to use the PTEC options, and then took the test on objects in the **room**.

As in Experiment 1, results of the levels-of-processing task were consistent with prior research on remember–know judgments in that deep processing ($M = 0.72$) led to significantly more remember judgments than shallow processing ($M = 0.62$), $F(1, 77) = 12.14$, $MSE = 0.04$. There was no significant difference in the rate of know judgments between shallow and deep processing, $F < 1.00$. There were marginally fewer remember judgments after the delayed test ($M = 0.67$) than after the immediate test ($M = 0.78$) for deeply processed items, $F(1, 77) = 3.27$, $MSE = 0.08$, but not for shallowly processed items, $F < 1.00$. Relatively few false alarms were remember judgments ($M = 0.01$), and indeed there were also few false alarms that were know judgments ($M = 0.03$). These results are in good agreement with the results of prior remember–know studies and give us some confidence that participants are understanding the instructions in our experiments in a way that's similar to how they have understood the instructions in prior research.

Results

Overall memory for objects in the room

We first turn to overall recognition memory for items in the **room**. The means are reported in Table 3. To analyze this data, we first performed a 2 (Typicality: typical, atypical) × 2 (Instructions: intentional, incidental) × 2 (Delay: immediate, 48 hr) mixed ANOVA on the rate of veridical memories. Consistent with Experiment 1, there was a significant main effect of instructions, with more veridical memories occurring under intentional instructions than under incidental instructions, $F(1, 75) = 12.62$, $MSE = 0.07$. There was also a marginally significant main effect of delay, with fewer veridical memories occurring after a 48-hr delay than during immediate testing, $F(1, 75) = 3.64$, $MSE = 0.07$, $p = .06$.

Table 3
Mean Proportion of Objects Recognized in Experiment 2

Item type, instructions, and delay	Overall	Remember	Know
Veridical memories/intentional learning instructions			
Typical/immediate	.62	.48	.14
Atypical/immediate	.70	.61	.09
Typical/48 hr	.55	.28	.27
Atypical/48 hr	.62	.56	.07
Veridical memories/incidental learning instructions			
Typical/immediate	.47	.26	.22
Atypical/immediate	.57	.52	.05
Typical/48 hr	.60	.31	.29
Atypical/48 hr	.26	.23	.03
False memories/intentional learning instructions			
Typical/immediate	.25	.13	.13
Atypical/immediate	.02	.02	.00
Typical/48 hr	.48	.16	.32
Atypical/48 hr	.07	.03	.04
False memories/incidental			
Typical/immediate	.31	.07	.24
Atypical/immediate	.01	.00	.01
Typical/48 hr	.54	.27	.27
Atypical/48 hr	.06	.04	.02

Mean Proportion of Objects Recognized in Experiment 2

In addition to these main effects, there were also significant two-way interactions between typicality and delay, $F(1, 75) = 6.99$, $MSE = 0.07$, typicality and instructions, $F(1, 75) = 5.99$, $MSE = 0.07$, as well as a significant three-way interaction between typicality, instructions, and delay, $F(1, 75) = 5.70$, $MSE = 0.07$. As can be seen from Table 3, the effects of delay and typicality on memory for objects in the **room** is greatly influenced by the types of instructions participants were given. Under intentional learning instructions, participants' veridical recognition of both typical and atypical objects does not significantly change across the delay, ps > .37. Under incidental learning instructions, veridical recognition of atypical objects declines steeply across the delay, $t(38) = 3.53$, $p < .01$, whereas veridical recognition of typical objects does not significantly decline, $t(38) = -1.43$, $p = .16$. These findings suggest, that across a 48-hr delay, memory becomes greatly schematized, especially when participants are not engaged in any special strategies.

We next performed the same analysis on participants' false memories. The analysis revealed a significant main effect of typicality, with significantly more false memories for typical objects than for atypical objects, $F(1, 75) = 152.78$, $MSE = 0.03$. In addition, there was a significant main effect of delay, with more false memories occurring after a 48-hr delay than at immediate testing, $F(1, 75) = 19.66$, $MSE = 0.04$. This finding is consistent with the view stated above, that across the 48-hr delay, memory has become increasingly schematized. In addition, there was a significant two-way interaction between delay and typicality, $F(1, 75) = 9.29$, $MSE = 0.03$. This interaction reflected the fact that although delay significantly increased, false memories for both typical objects, $t(77) = -3.99$, $p < .01$, and atypical objects, $t(77) = -3.02$, $p < .01$, the size of the increase in absolute terms was much greater for typical objects than for atypical objects.

