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Remembering and knowing: Two means of access to the personal past

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The nature of recollective experience was examined in a recognition memory task. Subjects gave "remember" judgments to recognized items that were accompanied by conscious recollection and "know" judgments to items that were recognized on some other basis. Although a levels-of-processing effect (Experiment 1) and a picture-superiority effect (Experiment 2) were obtained for overall recognition, these effects occurred only for "remember" judgments, and were reversed for "know" judgments. In Experiment 3, targets and lures were either preceded by a masked repetition of their own presentation (thought to increase perceptual fluency) or of an unrelated word. The effect of perceptual fluency was obtained for overall recognition and "know" judgments but not for "remember" judgments. The data obtained for confidence judgments using the same design (Experiment 4) indicated that "remember"/"know" judgments are not made solely on the basis of confidence. These data support the two-factor theories of recognition memory by dissociating two forms of recognition, and shed light on the nature of conscious recollection.

Consciousness permeates mental activity and yet, with a few exceptions (Holender, 1986; Mandler, 1975, 1985, 1989; Marcel, 1983a, 1983b; Posner & Snyder, 1975), it has not been considered a suitable topic of scientific enquiry for decades. Mandler (1975, 1985) commented on this lack of interest and emphasized the adaptive role and functional importance of the role of consciousness. Tulving (1985) points out that the neglect in the study of consciousness is especially noticeable in the study of memory. He says:

> One might think that memory should have something to do with remembering, and remembering *is* a conscious experience. To remember an event means to be consciously aware now of something that happened on an earlier occasion. Nevertheless, through most of its history, including the current heyday of cognitive psychology, the psychological study of memory has largely proceeded without reference to the existence of conscious awareness in remembering. (p. 1)

In recent years however, interest in the role of conscious awareness in memory has been expressed in two broad lines of research—the work on amnesics, who suffer memory loss as a result of certain types of brain damage (e.g., Warrington & Weiskrantz, 1968, 1970), and the work on understanding the nature of recollective experience (Gardiner, 1988; Tulving, 1985).

Although amnesics are unable to perform at normal levels on explicit memory tests such as recall and recognition, their performance is comparable to that of normals on implicit memory tests (e.g., Warrington & Weiskrantz, 1968, 1970), which do not require conscious recollection. On implicit memory tests, subjects are simply required to perform a task without reference to the study event (e.g., solve fragments such as e _ e _ ha _ _ with the first word that comes to mind). The extent to which performance on these tasks is primed by earlier studied events (e.g., by studying the word *elephant*) is assumed to reflect memory.

Dissociations between explicit and implicit memory tasks as a function of encoding variables have been obtained in normals as well (Jacoby, 1983a, 1983b; Jacoby & Dallas, 1981; Roediger, Weldon, & Challis, 1989).[1] For many theorists (Squire, 1987; Tulving & Schacter, 1990), these dissociations in normals and amnesics indicate fundamental differences between measures of memory that require conscious recollection (explicit memory tests) and those that do not (implicit memory tests). Explicit memory tests are assumed to tap conscious recollection of the studied event simply because, in these tests, subjects are instructed to recollect studied events, whereas in implicit memory tests they are not.

Recently, Tulving (1989) termed this approach to the study of conscious recollection as the doctrine of concordance of behavior, cognition, and experience. That is, based on the subject's performance, the nature of the experience is inferred and the study of cognitive processes has been mistaken for the study of conscious experience.

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As Tulving (1989) suggests, there is no logical necessity for a relation between behavior (or performance) and conscious experience. In fact, recent data show that performance on explicit memory tests does not depend solely on the conscious recollection of studied events by the rememberer (Gardiner, 1988; Gardiner & Java, 1990; Gardiner & Parkin, 1990; Tulving, 1985).

Explicit Memory: "Remembering" and "Knowing"

The basic paradigm for exploring the role of conscious recollection in memory involves requiring people to make judgments regarding the nature of their memories for recalled or recognized items (e.g., Gardiner, 1988; Tulving, 1985), instead of assuming the involvement of conscious recollection on the basis of successful memory performance. One type of experience, which subjects judge as "remember," refers to those items for which they have a vivid memory, a subjective feeling of having seen the item during the study episode, and a conscious recollection of it occurring on the study list. The other type of experience, which subjects judge as "know," refers to items for which they can tell (usually with certainty) were on the study list, but cannot recollect the actual occurrence. It is assumed that this judgment is made on some other basis because the subject does not remember actually seeing the item on the study list, and does not have a conscious recollection of it. For example, while describing a recent visit to a national park, one may recall all the details and mentally relive the events that took place. This would be an example of a "remember" judgment. On the other hand, there are times when we meet someone on the street whom we met at a party a few days ago. Although we know that we met this person at the party, we may not remember actually meeting the person, or his/her name. In this case, the recognition of this person would be classified as a "know" judgment, not a "remember" judgment.

Tulving's (1985) and Gardiner's (1988) technique to disentangle the components of recognition memory is a recent one, but the notion that there are two bases of recognition memory had been proposed before.

The Two Bases of Recognition Memory

Mandler (1979, 1980) and Jacoby (1983a, 1983b; Jacoby & Dallas, 1981) have been the two notable proponents of the theory that there are two bases for recognition memory. Mandler (1980) termed these components integration and elaboration. A process of intraitem integration occurs when "repeated exposures of an event focus organizational processes on the perceptual, featural, and intrastructural aspects of the event; intraitem organization involves sensory and perceptual integrations of the elements of the target event. This increased integration . . . is perceived as the familiarity of the event" (p. 255). Elaborative processes depend on interitem organization and include a meaning-based analysis of the to-be-recognized material. These elaborative processes are termed retrieval processes in Mandler's model.

Jacoby (1983a, 1983b; Jacoby & Dallas, 1981) postulated two bases of recognition memory—perceptual and conceptual—on the basis of the findings that, on the one hand, parallel effects of perceptual variables are observed on recognition memory tasks and perceptual implicit memory tasks such as perceptual identification, and on the other hand, dissociative effects of conceptual variables are also observed for the two tasks.

Tulving's (1985) and Gardiner's (1988; Gardiner & Java, 1990; Gardiner & Parkin, 1990) data support these models of recognition memory, although the central aim of their work was to use their paradigm to test whether explicit memory tests are faithful measures of conscious recollective processes.

"Remember" and "Know" Judgments: A Review of Previous Studies

The first study that employed "remember" and "know" responses to study the nature of conscious experience was reported by Tulving (1985). Subjects studied category name-instance pairs (e.g., musical instrument-VIOLA) and then participated in three successive recall tests, in the following order, in which increasingly more cues were provided to aid recall: first, a free-recall test, second, a category cued-recall test (e.g., musical instrument-_________), and third, a category and letter cued-recall test (e.g., musical instrument-v_________). Subjects also made "remember" and "know" judgments to the recalled items. As was predicted, the proportion of "remember" responses declined as the cues provided at test increased. Furthermore, in a recognition memory experiment (Tulving, 1985), "remember" responses declined more with retention interval (from Day 1 to Day 8) relative to the overall recognition performance.

