Journal of Experimental Psychology:
Learning, Memory, and Cognition
2000, Vol. 26, No. 4, 1070–1074

0278-7393/00/$5.00 DOI: 10.1037//0278-7393.26.4.1070

Conceptual Fluency Selectively Influences Knowing

Suparna Rajaram and Lisa Geraci
State University of New York at Stony Brook

Research shows that Remember and Know judgments are effective measures of recollective experience. This article shows that Know responses can be selectively affected by fluency of processing that is created using a conceptual manipulation. In a recognition test, studied and nonstudied words were preceded by semantically related or unrelated primes. Participants gave significantly more Know judgments to items with related primes than unrelated primes but Remember responses were unaffected. Know responses are discussed in terms of familiarity assumed to arise from fluency of processing which, in turn, may be created through various sources including conceptual processes.

This study examines the nature of recollective experience using the Remember/Know paradigm. Remember and Know responses are used to measure different states of conscious awareness of past events. The experiment reported here was designed to test the distinctiveness/fluency framework proposed to explain the types of processes that give rise to Remember and Know judgments in a memory task (Rajaram, 1996; Rajaram & Roediger, 1997). From this view, Remembering is said to be influenced by processing the distinctive properties of the material, and Knowing is said to be influenced by the fluency with which materials are processed. Furthermore, the framework suggests that fluency and distinctiveness can arise from manipulating perceptual or conceptual sources. In this article, we provide evidence that Knowing can be selectively affected by conceptual fluency.

The Remember/Know paradigm for studying recollective experience requires participants to assign Remember or Know judgments to items that they recognize from a previous study episode. Participants give Remember judgments to explicitly retrieved items that are accompanied by the experience of being able to vividly recall the study episode and Know responses when they recognize the items but they cannot recollect any specific details associated with studying the item. In Tulving's (1985) original proposal, Remembering was considered to be a product of the episodic memory system and was associated with one's awareness that an event occurred as part of one's personal past or autonoetic consciousness (e.g., Remembering the party one attended last week). Knowing, on the other hand, was considered to be a product of the semantic memory system and was associated with one's knowledge of the world in more symbolic terms or noetic consciousness (e.g., Knowing that one had read a book but is unable to recall the episode of reading it).

Gardiner (1988) and Gardiner and Parkin (1990) elaborated on these states of recollective experience. They proposed that Remember responses are affected by conceptual processing arising from the episodic memory system and Know responses are affected by perceptual processing arising from the semantic memory system or the procedural memory system. Subsequently, Rajaram (1993) proposed a complementary processing view where Remembering was thought to result from deeper, more meaningful processing and Knowing was thought to result from lower level, perceptual processing. The focus of this account on the differential effects of conceptual and perceptual processes is similar to the dual-process theories of recognition memory (Jacoby, 1983a, 1983b; Jacoby & Dallas, 1981; Mandler, 1980). Until recently, a number of studies have supported the conceptual/perceptual processing dichotomy proposed to explain the distinction between Remember and Know judgments (see Gardiner & Richardson-Klavehn, in press; Rajaram, 1999; Rajaram & Roediger, 1997; Richardson-Klavehn, Gardiner, & Java, 1996; Roediger, Wheeler, & Rajaram, 1993, for reviews).

However, recent research suggests that the conceptual/perceptual dichotomy may not adequately describe the differences in processing that give rise to the experiences of Remembering and Knowing, respectively. In fact, certain perceptual changes (e.g., changes in size and reflection of objects across study and test) have been found to influence Remember responses while having little effect on Know responses (Rajaram, 1996). These and other recent reports (e.g., Mantyla, 1997) have led to a revised account that distinguishes between distinctiveness and fluency as the respective processes that give rise to the experiences of Remembering and Knowing (Rajaram, 1996; Rajaram & Roediger, 1997). The distinctiveness/fluency processing framework suggests that Remembering is influenced by processing the distinctive properties of events (see Hunt & McDaniel, 1993) and Knowing is influenced by fluency of processing (see Jacoby, Kelley, & Dywan, 1989), regardless of whether these types of processing are initiated by conceptual or perceptual variables. This account nicely accommodates the extant data (see Rajaram, 1996; Rajaram & Roediger, 1997). Furthermore, the claim that processing of distinctive attributes enhances Remembering has received support from recent empirical tests of this framework as well (Rajaram, 1998). For example, participants gave more Remember responses to orthographically distinct words such as *subpoena* than orthographically common words such as *sailboat*. Know responses were unaffected by the processing of such distinctive information.