To compare the effects of **schema** consistency, delay, and instructions on overall sensitivity, we next performed a signal-detection analysis on the data by calculating A' for each condition within each participant. These results are shown in Table 4. Consistent with Experiment 1, participants showed greater sensitivity for atypical objects than for typical objects, $F(1, 75) = 74.54$, $MSE = 0.02$. Participants showed greater sensitivity under intentional learning instructions than under incidental learning instructions, $F(1, 75) = 13.45$, $MSE = 0.02$. Participants also showed greater sensitivity when tested immediately after viewing the **room** than when they were tested after a 48-hr delay, $F(1, 75) = 24.68$, $MSE = 0.02$.

Table 4

Mean Measures of Sensitivity (A′) and Response Bias (B″) in Experiment 2

Instructions and typicality	Delay	A′ Overall	A′ Remember	B″ Overall	B″ Remember
Intentional					
Typical	Immediate	0.74	0.76	0.15	0.35
Atypical	Immediate	0.89	0.86	0.46	0.49
Typical	48 hr	0.57	0.64	−0.01	0.25
Atypical	48 hr	0.83	0.82	0.28	0.39
Incidental					
Typical	Immediate	0.63	0.70	0.08	0.39
Atypical	Immediate	0.83	0.82	0.45	0.54
Typical	48 hr	0.54	0.54	−0.09	0.09
Atypical	48 hr	0.66	0.65	0.34	0.33

Mean Measures of Sensitivity (A′) and Response Bias (B″) in Experiment 2

In addition to these main effects, there was a significant three-way interaction between typicality, delay, and instructions, $F(1, 75) = 5.63$, $MSE = 0.02$. For participants in the intentional learning condition, delay decreased sensitivity by a greater amount for typical objects, $t(37) = 3.71$, $p < .01$, than for atypical objects, $t(37) = 1.93$, $p = .06$. For participants in the incidental learning condition, the opposite was true —delay produced a greater decrease in sensitivity for atypical objects, $t(38) = 3.67$, $p < .01$, than for typical objects $t(37) = 1.51$, *ns.*. This interaction thus seems to be produced by two **things**. First, there appeared to be a floor effect for typical objects in the incidental learning condition. Second, when participants were aware that their memories would be tested for the **room**, they showed relatively little forgetting of atypical objects but they showed considerable forgetting of atypical objects when they were not forewarned that there would be such a test.

Consistent with Experiment 1, participants had more of a bias towards saying “not presented” for atypical objects than for typical objects, $F(1, 75) = 64.87$, $MSE = 0.07$. In addition, participants’ response biases became somewhat more liberal after the 48-hr delay than they were when tested immediately, $F(1, 75) = 10.07$, $MSE = 0.09$. No other effects were significant at conventional levels.

Remember judgments for objects in the room

The mean proportion of remember judgments are reported in Table 3. To analyze these data, we performed a 2 (Typicality: typical, atypical) × 2 (Instructions: intentional, incidental) × 2 (Delay: immediate, 48 hr) mixed ANOVA on the proportion of veridical remember judgments made. Consistent with Experiment 1 and the results of Lampinen et al. (2000), participants had more veridical remember judgments for atypical objects than for typical objects, $F(1, 75) = 11.40$, $MSE = 0.07$. Also consistent with our predictions, there were more veridical remember judgments when participants were given intentional learning instructions than when they were given incidental learning instructions, $F(1, 75) = 14.99$, $MSE = 0.06$. In addition, veridical remember judgments were higher when participants were tested immediately than when they were tested after a 48-hour delay, $F(1, 75) = 8.46$, $MSE = 0.06$.

In addition to these main effects, there was a significant three-way interaction between typicality, instructions, and delay, $F(1, 75) = 8.79$, $MSE = 0.07$. Under intentional learning instructions, there was a significant decline in the rate of veridical remember judgments for typical objects, $t(37) = 2.64$, $p < .05$, but not for atypical objects, $t(37) = 0.38$, *ns.* Under incidental learning instructions, there was a significant decline in the rate of veridical remember judgments for atypical objects, $t(38) = 3.39$, $p < .01$, but not for typical objects, $t(38) = -0.76$, *ns.*

We next performed the same analysis on false remember judgments. As expected, there were more false remember judgments for typical objects than for atypical objects, $F(1, 75) = 35.75$, $MSE = 0.02$. Of interest, we also found that the proportion of false remember judgments was significantly greater after the 48-hr delay than when participants were tested immediately, $F(1, 75) = 10.00$, $MSE = 0.02$.