A series of experiments reported by Gardiner and his colleagues (1988; Gardiner & Java, 1990; Gardiner & Parkin, 1990) have shown that several variables produce dissociations between "remember" and "know" responses, even though both responses were made to items that were recognized in an explicit memory test. Moreover, these differences between the two responses were similar to the dissociations observed as a function of the same variables between conceptual explicit memory tasks and perceptual implicit memory tasks, respectively.

In Gardiner's experiments, subjects first studied some items under different study conditions. After a retention interval, they participated in a recognition memory task and also made "remember" and "know" judgments. In one experiment (Gardiner, 1988, Experiment 1), the levels-of-processing effect, that is, superior recognition memory for items for which semantic rather than rhyme associates were produced at study (see Craik & Lockhart, 1972; Craik & Tulving, 1975), was observed for "remember" responses. This manipulation had no effect on "know" responses, a pattern similar to that observed in perceptual implicit memory tests (Jacoby & Dallas, 1981). In another experiment (Gardiner, 1988, Experiment 2), the effect of generation (produce "COLD" given

"HOT-C???") versus reading (read "HOT-COLD") was tested at 1-h and 1-week retention intervals. At both retention intervals, the generation effect, that is, superior recognition memory for generated than for read items (Slamecka & Graf, 1978), was observed only for "remember" responses and not for "know" responses.[2] However, Wippich (1992) has reported a small but significant generation effect for "know" responses.

These experiments demonstrate that "remember" and "know" responses generally show functional dissociations similar to those observed between explicit and implicit memory tests (e.g., Jacoby & Dallas, 1981; Tulving, Schacter, & Stark, 1982). Alternately, a "weak trace strength" hypothesis would suggest that "know" responses failed to show the levels-of-processing effect and the generation effect due to low levels of performance and, if a higher proportion of "know" responses was obtained, we may have observed the same pattern of results for both types of responses.

Gardiner and Java (1990) employed a number of other independent variables to test the weak trace strength hypothesis against a "dual-component hypothesis." According to the latter, "know" responses should sometimes be systematically influenced by some other independent variable that does not influence the "remember" responses, or influences "remember" responses in the opposite direction. In one experiment, subjects made recognition and "remember"/"know" judgments on studied and nonstudied high- and low-frequency words (Gardiner & Java, 1990). They recognized more of the low-frequency than high-frequency items; this effect was restricted only to "remember" judgments, thereby failing to refute the weak trace strength hypothesis. It should be noted that this result is inconsistent with the previous assumptions (Jacoby & Dallas, 1981; Mandler, 1980) that superior recognition of low-frequency words is based on enhanced fluency or a feeling of familiarity for those words. In another experiment, Gardiner and Java (1990) succeeded in demonstrating the opposite effects of a variable on "remember" and "know" responses when subjects gave significantly more "remember" responses to studied words than to studied nonwords, and gave significantly more "know" responses to studied nonwords than to studied words. These results refute the hypothesis of weak trace strength or floor effects for "know" responses.

Gardiner and Parkin (1990) examined the effects of divided attention (subjects engage in a secondary task in addition to the main task at study or at test) on "remember" and "know" responses. Gardiner and Parkin found that divided attention at study affected only the "remember" responses. "Know" responses were equivalent for the undivided (no secondary task) and divided study conditions. Once again, this dissociation is similar to the one observed between explicit and implicit memory tasks as a function of divided attention manipulation (e.g., Jacoby, Woloshyn, & Kelley, 1989; Parkin & Russo, 1989). Recently, Gardiner and Java (1991) have also shown that "remember" and "know" judgments have different forgetting rates over a period of 6 months.

On the basis of these results, Gardiner and Parkin (1990) have suggested that "remember" responses are based on an episodic memory system that largely depends on conceptual processing, whereas "know" responses are possibly based on a procedural memory system that largely employs perceptual processing (Schacter, 1990; Tulving & Schacter, 1990). The present experiments were carried out to further examine the nature of conscious recollective experience as measured by "remember" and "know" responses. The general goal was to identify additional factors that influence these two responses. The specific goal was to test Gardiner and Parkin's claim that "remember" responses are sensitive to conceptual manipulations, whereas "know" responses are sensitive to perceptual manipulations.

EXPERIMENT 1

The central aim in Experiment 1 was to replicate Gardiner's (1988) results with the levels-of-processing manipulation on "remember" and "know" judgments in a recognition memory task. This manipulation was used to ensure that the subjects understood the terms "remember" and "know" as the experimenter intended. If this manipulation was successful, the results should replicate those of Gardiner (1988, Experiment 1). Specifically, "remember" responses would show a significant levels-of-processing effect (Craik & Lockhart, 1972; Craik & Tulving, 1975; Gardiner, 1988), whereas no levels-of-processing effect would be obtained for "know" responses, given that "know" responses depend on enhanced perceptual processing (see Graf & Mandler, 1984; Jacoby & Dallas, 1981). A reversed levels-of-processing effect for "know" responses might appear, however, in which a greater proportion of "know" responses would be observed for items studied in the rhyme condition (producing rhyme associates) than for items studied in the semantic condition (producing semantic associates). This prediction is based on the logic that the rhyme condition produces greater perceptual processing than the semantic condition, because the subjects pay more attention to the perceptual information in the former condition.

In addition, the effect of modality of presentation of study items (visual and auditory) on "remember" and "know" judgments in the recognition task (in which all items were presented visually) was examined. The reports of the effect of modality in recognition memory tasks have been mixed. Some studies have reported slightly but significantly better recognition performance for items that were studied and tested in the same modality than for items studied and tested in different modalities (e.g., Geiselman & Bjork, 1980; Kirsner, 1974; Kirsner & Smith, 1974). Other studies have either failed to find this effect or found that the effect of modality of presentation interacted with other variables (Jacoby & Dallas, 1981; Kirsner, Milech, & Standen, 1983; Roediger & Blaxton, 1987).

If we were to obtain superior memory for items presented in the same mode at study and at test, we can predict that this perceptual effect will be reflected in "know" responses, if "know" responses are sensitive to perceptual factors. This prediction is based on some previous findings (Blaxton, 1989; Jacoby & Dallas, 1981; Roediger & Blaxton, 1987) that showed superior performance for items with preserved modality across study and test in perceptual implicit memory tasks. "Remember" responses are not likely to reflect the same mode superiority, because conceptual tasks such as free recall are not sensitive to manipulation of modality (Blaxton, 1989).

Method

Subjects. Sixteen Rice University undergraduates participated in partial fulfillment of a course requirement.

Design and Materials. This experiment employed a 2 (levels of processing) × 2 (modality of presentation) within-subject design for the recognition memory task. The orienting tasks employed for the levels-of-processing variable were the same as those used by Gardiner (1988) except that, unlike in his study, levels of processing was manipulated as a within-subject variable. The subjects produced semantic associates to half of the study words and produced rhyming words to the other half of the study words. Half of the study words were presented visually and the other half were presented auditorily.

The presentation of items was blocked by condition in such a way that, in one block, the subjects produced semantic associates to visually presented words. In the second block, they produced rhyme associates to visually presented words. In the third block, the subjects produced rhyme associates to auditorily presented words, and finally, for the fourth block, they produced semantic associates to auditorily presented words. The order of blocks was counterbalanced, using a Latin-square design. Twenty words were presented in each of the four blocks. Each set of 20 words was rotated through every block.