Suparna Rajaram and Lisa Geraci, Department of Psychology, State University of New York at Stony Brook.

Research reported in this article was supported by National Institutes of Health Grant R29MH57345-01.

Correspondence concerning this article should be addressed to Suparna Rajaram, Department of Psychology, State University of New York, Stony Brook, New York 11794-2500. Electronic mail may be sent to srajaram@psych1.psy.sunysb.edu.

The second part of the distinctiveness/fluency account proposes that Know responses should be sensitive to fluency of processing, arising from either perceptual or conceptual sources. The existing studies provide considerable evidence in favor of the facilitatory effects of perceptual fluency on the experience of Knowing. For example, Know responses increased in studies where experimental manipulations afforded greater perceptual fluency of processing, such as masked repetition of test targets (Rajaram, 1993), modality match (vs. mismatch) across study and test (Gregg & Gardiner, 1994), and word-fragment cued recall using easy (vs. difficult) fragments (Lindsay & Kelley, 1996). Notably, no published study has directly tested the effects of conceptual fluency on the experience of Knowing.

Other memory researchers have considered the effects of conceptual fluency as well. However, these theoretical considerations and empirical tests have focused on overall memory performance (Jacoby et al., 1989; Whittlesea, 1993; Whittlesea & Williams, 1998), and sometimes on judgments of stimulus duration, recency, meaning, and pleasantness (Whittlesea, 1993), but not on the experiential aspects of memory. For example, in Whittlesea's study, participants falsely claimed to more often recognize target words when they occurred in a predictive or conceptually related context (e.g., "The stormy seas tossed the BOAT") than in an unpredictive or unrelated context ("She saved her money and bought a LAMP"). Similarly, Toth (1996) has reported the effects of "conceptual automaticity" on recollective and familiarity estimates of recognition memory. Although these experiments did not strictly entail a manipulation of fluency, we found that when participants were asked to respond within a 500-ms deadline, a level of processing effect emerged. In fact, this advantage for conceptual encoding was obtained even for those study items that participants were asked to exclude from their responses but failed to do so because they did not recollect them. Thus, although the influence of conceptual fluency or conceptual automaticity has been demonstrated on overall recognition and on estimates of recollective and automatic processes, the selective effects of conceptual fluency on Knowing, per se, remain unknown.

Some studies (Conway, Gardiner, Perfect, Anderson, & Cohen, 1997; see also Mantyla, 1997) provide preliminary but indirect evidence that conceptual processes influence Know responses. For example, Conway et al. showed that, over time, memory for class material shifted from Remember to Know responses and that this shift was faster for research methods test questions than for psychology lecture test questions. A plausible account of this outcome is that questions on the research methods test required more conceptual integration of the material, whereas questions on the lecture course test required less synthesis and more episodic memory for individual facts. Aside from such conjecture, the effects of conceptual processes, and in particular of conceptual fluency, on Know responses have not been directly and specifically tested. This is the goal of the present study.

We created conceptual fluency in this study by priming studied and nonstudied target words at test with conceptually related words, such as *author* to prime the target *BOOK*, and contrasted the effects of conceptual fluency generated in this condition with prime-target pairs that were conceptually unrelated (e.g., *delay-TREE*). We predicted that recognition of the items preceded by related primes would be accompanied by Know responses more often than recognition of items preceded by unrelated primes. Furthermore, we predicted that Remembering would be unaffected by this manipulation because the experience of Remembering is assumed to be a function of processing distinctive information and not fluency of processing.