These main effects were qualified by two significant interactions. First, there was a significant two-way interaction between typicality and delay, $F(1, 75) = 4.16$, $MSE = 0.02$. This interaction occurred because the proportion of false remember judgments increased across the delay for both typical objects, $t(77) = -2.71$, $p < .01$, and atypical objects, $t(77) = -2.34$, $p < .05$, but the absolute magnitude of the increase was much greater for typical objects. There was also a significant interaction between instructions and delay, $F(1, 75) = 4.41$, $MSE = 0.02$. This interaction occurred because there were significantly more false remember judgments after the delay for participants in the incidental learning conditions, $t(38) = -3.87$, $p < .01$, but this did not occur for participants in the intentional learning conditions, $t(38) = -0.72$, *ns*.

This high rate of false remember judgments under incidental learning instructions at the 48-hr delay could explain why veridical remember judgments are not declining in the incidental learning conditions. The rate of true remember judgments is not much higher than the rate of false remember judgments in that condition, suggesting that participants in that condition may be at floor or close to it.

These results are consistent with both FTT and the distinctiveness heuristic. According to FTT, verbatim traces decompose into fractional parts (i.e., perceptual details, conceptual details, and so forth) if nothing is done to refresh the original trace, and this process should increase as time passes. These fractional parts can attach to gist traces resulting in subjectively compelling false memories (Reyna & Titcomb, 1996). As the retention interval increases, there should be more fractional parts to adhere to gist traces, which are more durable than verbatim traces. Thus, false memories may contain more experiential details as time passes and therefore may receive more remember responses after a long retention interval.

These results can also be explained by the distinctiveness heuristic (Norman & Schacter, 1997). False remember judgments are constrained at immediate testing because of the relative memorial vividness of the accurate **recollections**. After a delay, and especially when participants were unaware that they were going to be tested, that distinctiveness is not available to constrain participants' confabulations.

To compare the effects of **schema** consistency, delay, and instructions on the sensitivity of participants' remember judgments, we next performed a signal-detection analysis on the data by calculating A′ for the remember judgments in each condition. These results are shown in Table 4. Participants' remember judgments showed greater sensitivity for atypical objects than for typical objects, $F(1, 75) = 46.56$, $MSE = 0.01$. In addition, participants' remember judgments showed greater sensitivity under intentional learning instructions than under incidental learning instructions, $F(1, 75) = 14.02$, $MSE = 0.02$. Participants also showed greater sensitivity when they were tested immediately than when they were tested after a 48-hr delay, $F(1, 75) = 24.92$, $MSE = 0.73$. There was also a marginally significant interaction between instructions and delay, $F(1, 75) = 2.86$, $MSE = 0.02$. This interaction appears to reflect that delay decreased sensitivity somewhat more in the incidental learning condition than in the intentional learning condition.

As was true with overall recognition, participants had a more conservative response bias as measured by B″ for atypical objects than for typical objects, $F(1, 75) = 18.27$, $MSE = 0.06$. Participants were also more conservative in making remember judgments at the short delay than at the longer delay, $F(1, 75) = 11.37$, $MSE = 0.11$. No other results were significant at conventional levels.

Phenomenal qualities

In addition to making remember–know judgments, participants in Experiment 2 indicated for every remember judgment made what kinds of details they were recollecting. To examine whether there were any differences in the experiential content of people's remember judgments across conditions, we calculated the conditional probabilities of experiencing a particular type of detail (e.g., perceptual detail) given that a remember judgment was made. These results are shown in Table 5. Because not all participants made a remember judgment for both typical and atypical objects, 14 participants were eliminated from this analysis.