A total of 160 medium- to high-frequency (20-50 per million, Kučera & Francis, 1967) common nouns of five to nine letters in length were used. The presentation of words in the recognition test phase was random with reference to the study condition. All items that were presented as targets in the recognition task for 8 subjects were presented as lures for the other 8 subjects. In all, eight combinations of study and test lists were required to achieve complete counterbalancing.

Procedure. The subjects were tested in groups of 1 to 4. In the study phase, they produced semantic associates or rhyming words to the study words, presented at the rate of 5 sec per item, either visually in a booklet or auditorily via a tape recorder. No mention of the test phase was made at this point, and the subjects were told that they were assisting the experimenter in preparing materials for other experiments. In the test phase, they participated in a recognition task that followed a 1-h retention interval. During the retention interval, the subjects participated in another experiment in which neither the materials nor the procedure overlapped with those of the present experiment.

For the recognition task, all the test items were presented visually. The subjects were asked to write whether the test words printed in a booklet were presented in the study list ("Y" for yes) or not ("N" for no). They were given a blank sheet to cover the items and to expose each item in turn as they proceeded down the list. For the words they recognized as having been on the study list, the subjects were asked to write "R" for "remember" and "K" for "know" judgments. The recognition, "remember," and "know" judgments were made on an item-by-item basis; that is, if an item was recognized, they made the "remember" or "know" response to it before proceeding to the next item. The entire procedure, including the retention interval, took 1 h and 40 min.

The instructions to explain the "R" and "K" responses, presented in the Appendix, followed very closely those specified by Gardiner (1988). After reading these instructions, each subject was asked to explain to the experimenter how she/he would make the "remember" and "know" judgments on the basis of the instructions provided. If they were confused about the distinction, the experimenter clarified the instructions further before the test phase began. This procedure was adopted in all the subsequent experiments reported here.

Results and Discussion

The results from the recognition task are presented in Table 1, which displays proportion of hits as a function of different study conditions, and proportion of false alarms for "remember" and "know" responses. The level of significance for this experiment and all the subsequent experiments was set at $p < .05$, unless otherwise noted. In all the experiments, paired comparison t tests, computed separately for overall recognition, "remember," and "know" responses, are reported more frequently than analysis of variance (ANOVA). This was done because "remember" and "know" judgments could be considered stochastically dependent by means of the instructions. Therefore, some may consider it inappropriate to treat these two judgments as two levels of an independent variable to examine interaction effects (this issue is discussed in more detail later). Because different a priori predictions for the two types of responses were made in each experiment, t tests were used to examine the effect of independent variables on these two responses.

For the overall recognition data, a levels-of-processing effect was obtained such that studied items to which semantic associates were produced were recognized significantly more often (.86) than were studied items to which rhyme associates were produced (.62) [$t(15) = 4.36$, $SE = .05$]. When the overall recognition data were broken down by "remember" and "know" responses, opposite patterns of results were obtained for the two responses. For "remember" responses, a significant levels-of-processing effect was found such that more items in

Table 1
Mean Proportion of Hits and False Alarms as a Function of Study Conditions and Response Type in Experiment 1

Study Manipulation	Targets: Levels of Processing		Targets: Modality		Lures
	Semantic	Rhyme	Visual	Auditory	(False Alarms)
Overall Recognition	.86	.62	.74	.74	.16
"Remember"	.66	.32	.49	.49	.02
"Know"	.20	.30	.25	.25	.14

the semantic condition (.66) were given "remember" responses than were items in the rhyme condition (.32) [$t(15) = 5.96$, $SE = .06$]. For "know" responses, on the other hand, the effect was reversed such that more "know" responses were given to the items in the rhyme condition (.30) than in the semantic condition (.20) [$t(15) = -4.27$, $SE = .02$].

No effect of modality of presentation was obtained for the overall recognition data such that there was no difference in recognition between the proportion of visually (.74) and auditorily (.74) studied items ($t < 1$). The same pattern was obtained for "remember" responses for auditorily (.49) and visually (.49) studied items ($t < 1$), and for "know" responses for auditorily (.25) and visually (.25) studied items ($t < 1$).

The levels-of-processing effect in recognition memory (.24) was smaller than the effect observed for "remember" responses (.34). The theoretical rationale for this comparison lies in the assumption that "remember" responses are a "purer" measure of conscious recollection than is overall recognition. A larger levels-of-processing effect for "remember" responses than for overall recognition responses suggests that "remember" responses are more sensitive to the levels-of-processing manipulation than are recognition memory responses.

One way to capture this difference statistically would be to treat "remember" and "know" responses as two levels of a factor, response type (which is presumably manipulated by the instructions given at test), and examine its interaction with the levels-of-processing manipulation. A significant levels-of-processing × response type interaction was obtained [$F(1,15) = 41.16$, $MS_e = .02$], such that significantly more "remember" responses were given to the items encoded in the semantic condition (.66) than were given to the items encoded in the rhyme condition (.32) (t value is reported above). This pattern was reversed for "know" responses; significantly more "know" responses were given to items that were encoded in the rhyme condition (.30) than in the semantic condition (.20) (t value is reported above). This reversed levels-of-processing effect for "know" responses resulted in a smaller levels-of-processing effect for the overall recognition data than for the "remember" data. These data indicate that recognition memory includes another component (termed "know" judgments here) in addition to pure conscious recollection.

However, an ANOVA to interpret the crossover interaction between "remember" and "know" responses may be considered problematic because these responses are not statistically independent, given the nature of the instructions. The instructions given to the subjects imply that they make a "know" judgment to a recognized item whenever they fail to make a "remember" judgment. Thus, "remember" and "know" judgments always add up to the overall recognition responses and the value of one judgment can be determined if the values of the other two judgments are known. As a result, "remember" and "know" judgments cannot be treated as two independent levels of a factor.

Therefore, a different analysis was undertaken to test the statistical significance of the difference in the levels-of-processing effect between "remember" responses and the overall recognition data. For each subject, the ratio between the proportion of "remember" responses and overall recognition responses was obtained for each condition.[3] The advantage of using this technique is that it captures the differential effects of an independent variable on "remember" and overall recognition responses across conditions while circumventing the interpretative difficulties inherent in using a crossover interaction for the same purpose.

Thus, for the levels-of-processing manipulation, this ratio indicates the proportion of overall recognized items that were given "remember" responses for semantically and phonetically processed items. For items in the semantic condition, the mean remember/recognition ratio across subjects was .76, whereas in the rhyme condition this ratio was .49. A paired comparison t test, comparing the remember/recognition ratio for the semantic condition with the rhyme condition, was found to be significant [$t(15) = 5.35$, $SE = .05$]. These ratios indicate that a greater proportion of recognized items were given the "remember" judgment in the semantic condition than in the rhyme condition. Thus, the decrease in "remember" responses from semantic to rhyme conditions was greater than the decrease in the overall recognition responses. This larger levels-of-processing effect for "remember" responses than for overall recognition responses suggests that there are factors other than conscious recollection that influence recognition memory and that these factors can be identified when "remember" responses are taken out of the total recognition performance. The residual, termed "know" responses here, may correspond to perceptual fluency (Jacoby, 1983a, 1983b; Jacoby & Dallas, 1981) or familiarity (Mandler, 1979, 1980).