Method

Subjects

Seventy-two undergraduate students at the State University of New York (SUNY) at Stony Brook participated for research credit.

Design and Materials

The experiment was a 2 × 2 within-subject design where prime relation (semantically related or unrelated to the target) and study status (studied or nonstudied) were the independent variables, and recognition and recollective judgments (Remember and Know) were the dependent variables. Conceptual fluency was manipulated by showing related or unrelated primes flashed briefly at test before each studied or nonstudied target. There were 30 words presented at study that later served as studied targets at test.

At test, 30 studied and 30 nonstudied target words were presented. Each of these 60 targets was preceded by a prime not shown anywhere else in the experiment. Half of the studied and half of the nonstudied test targets were preceded by semantically related primes, and the other half were preceded by semantically unrelated primes. All prime-target pairs were taken from the Shapiro and Palermo (1968) association norms and were selected with the constraint that each pair had at least a .60 probability that the first word (the prime) would elicit the second word (the target) in the pair. The study status of a target and its pairing at test with a related or an unrelated prime were counterbalanced across subjects to produce two study lists and four test lists. The presentation order of items in the study and test lists was random with respect to conditions.

Procedure

In the study phase of the experiment, participants saw a list of 30 words presented individually for 5 s each using Schneider's (1990) Micro Experimental Laboratory program, Version 1.0. Participants were asked to study each word for a later (unspecified) memory test. After a 20-min distractor period where the participants took part in an unrelated experiment, participants returned to the test phase of this experiment and were given instructions for approximately 10 min. Extensive Remember/Know instructions were given during this time, and participants were asked to give examples of how they would use each of the judgments to ensure that they understood the distinction (detailed instructions taken from Rajaram, 1993).

At test, participants saw a total of 60 trials. Each trial consisted of three presentations (see Table 1). First, a fixation mask was presented for 2 s. Next, the prime (either semantically related or unrelated to the target) was presented in lowercase letters for 150 ms. This presentation was followed by a blank screen for 100 ms. Last, the target word (studied or nonstudied) was presented in full view until the participant responded with a recognition (yes or no) decision. For an item that was given a "yes" response, the participant was then required to also provide a Remember/Know judgment before proceeding to the next item. We collected the reaction times (RT) for overall recognition as well as for Remember/Know judgments. No emphasis was placed on the speed of responding so as not to interfere with the experiential measures of memory. Because previous studies using similar methodology did not report specific effects of fluency in the RT data (Jacoby & Whitehouse, 1989; Rajaram, 1993), we did not have specific predictions for this measure although we expected an advantage, if any, for the related condition compared to the unrelated condition. Our main aims in collecting the RT measure were to rule out any speed–

Table 1
Response Proportions for Remember and Know Responses to Studied and Nonstudied Targets as a Function of Prime Relation

	Conditions			
	Studied		Nonstudied	
Prime relation	Related	Unrelated	Related	Unrelated
Prime	sugar	fruit	author	delay
Target	SWEET	INK	BOOK	TREE
Recognition	.70	.67	.16	.10
Remember	.41	.43	.04	.03
Know	.30	.24	.13	.07

accuracy trade-offs in our data as well as to obtain some exploratory information for the Remember/Know responses.

Conceptual fluency was created by ensuring that the semantically related and unrelated primes appeared close in time to the target words. The specific time parameters described above were chosen to take advantage of automatic spreading activation (Neely, 1977). This automatic spread of activation was expected to increase the conceptual fluency of processing for the target items paired with semantically related primes. The semantically unrelated primes served as the baseline against which effects of conceptual fluency were measured.

Results

The mean recognition, Remember, and Know scores are presented in Table 1. The alpha level was set at .05. For overall recognition, a greater proportion of studied items with related primes were correctly recognized compared to studied items with unrelated primes, although this difference did not reach statistical significance, $t(71) = 1.21$, $SEM = .02$. As predicted, Remember responses did not differ significantly for studied targets with related and unrelated primes, $t(71) = -1.02$, $SEM = .03$. In contrast, and consistent with our predictions, participants assigned significantly more Know responses to studied targets when the prime was related than when it was unrelated, $t(71) = 2.69$, $SEM = .02$.