Table 5
Conditional Probability of Recollecting a Detail Type Given That a Remember Judgment Was Made

Item type, instructions, and delay	P	T	E	C
Veridical memories/intentional learning instructions				
Typical/immediate	0.64	0.39	0.08	0.53
Atypical/immediate	0.65	0.36	0.41	0.54
Typical/48 hr	0.49	0.32	0.09	0.60
Atypical/48 hr	0.62	0.44	0.59	0.58
Veridical memories/incidental learning instructions				
Typical/immediate	0.76	0.34	0.03	0.60
Atypical/immediate	0.76	0.43	0.47	0.75
Typical/48 hr	0.32	0.50	0.10	0.39
Atypical/48 hr	0.43	0.47	0.55	0.65
False memories/intentional learning instructions				
Typical/immediate	0.70	0.24	0.04	0.19
Typical/48 hr	0.32	0.06	0.03	0.73
False memories/incidental				
Typical/immediate	0.46	0.08	0.00	0.63
Typical/48 hr	0.40	0.24	0.05	0.63

Note. Participants could indicate more than one type of detail for any remember judgment, so rows will not equal 1.00. P = perceptual details; T = thoughts; E = emotions; C = context.

Conditional Probability of Recollecting a Detail Type Given That a Remember Judgment Was Made

For our analysis of veridical remember judgments, we found that the conditional probability of recollecting perceptual details, given that a remember judgment was made, was greater when participants were tested immediately than when they were tested after a 48-hr delay, $F(1, 60) = 5.41$, $MSE = 0.23$. Consistent with our previous findings (Lampinen et al., 2000), the conditional probability of recollecting emotional details, given that a remember judgment was made, was significantly greater for atypical objects than for typical objects, $F(1, 60) = 78.08$, $MSE = 0.01$. During debriefing, participants often mentioned feeling surprised or amused by the atypical objects and sometimes recollected their own experiences with the objects (i.e., Pez dispenser, Barbie).

In addition, the conditional probability of recollecting contextual details, given that a remember judgment was made, was marginally greater for atypical objects than for typical objects, $F(1, 60) = 3.16$, $MSE = 0.11$, $p = .08$. There was also a marginally significant interaction between instructions and typicality in memory for contextual details , $F(1, 60) = 3.40$, $MSE = 0.11$, $p = .07$. This interaction occurred because the conditional probability of recollecting contextual details, given that a remember judgment had been made, was greater for atypical objects than for typical objects when participants were given incidental learning instructions, $t(27) = 2.97$, $p < .01$, but not when they were given intentional learning instructions, $t(35) = -0.32$, *ns.* No other results were significant at $p < .10$.

We also compared the phenomenal qualities of typical veridical remember judgments with the phenomenal qualities of typical false remember judgments. False atypical remember judgments were not included in the analysis because there were so few of them. One should be cautious when interpreting this analysis because 38 participants had to be eliminated because they either did not have any typical veridical remember judgments, or more often, they did not have any typical false remember judgments. Like the above analyses, the conditional probability of recollecting a perceptual detail, given that a remember judgment was made, was lower after the 48-hr delay than when participants were tested immediately, $F(1, 37) = 3.20$, $MSE = 0.28$, but this effect was only marginally significant, $p = .08$. Participants were, however, more likely to recollect thoughts for their veridical **recollections** ($M = 0.37$) than for their false **recollections** ($M = 0.17$), $F(1, 37) = 14.78$, $MSE = 0.06$. This likely reflects the thoughts participants had when they saw the items. It is perhaps somewhat easier for participants to imagine what a nonpresented item looked like than to imagine what they thought on seeing the item.

Participants were marginally more likely to recollect contextual detail when they were tested after a 48-hr delay than when they were tested immediately, $F(1, 37) = 3.93$, $MSE = 0.26$, $p = .055$. One should recall that these are conditional probabilities. What this finding suggests, then, is that participants' **recollections** of typical objects become less based on perceptual detail and more based on contextual detail (e.g., where the item was) as time passes. This main effect was qualified by a marginally significant interaction between instructions and delay, $F(1, 37) = 3.33$, $MSE = 0.26$, $p = .08$. This reflected that, although delay increased the proportion of remember judgments that included contextual detail for participants in the intentional learning condition, $t(17) = -2.94$, $p < .01$, it did not have this effect for participants in the incidental learning condition, $t(20) = -0.10$, *ns.* In addition, there was a marginally significant interaction between instructions and item type, $F(1, 37) = 3.17$, $MSE = 0.08$, $p = .08$. This appeared to reflect that participants in the incidental learning condition were more likely to recollect contextual details for atypical objects than for typical objects, $t(21) = 1.96$, $p = .06$, but this difference did not even approach significance for participants in the intentional learning condition, $p > .60$. No other results were significant at $p < .10$.