The modality manipulation produced little effect in the overall recognition data. The reports of the effect of modality of presentation in recognition memory have not been consistent in the literature and the conditions under which this effect is observed are unclear. For example, recently, Gregg and Gardiner (1991) reported a study in which subjects read words either silently or aloud both at the time of study and at test (a recognition memory test). They found that the items that were read aloud produced greater "remember" responses. However, a match of modality (read silently at study and test, or read aloud at study and test) did not increase "know" judgments relative to the modality mismatch condition. The purpose of the second experiment was to use a stronger manipulation to examine the possible role of perceptual features in influencing "know" judgments. This manipulation also allowed for a straightforward prediction for the "remember" responses.

EXPERIMENT 2

Dissociations between "remember" and "know" responses should be obtained by manipulating the symbolic form (pictures vs. words) of study items in a recognition memory task if "remember" responses depend on an episodic memory system that employs conceptual processing, and "know" responses depend on a procedural memory system that employs perceptual processing (Gardiner & Parkin, 1990). Previous studies (e.g., Madigan, 1983) have shown that memory for pictures is significantly better than memory for words, even when only the word counterparts are presented at test. In the recognition task, we should obtain this picture-superiority effect. The critical issue here was the pattern of results that we would obtain for "remember" and "know" responses.

From previous studies, we know that on perceptual tasks such as word-fragment completion, performance on items studied in the *same* symbolic form is superior to performance on items that were studied in a different mode (Roediger & Weldon, 1987; Weldon & Roediger, 1987). Weldon and Roediger (1987, Experiment 4) found that the picture-superiority effect obtained in free recall and recognition was not obtained in word-fragment completion. Instead, a greater proportion of fragments were completed if subjects had studied them in word rather than pictorial form.

Taken together, the results from the recognition task (Madigan, 1983) and the word-fragment completion task (Roediger & Weldon, 1987; Weldon & Roediger, 1987) indicate that a picture-superiority effect should be observed for "remember" responses because these responses presumably tap conceptual processing. "Know" responses, on the other hand, are presumed to tap perceptual processing and, therefore, should exhibit a pattern of results similar to that observed in word-fragment completion; that is, a greater proportion of "know" judgments should be observed for studied words than for studied pictures. This opposite pattern of results for "remember" and "know" responses is critical for the argument that these two types of responses employ different types of processing. If we observe no effect of mode of presentation on "know" responses, we would be faced with the weak trace strength hypothesis in interpreting these results.

Method

Subjects. Twenty Rice University undergraduates participated to fulfill course requirements.

Design and Materials. Study items were presented either in pictorial form or as words in a within-subject design. At test, all items were presented in word form for recognition and subsequent "remember" and "know" judgments.

The study items were selected from Snodgrass and Vanderwart's (1980) norms. A total of 120 items were selected such that the name agreement on the pictorial representations of these items was 85% or above, according to the norms. The digitized versions of these line drawings on the Macintosh were converted to be displayed on IBM PCs. In the recognition task, 60 target items and 60 lures were presented in word form. Thus, 30 words representing the names of the 30 studied pictures, 30 studied words, and 60 lure words were presented to the subjects. Counterbalancing was achieved by rotating each set of items through every condition and by ensuring that all items appeared as words and pictures at study, and as targets and lures at test, equally often across subjects. Thus, a total of four study-test list combinations were required to achieve complete counterbalancing.

Procedure. The subjects were tested in groups of 1 to 4. At study, they were presented with pictures and words on the computer screen at the rate of 5 sec per item and they were asked to study these items for a later (unspecified) memory task. The presentation of words and pictures was controlled by a program written in the MEL programming language, and was displayed on Micro Express-386SX computers with SuperSync 2A+ color monitors. The words and pictures were presented in blocks. A 15-min filled retention interval was introduced between the study and test phases. The retention interval was reduced from 1 h to 15 min on the basis of Gardiner's (personal communication, June 1990) finding that a retention interval of 10 min is sufficient to stabilize "remember" and "know" responses. In other words, the proportion of "remember" and "know" judgments stay more or less constant between 10-min and 1-h intervals. The subjects solved word fragments in this interval with the help of semantic cues. None of the words used in the study and test phase of this experiment were presented during the retention interval task.

At the time of test, the subjects were given a booklet containing both studied and nonstudied items in word form and were asked to indicate which of the test items were on the study list ("Y" for yes) and which ones were not ("N" for no). In addition, they were asked to give "R" and "K" responses to each recognized item as they proceeded through the list. The instructions for "R" and "K" judgments were the same as those given in Experiment 1. The entire procedure took about 45 min.

Results and Discussion

Table 2 displays the data for Experiment 2 for proportion of hits as a function of study conditions, the proportion of "remember" and "know" responses, and the proportion of false alarms.

The results for the overall recognition data indicate that a significant picture-superiority effect was obtained [$t(19) = 5.39$, $SE = .04$], such that pictures were recognized significantly more often (.90) than words (.69). When the recognition data were broken down by "remember" and "know" responses, the data showed that more "remember" responses were given to pictures (.81) than to words (.51) [$t(19) = 6.53$, $SE = .07$], whereas significantly more "know" responses were given to words (.18) than to pictures (.09) [$t(19) = -3.91$, $SE = .02$].

Similar to the levels-of-processing effect in Experiment 1, the picture-superiority effect obtained for "remember" responses (.30) was greater than that for the overall recognition responses (.21). This difference produced a statistically significant crossover interaction between "remember"/"know" responses and the picture-word manipulation [$F(1,19) = 40.11$, $MS_e = .02$]. In other words, the greater proportion of "know" responses for words than for pictures suggests that the picture-

Table 2
Mean Proportion of Hits and False Alarms as a Function of Study Conditions and Response Type in Experiment 2

Study Manipulation	Targets: Pictures	Targets: Words	Lures (False Alarms)
Overall Recognition	.90	.69	.09
"Remember"	.81	.51	.01
"Know"	.09	.18	.08

superiority effect was greater in "remember" responses than in overall recognition responses.

Once again, this difference in the picture-superiority effect between the overall recognition and "remember" data can be assessed by computing the remember/recognition ratio (see Results and Discussion section of Experiment 1) for the picture and word conditions in order to circumvent the problems associated with treating "remember" and "know" responses as two levels of an independent factor. A significant difference was obtained between the remember/recognition ratio for the picture condition (.90) and the word condition (.70) [$t(19) = 4.43$, $SE = .04$]. Thus, a greater proportion of recognized items received "remember" judgments in the picture condition than in the word condition, thereby indicating that the picture-superiority effect was greater for "remember" responses than for the overall recognition responses. These data provide support for the idea that factors other than pure conscious recollection mediate overall recognition responses.

The stronger effects of levels-of-processing and picture-word manipulations on "remember" responses than on overall recognition support Gardiner's (1988) notion that "remember" responses are mediated by conceptual processes. Reversed levels-of-processing and picture-superiority effects for "know" responses indicate that these responses are mediated by perceptual processes. However, this interpretation is tempered by the absence of modality (visual-auditory) effects for "know" responses. One possible, albeit post hoc, explanation for the presence of the reversed picture-superiority effect and the absence of the modality effect for "know" responses (given that both are presumably perceptually guided processes), might be that these responses involve the use of phonological codes that are presumably common for visual and auditory words but not for pictorial and word form representations. Another cautionary note to keep in mind while interpreting these results is that test conditions for both the visual-auditory and picture-word study manipulations were asymmetric in that auditory and picture test conditions (in Experiments 1 and 2, respectively) were not employed.