The overall proportion of false alarms made during recognition were significantly greater for nonstudied items with related primes than for nonstudied items with unrelated primes, $t(71) = 4.60$, $SEM = .01$. There was no difference between Remember false alarms for targets with related and unrelated primes, $t(71) = 1.59$, $SEM = .01$. Again, Know false alarms were significantly greater when the prime was related to the lure than when the prime was unrelated to the lure, $t(71) = 4.29$, $SEM = .01$.

For the RT data, outliers were removed and replaced with the group mean, and this correction was needed for less than .05% of the trials. For the overall recognition performance, the difference in RTs for hits preceded by related (1,989 ms) versus unrelated (2,039 ms) primes was not significant, $t(61) = -.51$, $SEM = 95.73$. Similarly, the difference in RTs for false alarms preceded by related (2,398 ms) versus unrelated (2,249 ms) primes was not significant, $t(5) = .36$, $SEM = 505.55$. For the Remember and Know responses, we used the following RT measures. Because it is likely that Remember and Know responses are highly dependent on the time taken for the prior recognition decision, we examined the total RT to respond "yes" to a studied or nonstudied item (i.e., the recognition judgment) and to respond "Remember" or "Know" to that item (i.e., recognition plus Remember, and recognition plus Know). There was no effect of prime relation for studied targets when recognition was accompanied by a Remember response (related = 2,974 ms; unrelated = 3,155 ms), $t(65) = -1.12$, $SEM = 137.00$, or when it was accompanied by a Know response (related = 3,586 ms; unrelated = 3,912 ms), $t(66) = -1.61$, $SEM = 237.98$. The same was true for nonstudied items; there was no effect of prime relation when false recognition was accompanied by a Remember response (related = 3,282 ms; unrelated = 3,637 ms), $t(12) = -1.45$, $SEM = 625.59$, or a Know response (related = 3,811 ms; unrelated = 3,862 ms), $t(25) = -.72$, $SEM = 305.35$.[1] Although the effect of prime relation was not statistically evident in the RT data, these data clearly demonstrate that the accuracy data were not compromised by a speed–accuracy trade-off.

Discussion

The aim of this study was to test the distinctiveness/fluency framework by examining whether Know responses could be influenced by conceptual fluency. Participants gave significantly more Know responses to recognized targets when the prime was semantically related to the target than when it was unrelated. Remember responses were entirely unaffected by this manipulation. This demonstration—that Know responses can be selectively influenced by conceptual fluency—is important because only perceptual fluency has been shown to selectively affect Know responses (Rajaram, 1993). Thus, these data support the claim that Know responses are best characterized as arising from fluency of processing, in general, and not from perceptual processing, per se (Rajaram, 1996).

These results also show that Know responses were affected by conceptual fluency, both when the target was studied and when it was nonstudied. Because fluency was manipulated at test for both studied and nonstudied items, this outcome is not surprising. Other recent empirical evidence also demonstrates that feelings of familiarity are not necessarily a direct result of having previously encountered an item but can arise from other sources (Lindsay & Kelley, 1996; Verfaellie & Cermak, 1999; Whittlesea, Jacoby, & Girard, 1990).

We manipulated fluency in our study by varying the semantic relationship between the prime and the target words at test. The increase in the fluency of processing in the related condition was assumed on the basis of automatic spreading activation (Neely, 1977). Others have measured the operation of fluency in reaction time by demonstrating faster pronunciation latencies in semantic contexts relative to the control conditions (Whittlesea, 1993). We did not obtain a statistically significant advantage for related compared to unrelated pairs in our reaction time measure. This result may be attributable to our use of a more complicated

[1] We also analyzed the RT data for those recognition responses that eventually received Know responses. However, we found no differences between the related and unrelated items in this analysis for studied as well as nonstudied items (both $ts < 1$).

recognition memory measure that included the requirement to make Remember/Know judgments compared with a simpler pronunciation measure used in other studies. Future studies should obtain a more direct measure of fluency to examine this issue. In the meantime, it is important to note that our manipulation of fluency was not unusual. Rather, it was based on a classic manipulation of automatic spreading activation and also followed very closely the methods Jacoby and Whitehouse (1989) and Rajaram (1993) used to measure perceptual fluency.