Know judgments for objects in the room

Consistent with the findings of Experiment 1, participants had more veridical know judgments for typical objects than for atypical objects, $F(1, 75) = 36.68$, $MSE = 0.03$. In addition, there was a significant interaction between typicality and delay for veridical typical know judgments, $F(1, 75) = 5.11$, $MSE = 0.03$. This interaction reflected the fact that the difference between the proportion of know judgments for typical and atypical objects was greater when participants were tested after a delay than when they were tested immediately, $t(77) = 2.26$, $p < .05$.

Also consistent with Experiment 1, there were significantly more false know judgments for typical objects than for atypical objects, $F(1, 75) = 75.69$, $MSE = 0.03$. There were also more false know after the 48-hr delay than when participants were tested immediately, $F(1, 75) = 5.95$, $MSE = 0.03$. In addition to these main effects, there was a marginally significant interaction between typicality and delay, $F(1, 75) = 1.74$, $MSE = 0.03$, $p = .09$. As with the know hit rate, this appeared to occur because the difference between typical and atypical objects was greater at the longer delay, $t(77) = 1.70$, $p = .09$. There was also a marginally significant interaction between instructions and delay, $F(1, 75) = 3.02$, $MSE = 0.03$. This occurred because participants in the intentional learning condition had significantly more know judgments after the delay than when tested immediately, $t(37) = 3.13$, $p < .01$, but the same was not true for participants in the incidental learning condition, $t(38) = 0.47$, *ns.*

The results of Experiment 2 confirm the overall pattern of results in Experiment 1. Memories for atypical objects are experienced in a phenomenologically richer form than are memories for typical objects. Intentional learning instructions increase the rate of remember judgments. At short retention intervals, false memories for perceptually rich items like objects in a **room** tend not to be experienced in an experientially rich manner. However, after a 48-hr delay, there was a marked increase in the rate of false remember judgments especially in the incidental learning condition.

General Discussion

The research reported in this article breaks new ground in demonstrating that **schemas** can substantially influence the subjective experience of remembering. Sensitivity, as measured by A′, was greater for atypical objects than for typical objects. In addition, memories for atypical objects were more likely to be experienced as conscious **recollections** (i.e., remember judgments) than were memories for typical objects. Memories for atypical objects were especially likely to include experiential details about the emotions experienced on encountering the object. Memories for typical objects, however, were more likely to be based on know judgments. These findings are consistent with the results we reported in Lampinen et al. (2000) for memory for story materials. These findings are also consistent with models of memory, such as Schank's (1982, 1999) dynamic memory model, and with **schema**-plus-correction accounts of memory (Graesser et al., 1979).

More broadly, these findings are consistent with Rajaram's (1996, 1998) distinctiveness-fluency account of remember–know judgments. Rajaram (1996, 1998) argued that remember judgments are influenced by distinctiveness and know judgments are influenced by the fluency of processing. Relative to the existing **schema**, atypical items are more distinctive than are typical items and thus, according to Rajaram's account, they should be experienced in the remember sense.

Recollection was also greatly influenced by the instructions that participants were given. Consistent with Carter's finding (as cited in Gardiner & Java, 1993), we found that participants had more remember judgments when they encountered objects under intentional learning instructions than when they encountered those same objects under incidental learning instructions. Intentional learning instructions allowed participants to survey the contents of the **room** and also form associations between the objects and items in their long-term memory. A striking finding of the study is the rate at which atypical objects were forgotten in the incidental learning condition. Although participants in that condition had fairly good memory for atypical objects when tested immediately, those objects were quickly forgotten after a 48-hr delay. This suggests that the intention to remember may play a role in the consolidation of memory over time.

One should also notice that delay had a significant effect on the nature of the subjective experience of memories. As previous researchers (Gardiner & Java, 1993) have reported, imposition of a delay decreased the overall rate of remember judgments. Delay also appeared to decrease the perceptual distinctiveness of memories. Indeed, perceptual details appeared to be lost more quickly than other sorts of details across the delay.

Contrary to many studies of the subjective experience of false memories (see Lampinen et al., 1998, for a review), relatively few false memories for this complex visual scene were experienced in the remember sense. Indeed, even if one measures remember judgments as a proportion of all judgments, the proportion of false remember judgments is lower in this paradigm than in the DRM paradigm. This finding is consistent with the distinctiveness heuristic account proposed by Schacter et al. (1999). One should consider that in order for someone to make a remember judgment, their memory for the item must be accompanied by specific experiential details. It is likely, however, that for a complex visual scene, participants will expect that their memories will include considerably more of those experiential details than for less complex stimuli. It is not surprising then that most of the false memories in the present experiments were experienced in the know sense.