In all the experiments reported by Gardiner, and in Experiments 1 and 2 reported here, the effects of independent variables were always present in "remember" responses, whereas "know" judgments were not consistently affected. In some instances, the dissociations between "remember" and "know" judgments were observed when only the "remember" responses showed the effect of the independent variables and no effect was observed for "know" responses (Gardiner, 1988; Gardiner & Java, 1990, Experiment 1; Gardiner & Parkin, 1990). In other cases, the independent variables influenced "remember" responses in one direction and "know" responses in the other direction (Gardiner & Java, 1990, Experiment 2; the present Experiments 1 and 2). Although the crossover interactions constitute a stronger case that "know" judgments have a different basis than "remember" judgments, there was no instance where the effect of an independent variable was observed only on "know" and not on "remember" responses. It is critical to demonstrate that a perceptual variable would selectively influence only "know" judgments to bolster the idea that "remember" and "know" judgments are influenced by different factors. The aim in Experiment 3 was to manipulate an independent variable that would presumably leave the "remember" responses unaffected but would influence the recognition performance, thereby producing an effect on the "know" responses.

EXPERIMENT 3

In this experiment, the relation between perceptual fluency in the processing of test items and "remember"/"know" judgments was examined. Jacoby (1983a, 1983b, 1984; Jacoby & Dallas, 1981; Jacoby & Whitehouse, 1989; Jacoby & Witherspoon, 1982) and Mandler (1979, 1980, 1985; Mandler, Graf, & Kraft, 1986) have been the most notable proponents of the view that perceptual fluency or familiarity enhances recognition.

It should be noted that Watkins and Gibson (1988) have reported an experiment in which manipulating perceptual fluency did not influence recognition memory. They reasoned that the relationship between perceptual fluency and recognition is due to item selection effects, that is, items that are easily identified in a perceptual identification task are also easily recognized in a recognition memory task. On the other hand, some reported studies have shown an effect of perceptual priming on recognition performance (e.g., Feustel, Shiffrin, & Salasoo, 1983; Jacoby & Whitehouse, 1989; Johnston, Dark, & Jacoby, 1985; Johnston, Hawley, & Elliott, 1991).

One way to enhance the fluency of processing is to immediately precede the presentation of a target item by its own masked presentation. In other words, the first presentation of the item is very rapid and is preceded by a mask (e.g., &&&&&&&&&) so that subjects are unable to identify the first presentation, but can clearly see the second presentation. This repeated exposure is presumed to enhance the perceptual fluency with which the target item is processed.

Previous studies have shown that when a target is immediately preceded by its own masked presentation, performance on a recognition task is facilitated for the studied items relative to when the target is preceded by an unrelated word (Forster, 1985; Jacoby & Whitehouse, 1989; Rajaram & Neely, 1992). In fact, masked repetition of the item also increases the number of false-positive responses to nonstudied items (Jacoby & Whitehouse, 1989). Jacoby and Whitehouse explained this increase in false positives for repeated items as the increased fluency with which these items were processed by the subjects and their attribution of this fluency to familiarity; that is, because these items were easier to perceive, subjects falsely called them "old."

As noted before, "remember" judgments presumably depend on conceptual processing, and "know" judgments depend on perceptual processing. Given these assumptions, one may hypothesize that "remember" responses should be relatively insensitive to changes in perceptual fluency, whereas "know" responses should be sensitive to such changes. If this assumption is correct, facilitation of the perceptual processing of a target item by masked priming should increase "know" responses selectively. No claim is made here that the masked word is presented subliminally, but only that the subjects be unable to read it or to report its presence.

Method

Subjects. Twenty-four Rice University undergraduates participated in partial fulfillment of a course requirement.

Design and Materials. A 2×2 within-subject design was used in which study status (targets vs. lures) and priming (a test word immediately preceded by its own masked presentation or by the masked presentation of an unrelated word) were the two factors. Their effects on the overall recognition responses and "remember" and "know" responses were recorded.

A set of 240 common nouns of high frequency (20-60 per million, Kučera & Francis, 1967) and five to seven letters in length were used. These words were divided into four groups of 60 words each. For the first three groups, one group constituted "old" and another group "new" words in the test list. The third group of 60 words was used for the masked unrelated primes presented in the test list. The first group of words (to be classified as "old" or "studied" in the test list) was also presented in the study list. Thus, in the test list, 60 words were previously studied, and 60 were new. Of these 120 words, 30 studied and 30 nonstudied words were preceded by a masked repetition (in lowercase letters) and the other 30 studied and 30 nonstudied words were preceded by a masked presentation of an unrelated word in lowercase letters. The fourth group of 60 words was required in order to complete the counterbalancing such that all the words were presented in all conditions both as repeated and unrelated primes, and studied and nonstudied test words across subjects. To achieve this, eight study-test list combinations were constructed.

In addition to the 60 words in the study list, 4 words were added as buffer items, 2 at the beginning and 2 at the end of the list. In the test list, the first eight trials were practice trials in which four trials contained studied test words and the other four contained nonstudied test words. In addition, 2 studied and 2 nonstudied test words were preceded by their own masked repetition and the rest were preceded by a different word under the masked condition. The order of words in the test list was random with reference to their conditions.

Procedure. The presentation of words was controlled by a program written in Turbo Pascal; Micro Express-386SX computers with SuperSync 2A+ color monitors were used to display study and test items and also to collect reaction time (RT) data in milliseconds as well as accuracy data.

The items were presented at the center of the screen both in the study and test phases. For the test phase, the response keys were labeled "Y" ("Yes, the item was on the study list") or "N" ("No, the item was not on the study list") such that they were adjacent on the keyboard (the "u" key was labeled "N" to ensure that the subjects would use the index and middle fingers of their preferred hand to press the two keys). For the "remember" and "know" judgments, the "r" and "k" keys were labeled "R" and "K," respectively. The nonadjacent positions of these keys were not problematic because speeded responses were not required for "remember" and "know" judgments.

The subjects were asked to use only their preferred hand for all the keys used in the test phase. They were also told that the first eight items on the test list would be counted as practice items so that they could get accustomed to the sequence of keys to be operated.

The study list and the masked primes in the test list were presented in lowercase letters, whereas the test words in the test list were presented in uppercase letters. The masked primes and the unmasked test words were presented in different cases to ensure that the two presentations did not effectively become just one presentation lasting 550 msec. The computers recorded the subjects' responses and response times.

In the first phase of the experiment, the subjects were presented with the study list, where each word appeared at the center of the computer screen for 5 sec each. The subjects were asked to study these words for a later (unspecified) memory task. After a 15-min retention interval, the subjects participated in a recognition test. During the retention interval, they completed some word fragments with the help of semantic cues. The materials and procedure of the retention interval task did not overlap with the present experiment.

In the test phase, every trial contained four items—a dashed signal (---   ---) for 2 sec to ensure that the subjects' attention was focused on the screen before the presentation of the remaining stimuli, a mask of ampersands (&&&&&&&&&) presented for 500 msec, followed by the prime word in lowercase letters (either the same as the target or an unrelated word) presented for 50 msec, and, finally, the *unmasked* presentation of the test word in uppercase letters (which was either studied or nonstudied).