The effects of conceptual fluency on Know responses in our study may also be considered within the context of two alternative accounts of recognition memory performance although our experiment was not designed to compare and contrast these models. The dual-process model of recognition memory advocated by Jacoby and colleagues (e.g., Jacoby, Yonelinas, & Jennings, 1997) makes the assumption of independence between processes of recollection and familiarity and recommends the use of a derived estimate of familiarity over the experiential measure obtained with Know responses. We note that the effects of conceptual fluency were evident on this derived estimate of familiarity, Familiarity = Know/(1 − Remember) as well, such that the familiarity estimates were higher for the studied-related (.51) compared to studied-unrelated (.42) items, and for nonstudied-related (.14) compared to nonstudied-unrelated (.07) items. Another approach to understanding the distinction between Remember and Know responses assumes a single process as the basis for both Remember and Know responses (e.g., Donaldson, 1996). According to this view, Remember and Know responses originate from a single process where participants set one threshold to decide whether the item was studied or nonstudied and another, higher threshold to decide whether the item is Remembered or Known (e.g., Donaldson, 1996, also see Hirshman & Masters, 1997). We note that our results are consistent with the single-process model because the effect of prime relation influenced Know responses for both hits and false alarms. This, of course, is not surprising because we manipulated fluency at test for both studied and nonstudied items, and therefore, we expected the effect to obtain on both sets of items. However, we also note that although our data fit the predictions of the single-process model, this model does not provide an explanation for the selective influence of conceptual fluency only on Know responses. Furthermore, other data obtained with the Remember/Know paradigm fit the two-process model and cannot be accommodated within the single-process model (Gardiner & Gregg, 1997).

We now turn to a brief discussion of the fluency effects in our study for overall recognition responses (Remember plus Know) where effects of conceptual fluency were found to be reliable for overall false alarms but not for overall hits. It is possible that for overall hits the recollective component for studied items may have partially counteracted the effects of fluency. However, in making the subsequent Remember/Know judgments, if participants were unable to clearly remember the study episode, then they may have relied more on the fluency of processing and given Know responses, rather than given Remember responses. For false alarms, because the nonstudied items did not have a memorial basis—and therefore no basis for recollection—the effects of recollection did not counteract the effects of fluency on false alarms. The possible role of recollection in counteracting the fluency effects on overall hits seems likely also because in our experiment the source of fluency was somewhat obvious; participants could read the primes—presented for 150 ms with a total stimulus onset asynchrony of 250 ms. By contrast, in other studies where reliable effects of fluency were obtained on overall hits, the prime was masked (presented for 50 ms, Rajaram, 1993) such that the source of fluency was barely observable. Jacoby and Whitehouse (1989) also reported such differential effects of fluency, arising albeit from perceptual sources, when the primes were masked versus when they were visible. Our results and interpretation of the differential effects of fluency on overall hits and false alarms are also consistent with the findings of a recent study by Verfaellie and Cermak (1999), in which nonamnesic participants showed effects of perceptual fluency (generated through unmasking words) on recognition only for nonstudied words, but amnesic participants (who cannot recruit recollective processes) exhibited fluency effects for both studied and nonstudied words.

We conclude by noting that the purpose of our study was to test a specific prediction of the distinctiveness/fluency account (Rajaram, 1996, 1998; Rajaram & Roediger, 1997) that conceptual fluency selectively affects Knowing. Our results confirmed this prediction and support the proposal that Know responses are influenced by fluency of processing, regardless of the source.