There was, however, one especially noteworthy exception to this overall pattern. Participants in the delay condition who had been given incidental learning instructions had a substantial number of false **recollections** (i.e., remember judgments). Under the distinctiveness account, one can explain this finding by assuming that participants in the delay condition who were given incidental learning instructions may not expect their memories to contain much experiential detail. For that reason, any level of experiential detail may be sufficient to convince them that the item had been presented and that they were remembering the item.

The phantom **recollection** account can also explain this finding. According to the phantom **recollection** account, participants with strong gist traces will sometimes falsely confabulate details for their false memories, turning a fuzzy gist memory into a more distinctive false **recollection**. If one assumes that gist extraction is relatively unaffected by attention, then this may be especially likely to occur when the verbatim trace is weak. One should notice two factors that tend to support the phantom **recollection** account of these findings. First, the rate of false remember judgments increases across the delay for **schema**-consistent objects. Because FTT posits that gist is more temporally stable than verbatim (Brainerd, Reyna, & Brandse, 1995; Lampinen & Schwartz, 2000), this finding is consistent with these false **recollections** being gist based rather than verbatim based.

Second, the phantom **recollection** account assumes that the subjective experience of **recollection** can occur in two ways. It can, and usually is, based on verbatim memory traces. When it is based on verbatim memory traces, discrimination between targets and meaning-preserving distractors should be relatively high. **Recollection** can also be based on gist traces to which participants confabulate additional supporting details. When these sorts of **recollections** occur, discrimination between targets and meaning-preserving distractors should be relatively low. One should now note that for participants in the incidental learning condition who are tested after the long delay, A′ did not differ greatly from 0.5, indicating that participants were relatively limited in their ability to discriminate between presented and nonpresented items, even with their remember judgments. Indeed, it is possible that both participants' veridical and false remember judgments in this condition were actually phantom **recollections**.

Our own view is that both of these accounts tell part of the story. Clearly not all remember judgments are created equal. Depending on the participants' goals and metamemorial assumptions, it is reasonable that they may accept or reject an item based on the degree of experiential detail they are able to retrieve. Under some conditions, a participant may require more experiential detail than under other circumstances. However, for false **recollections** to occur at all, there must be some experiential details; the phantom **recollection** account provides a hypothesis about the circumstances under which those experiential details will be confabulated.

These results also add to recent research showing that remember judgments can differ not only in quantity but in the types of details that make them remember judgments (Gardiner, Ramponi, & Richardson-Klavehn, 1998; Norman & Schacter, 1997; Lampinen et al., 2000). The present results show, for instance, that memories for atypical events are more likely to include emotional detail than are memories for typical events. Active consideration of the types of details **recollections** include may prevent theorists from going down unpromising explanatory paths. If one considers that remember judgments can be based on both perceptual and conceptual information, then arguments that **recollection** is best conceptualized as a perceptually based or a conceptually based process become far less convincing. Indeed, what these additional measures appear to be telling us is that all sorts of content can be experienced in the recollective sense (Lampinen et al., 2000; Lampinen & Schwartz, 2000; Rajaram, 1996, 1998).

The present research provides important new evidence concerning the nature of recollective experience and how **schemas** influence that experience. The **schema** concept is one of the most ubiquitous concepts in modern scientific psychology. The present research shows that **schemas** can result in veridical memories for atypical objects that are especially vivid and compelling. The research also shows that false memories for real-world scenes can at times be rich and vivid, although at other times they can be sparse and unconvincing. An important theoretical question for the future is how to develop theories that clearly specify the boundary conditions for when these two types of false memories will occur.

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APPENDIX

APPENDIX A: Items Used in Room Schema Experiments

Appendix

Items Used in Room Schema Experiments

Typical Room A	Atypical Room A	Typical Room B	Atypical Room B
Notebook	Press-on nails	Digital clock	Dog biscuit
Computer diskette	Harmonica	Phone book	Barbie
Box of staples	Beauty cream	Pop can	Cooking oil
Telephone	Shower cap	Post-It notes	Squirt gun
Stapler	Toy car	Tape dispenser	Rubber glove
Binder	Vinyl record	Day planner	Pepper
Pencil	Horse shoe	Desk lamp	Pez dispenser
Textbook	Toothbrush	File folder	Dental floss
Coffee mug	Die	Pen	Deodorant
Computer mouse	Cigar box	Trash can	Litter box

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