The subjects first made recognition judgments on the unmasked target words. They were told that the mask was a "get ready" signal and nothing was said about the masked (repeated or unrelated) primes. When the subjects classified an item as "new" ("N"), the computer prompted them to press "Enter" to proceed to the next item. When the subjects classified a target as "old" (by pressing the key labeled "Y"), they were prompted to make the "know" or "remember" judgment on that target. The instructions for the "remember" and "know" judgments were the same as in Experiments 1 and 2.

For recognition judgments, both speed and accuracy of response was emphasized. A speeded recognition task was used because masked repetition priming effects have been typically reported in speeded tasks and last only for a short period of time (Forster, 1985; Forster & Davis, 1984). However, the subjects were instructed to take their time for "remember" and "know" responses. After the test list ended, they were asked to report if they saw anything on the computer screen other than the mask or the test items in uppercase letters during any part of the test list.

Results and Discussion

To reiterate the logic of the current experiment, masked repetition of the items was expected to enhance recognition performance relative to the unrelated prime condition (Forster, 1985; Jacoby & Whitehouse, 1989; Rajaram & Neely, 1992). Furthermore, if masked repetition enhances perceptual fluency of processing, and if "know" responses depend on perceptual fluency, one would predict that for target (i.e., studied) items, the masked repetition condition would produce more "know" responses than would the masked unrelated prime condition. On the other hand, masked repetition of studied items is not likely to influence "remember" responses. For false alarms, one would expect more "know" responses in the masked repetition condition than in the unrelated prime condition, again because of enhanced perceptual fluency. "Remember" responses should be low (and equivalent) for false alarms in both primed and unprimed conditions.

Table 3
Design and Results for Proportion of Hits and False Alarms (FA) and the RT Data (in Milliseconds) in Experiment 3

Study items (targets)—table, plate:	Targets		Lures	
	Masked Repetition	Unrelated Prime	Masked Repetition	Unrelated Prime
Mask	&&&&&	&&&&&	&&&&&	&&&&&
Prime	table	scale	glass	chalk
Test Word	TABLE	PLATE	GLASS	SHIRT
Response Required	"Yes"	"Yes"	"No"	"No"
RT Data	1,296	1,275	1,354	1,293
Recognition	"Yes" .67	"Yes" .60	"Yes" (FA) .23	"Yes" (FA) .18
"Remember" Responses	.43	.42	.05	.05
"Know" Responses	.24	.18	.18	.13

Table 3 gives the design and results for Experiment 3. None of the subjects participating in this experiment reported either seeing or reading the prime. Some subjects noticed a "flicker" on the screen on some trials and they invariably attributed it to computer malfunction.

The overall recognition data indicate that the masked repetition manipulation was successful because the subjects recognized significantly more studied words when they were primed by their own presentation (.67) than when they were preceded by unrelated primes (.60) [$t(23) = 3.41$, $SE = .02$]. Similarly, significantly more false alarms were observed for nonstudied words when the test items were primed by their own presentation (.23) rather than preceded by unrelated primes (.18) [$t(23) = 3.33$, $SE = .01$]. This pattern of results replicates previous findings (Jacoby & Whitehouse, 1989). Table 3 also displays the mean RT data (in milliseconds) for hits and correct rejections. There was no effect of masked repetition priming on either studied ($t < 1$) or nonstudied words [$t(23) = -1.15$, $SE = 52.56$]. Essentially, the null results obtained for the RT data neither bolster nor undermine the effects observed with the accuracy data.

When the accuracy data are broken down by "remember" and "know" responses (as shown in Table 3), the results show that only "know" responses were influenced by the masked repetition manipulation. For studied words, more "know" responses were observed in the masked repetition condition (.24) than in the unrelated prime condition (.18) [$t(23) = 2.66$, $SE = .02$]. Similarly, for nonstudied words, more "know" responses were obtained in the masked repetition condition (.18) than in the unrelated prime condition (.13) [$t(23) = 3.61$, $SE = .01$]. For "remember" responses, there was no effect of the masked repetition manipulation, either for studied words or for nonstudied words ($ts < 1$).

These results indicate that priming enhanced recognition memory but did not affect "remember" responses. These data provide strong support for the pattern observed in the previous experiments that recognition memory includes a perceptual component that does not influence the "remember" responses. These data are also the first report of an instance in which the effect of a manipulation on recognition is observed solely in the "know" and not in the "remember" responses.

EXPERIMENT 4

The purpose of Experiment 4 was to examine whether confidence judgments regarding recognition memory would yield the same pattern of results as "remember" and "know" judgments. In an experiment in which subjects made both "remember"/"know" and confidence judgments to studied items, Tulving (1985) reported that "remember" judgments are correlated with high confidence in recognition judgment.

Gardiner and Java (1990), on the other hand, showed that when subjects are asked to make "remember"/"know" judgments (Experiment 2) and confidence judgments (Experiment 3) in separate experiments, the pattern of results obtained for "remember"/"know" judgments and "sure"/"unsure" judgments are different. Specifically, subjects made recognition judgments to words and nonwords that were studied or nonstudied in both their experiments. In their second experiment, subjects made "remember" and "know" judgments to the recognized words and nonwords. In their third experiment, subjects made "sure" and "unsure" judgments to the recognized words and nonwords. Although a greater proportion of "know" responses was given to nonwords than to words (Gardiner & Java, 1990, Experiment 2), nonwords did not receive a greater proportion of "unsure" responses than did words (Gardiner & Java, 1990, Experiment 3). These results refute the idea that "know" responses are made whenever subjects are not very confident that a test item was also on the study list.

Experiment 4 in this article was designed to test Gardiner and Java's (1990) conclusion that measures of conscious recollection are not equivalent to confidence levels. The results of the present Experiment 3 represent the first report in which the effect of a variable on recognition performance was observed only on "know" and not on "remember" judgments. This same variable was used in Experiment 4 to test whether the effect of increased perceptual fluency would be observed only on "not sure" responses or on both "sure" and "not sure" responses. If increased perceptual fluency merely increases the proportion of "not sure" responses, then "know" judgments in Experiment 3 reflect nothing more than increased "unsure" responses. However, if both "sure" and "unsure" responses are enhanced in the masked repetition condition, then "know" judgments cannot be interpreted as only an index of low confidence.

Method

Subjects. Forty-eight Rice University undergraduates participated for partial fulfillment of a course requirement.

Design and Materials. The design and materials employed in this experiment were identical to those employed in Experiment 3. However, instead of making "remember"/"know" judgments, the subjects made confidence judgments to the recognized items in the test list.

Procedure. The procedure in this experiment was also similar to that used in Experiment 3. However, the instructions in the test phase were somewhat different. For every trial, a dashed signal (---   ---) was presented for 2 sec before the presentation of the mask. This dashed signal was presented to ensure that the subjects' attention was focused on the screen when the forward mask (&&&&&&&&&) came on the screen. The subjects were asked to respond as quickly and as accurately as possible to the word that was presented in uppercase letters on the computer screen following this "get ready" signal. Following this stage, if the subject pressed the "N" key ("No, the item was not on the study list"), the computer prompted her/him to press the key labeled "Enter" to proceed to the next item. If the subject pressed "Y" ("Yes, the item was on the study list"), the computer prompted the subject to make confidence judgments. The subjects were instructed to press the key labeled "S" (for "sure") if they were absolutely sure that the test item was on the study list. However, if they were not completely sure that the item was on the study list, they were asked to press "NS" (for "not sure"). Once again, the "Y" and "N" keys were in adjacent positions on the keyboard for recognition judgments and the speed and accuracy of response was emphasized for these judgments. For the confidence judgments, the "s" key on the keyboard was labeled "S" and the "n" key was labeled "NS." The subjects were not required to make speeded responses for the confidence judgments.

Results and Discussion

The design and results of Experiment 4 are presented in Table 4 as proportion correct for targets and proportion of false alarms for lures. The recognition data broken down by "sure" and "not sure" responses are also presented as well as the RT data for recognition responses.

For the overall recognition data, the masked repetition priming effect was once again obtained such that studied items that were primed by their own presentation were recognized more accurately (.75) than were studied items that were preceded by unrelated primes (.70) [$t(47) = 2.49$, $SE = .02$]. Similarly, for lures, the subjects gave more false alarms to items that were in the masked repetition condition (.25) than to items that were in the unrelated prime condition (.20) [$t(47) = 3.85$, $SE = .01$].

Table 4 also displays the RT data obtained for hits and correct rejections in Experiment 4. Marginally faster RTs were obtained for studied items in the masked repetition condition (1,251 msec) compared with items in the unrelated prime condition (1,297 msec) [$t(47) = 1.86$, $p = .07$, $SE = 24.53$]. For the nonstudied items, this difference was in the opposite direction such that the items preceded by masked repetitions produced slower RTs (1,391 msec) than the items preceded by unrelated primes (1,340 msec). This pattern was similar to that obtained for nonstudied items in Experiment 3, but once again it failed to reach significance [$t(47) = 1.73$, $p = .09$, $SE = 28.86$]. Taken together, the accuracy and RT data for the overall recognition responses indicate that masked repetition priming led to more accurate and faster recognition responses for targets, and less accurate and slower responses for the lures.

With regard to "sure" and "not sure" recognition responses, although priming effects were present numerically for both studied items and lures, they were significant only for the lures. For lures, the subjects gave more "sure" responses in the masked repetition condition (.06) than in the unrelated prime condition (.04) [$t(47) = 2.78$, $SE = .005$]. Similarly, the subjects gave more "not sure" responses for lures in the masked repetition condition (.19) than for lures in the unrelated prime condition (.16) [$t(47) = 2.57$, $SE = .01$]. Similar priming effects were obtained for studied items; that is, more targets in the masked repetition condition received "sure" responses (.57) than did targets in the unrelated prime condition (.54). However, this difference was not statistically sig-

Table 4
Design and Results for Proportion of Hits and False Alarms (FA) and the RT Data (in milliseconds) in Experiment 4

Study items (targets)—table, plate:	Targets		Lures	
	Masked Repetition	Unrelated Prime	Masked Repetition	Unrelated Prime
Mask	&&&&&	&&&&&	&&&&&	&&&&&
Prime	table	scale	glass	chalk
Test Word	TABLE	PLATE	GLASS	SHIRT
Response Required	"Yes"	"Yes"	"No"	"No"
RT Data	1,251	1,297	1,391	1,340
Recognition	"Yes" .75	"Yes" .70	"Yes" (FA) .25	"Yes" (FA) .20
"Sure" Responses	.57	.54	.06	.04
"Not Sure" Responses	.18	.16	.19	.16

nificant [$t(47) = 1.49$, $SE = .02$]. Similarly, more targets in the masked repetition condition received "not sure" responses (.18) than did targets in the unrelated prime condition (.16), but this difference was also not significant [$t(47) = .99$, $SE = .01$].[4] Clearly, the pattern of results obtained with "sure"/"not sure" judgments in Experiment 4 was not the same as that obtained with the "remember"/"know" judgments in Experiment 3. These results do not support the idea that "remember"/"know" judgments are made solely on the basis of confidence.

GENERAL DISCUSSION

Four experiments were conducted to identify the processes that influence "remember" and "know" judgments in a recognition memory task. The main results were: (1) A levels-of-processing effect was obtained in overall recognition. This effect was more pronounced for "remember" responses and in the opposite direction for "know" responses. (2) A picture-superiority effect was obtained for overall recognition, which was more pronounced for "remember" responses and in the opposite direction for "know" responses. (3) The effect of masked repetition priming was obtained on overall recognition and "know" responses and this variable had no effect on "remember" responses. (4) Masked repetition priming did not produce the same pattern of results with "sure"/"unsure" responses as with "remember"/"know" responses, thereby implying that "remember"/"know" judgments are not made solely on the basis of confidence level.

Dissociations Between "Remember" and "Know" Responses and Perceptual Implicit Memory Tasks and Conceptual Explicit Memory Tasks

The dissociations between "remember" and "know" responses as a function of many variables bear resemblance to the dissociations obtained between implicit and explicit memory tests. These similarities have prompted researchers to suggest that "remember" responses arise from the episodic memory system and "know" responses from the semantic (Tulving, 1985) or procedural memory system (Gardiner & Parkin, 1990). There are two important issues to be considered in this regard. First, although many variables similarly influence performance on implicit memory tests and "know" judgments, some variables (such as mode of presentation, word frequency, levels of processing, and a small generation effect for "know" responses [reported by Wippich, 1992]) have different effects on these two measures.

The second issue concerns the episodic nature of "know" responses. When subjects make "know" judgments, they are aware of the past event that warrants this response. In implicit memory measures, this may not be (and often is not) the case. Thus, "know" responses often yield similar results, as these behavioral measures (i.e., implicit memory tests), are influenced by processes that influence these tests, and yet these responses are made in an episodic context.

Thus, it is difficult to determine whether "know" responses should be regarded as stemming from the episodic memory system or from the semantic/procedural memory system. One possibility may be to assume that recognized items classified as "know" responses are initially made on the same basis as the perceptually guided implicit memory responses. But because the instructions for making "know" judgments require subjects to reflect on the source of this memory, sometimes these responses may also be influenced by an episodic awareness that does not typically influence implicit memory performance. In this regard, one cannot also rule out the possibility that "remember" responses may occasionally be guided by perceptual factors, given that episodic details are often perceptual in nature. For example, Hunt and Toth (1990) reported that in both word-fragment completion, a predominantly implicit and perceptual task, and free recall, a predominantly explicit and conceptual task, performance benefited from the perceptual manipulation of orthographic distinctiveness of the studied words. Thus, one may classify "remember," "know," and implicit memory responses on a continuum ranging from the most aware to the least aware responses, although one should keep in mind that all three types of responses may include both conceptual and perceptual components of memory to varying degrees.

The Two Bases of Recognition Memory

The present data, in conjunction with Gardiner's (1988; Gardiner & Java, 1990; Gardiner & Parkin, 1990) studies, provide empirical support to Jacoby's and Mandler's formulations of the two bases of recognition memory. Mandler (1989) proposed that the integrative processes that operate in recognition memory also mediate implicit memory performance, and the elaborative processes that mediate the retrieval component in recognition memory underlie performance in explicit memory tests. In the "remember"/"know" paradigm in recognition memory, the processes captured by the "remember" responses mimic or enhance the effects of conceptual variables observed in conceptual explicit memory tasks (shown also in the overall recognition performance in the present experiments). For example, "remember" responses show large effects of levels of processing (Gardiner, 1988, Experiment 1; the present Experiment 1), generation (Gardiner, 1988, Experiment 2), picture superiority (the present Experiment 2), and divided attention (Gardiner & Parkin, 1990). On the other hand, "know" responses either show no effect of the conceptual variables (Gardiner, 1988, Experiments 1 and 2; Gardiner & Parkin, 1990) or greater effects from perceptual processing (the present Experiments 1, 2, and 3). Thus, separating recognition performance into "remember" and "know" components on the basis of the subjective experience of recollection provides an effective tool to separate the conceptual (or elaborative) and perceptual (or integrative) components in recognition memory.

"Remember"/"Know" Judgment Paradigm as a Tool

In Mandler's (1980) work, the familiarity component (also called the perceptual component) was estimated on the basis of the recall and recognition scores that resulted when the two tasks were administered either between subjects or in the successive testing paradigm. In Jacoby's early work (1983a, 1983b; Jacoby & Dallas, 1981), the familiarity component in recognition memory was assessed from the parallel effects of independent variables on recognition memory and perceptual identification.

The "remember"/"know" judgment paradigm provides a more direct way of separating the integrative or familiarity component and the elaborative or conceptual component involved in recognition memory. "Remember" responses, by definition, require recollecting the study phase and reinstating its context, and are found to be strongly influenced by the elaborative or conceptual variables. Thus, "remember" responses capture the elaborative or conceptual component involved in recognition memory performance. After subtracting the "remember" responses in recognition memory performance, the remainder ("know" responses) prompts the question as to what other factors affect recognition memory. A large body of data from previous research by Jacoby, Mandler, and Gardiner (as well as the present data) suggests that this other factor in recognition memory is perceptual in nature. (The only exception to these findings is the failure to obtain the effect of modality manipulation on "know" responses in Experiment 1 [see also Gregg & Gardiner, 1991]. It is unclear why this manipulation had no effect on "know" responses.)

Recently, Jacoby and his colleagues (Jacoby, Kelley, & Dywan, 1989) advocated a new framework, called an attributional analysis of remembering. This attributional analysis emphasizes the role of the subjective experience of the rememberer and provides a framework to examine the influence of perceptual and conceptual processes on the attributions that subjects make while participating in memory tasks. In this analysis, Jacoby, Kelley, and Dywan emphasize the distinction between using an analytic basis for judgment and using fluency of processing as a basis for judgment. "Remember" and "know" judgments constitute a useful tool to examine these two bases—analytic judgments and fluency of processing, respectively—in recollection.

Additionally, Jacoby (1991; Jacoby & Kelley, 1991) has also proposed another dichotomy, consciously controlled and automatic processing, to account for the two basic processes involved in memory. According to this theoretical account, memory performance is best captured by analyzing the contribution of distinctive processes involved in a task, rather than equating different tasks with different processes. This account also provides a useful technique to separate the two putative processes involved in recognition.

"Remember" Responses are a Purer Measure of Conscious Recollection of a Prior Event Than Conventional Measures of Explicit Memory

Tulving's (1985) study demonstrated that many of the standard explicit measures of memory are not faithful indicators of conscious recollection, whereas "remember" responses, by definition, do reflect such a recollective process. In the present study, the levels-of-processing effect and the picture-superiority effect were observed in both recognition memory and the "remember" judgments. However, both of these effects were greater in "remember" judgments than in recognition memory. These data compel us to reevaluate the measures that are used as an index of conscious recollection. Recently, Tulving (1985, 1989) and Jacoby (Jacoby, Kelley, & Dywan, 1989) have addressed this issue in detail. Tulving (1989) points out that cognitive psychologists tend to equate performance on a given task with experience. The results from Tulving's (1985) work and from the present experiments indicate that performance on explicit memory tests is not a reflection of the operation of conscious recollection alone. It would be useful to employ the "remember"/"know" judgment paradigm to study the recollective processes captured in serial recall, paired associate recall, and other such measures of explicit memory to separate the likely "remember" and "know" components involved.

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NOTES

1. Explicit memory tasks may also be predominantly perceptual in nature and implicit memory tasks may also be predominantly conceptual in nature (see Blaxton, 1989; Rappold & Hashtroudi, 1991; Roediger, Srinivas, & Weldon, 1989; and Srinivas & Roediger, 1990, for details). However, throughout the present article, the discussion is restricted to explicit memory tasks that are typically characterized as conceptual and implicit memory tasks that are typically characterized as perceptual in nature.

2. The absence of a greater proportion of "know" responses for read words compared with generated words is inconsistent with the previous finding with perceptual implicit memory tests in which performance in tasks such as perceptual identification (Jacoby, 1983b) is better for read than for generated words. However, a numerical trend of a greater proportion of "know" responses was observed for read items than for generated items after a 1-week retention interval.

3. I am grateful to Randi Martin for suggesting this method of scoring.

4. RT data were not collected separately for "sure" and "unsure" responses. It should be noted that Mandler and Boeck (1974) and Murdock and Dufty (1972) have reported strong correlations between confidence ratings and latency of responses in recognition memory, such that responses receiving high confidence ratings have faster response latencies than do low confidence responses.

APPENDIX
Instructions Given to the Subjects for Making Recognition, "Remember," and "Know" Responses

"Please read the following instructions carefully. You will be presented with a booklet containing words. Work carefully down the column and indicate on the first blank next to each word whether you recognize each word from the study list. If you do recognize the word, write "Y" (for "yes"), and if you do not recognize it, then write "N" (for "no"). In addition, at the time you recognize the word, you should also write on the second blank next to the word, whether or not you *remember* the word from the list or you just *know* on some other basis that the word was on the study list. Please read the following instructions to find out how to make the "remember" (or "R") and "know" (or "K") judgments.

Remember judgments: If your recognition of the word is accompanied by a conscious recollection of its prior occurrence in the study list, then write "R." "Remember" is the ability to become consciously aware again of some aspect or aspects of what happened or what was experienced at the time the word was presented (e.g., aspects of the physical appearance of the word, or of something that happened in the room, or of what you were thinking and doing at the time). In other words, the "remembered" word should bring back to mind a particular association, image, or something more personal from the time of study, or something about its appearance or position (i.e., what came before or after that word).

Know judgments: "Know" responses should be made when you recognize that the word was in the study list but you cannot consciously recollect anything about its actual occurrence or what happened or what was experienced at the time of its occurrence. In other words, write "K" (for "know") when you are certain of recognizing the words but these words fail to evoke any specific conscious recollection from the study list.

To further clarify the difference between these two judgments (i.e., "R" vs. "K"), here are a few examples. If someone asks for your name, you would typically respond in the "know" sense without becoming consciously aware of anything about a particular event or experience; however, when asked the last movie you saw, you would typically respond in the "remember" sense, that is, becoming consciously aware again of some aspects of the experience. If you have any questions regarding these judgments, please ask the experimenter. Thank you."

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