References

Conway, M. A., Gardiner, J. M., Perfect, T. J., Anderson, S. J., & Cohen, G. M. (1997). Changes in memory awareness during learning: The acquisition of knowledge by psychology undergraduates. *Journal of Experimental Psychology: General, 126,* 393–413.

Donaldson, W. (1996). The role of decision processes in remembering and knowing. *Memory & Cognition, 24,* 523–533.

Gardiner, J. M. (1988). Functional aspects of recollective experience. *Memory & Cognition, 16,* 309–313.

Gardiner, J. M., & Gregg, V. H. (1997). Recognition memory with little or no remembering: Implication for a detection model. *Psychonomic Bulletin & Review, 4,* 474–479.

Gardiner, J. M., & Parkin, A. J. (1990). Attention and recollective experience in recognition memory. *Memory & Cognition, 18,* 579–583.

Gardiner, J. M., & Richardson-Klavehn, A. (in press). Remembering and knowing. In E. Tulving & F. I. M. Craik (Eds.), *Handbook of memory.* New York: Oxford University Press.

Gregg, V. H., & Gardiner, J. M. (1994). Recognition memory and awareness: A large effect of study-test modalities on know responses following a highly perceptual orienting task. *European Journal of Cognitive Psychology, 6,* 137–147.

Hirshman, E., & Masters, S. (1997). Modeling the conscious correlates of recognition memory. *Psychonomic Bulletin & Review, 4,* 474–479.

Hunt, R. R., & McDaniel, M. A. (1993). The enigma of organization and distinctiveness. *Journal of Memory and Language, 32,* 421–445.

Jacoby, L. L. (1983a). Perceptual enhancement: Persistent effects of an experience. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,* 21–38.

Jacoby, L. L. (1983b). Remembering the data: Analyzing interactive processes in reading. *Journal of Verbal Learning and Verbal Behavior, 22,* 485–508.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General, 3,* 306–340.

Jacoby, L. L., Kelley, C. M., & Dywan, J. (1989). Memory attributions. In H. L. Roediger & F. I. M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving* (pp. 391–422). Hillsdale, NJ: Erlbaum.

Jacoby, L. L., & Whitehouse, K. (1989). An illusion of memory: False recognition influenced by unconscious perception. *Journal of Experimental Psychology: General, 118,* 126–135.

Jacoby, L. L., Yonelinas, A. P., & Jennings, J. M. (1997). The relation between conscious and unconscious (automatic) influences: A declaration of independence. In J. D. Cohen & J. W. Schooler (Eds.), *Scientific approaches to consciousness* (pp. 13–47). Hillsdale, NJ: Erlbaum.

Lindsay, D. S., & Kelley, C. M. (1996). Creating illusions of familiarity in a cued recall remember/know paradigm. *Journal of Memory and Language, 35,* 197–211.

Mandler, G. (1980). Recognizing: The judgment of previous occurrence. *Psychological Review, 87,* 252–271.

Mantyla, T. (1997). Recollections of faces: Remembering differences and knowing similarities. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23,* 1–14.

Neely, J. (1977). Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading activation and limited-capacity attention. *Journal of Experimental Psychology: General, 106,* 226–254.

Rajaram, S. (1993). Remembering and knowing: Two means of access to the personal past. *Memory & Cognition, 21,* 89–102.

Rajaram, S. (1996). Perceptual effects on remembering: Recollective processes in picture recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 365–377.

Rajaram, S. (1998). The effects of conceptual salience and perceptual distinctiveness on conscious recollection. *Psychological Bulletin & Review, 5,* 71–78.

Rajaram, S. (1999). Assessing the nature of retrieval experience: Advances and challenges. In B. H. Challis & B. M. Velichkovsky (Eds.), *Stratification of consciousness and cognition.* Amsterdam: John Benjamin Publishing.

Rajaram, S., & Roediger, H. L., III (1997). Remembering and knowing as states of consciousness during recollection. In J. D. Cohen & J. W. Schooler (Eds.), *Scientific approaches to the question of consciousness* (pp. 213–240). Hillsdale, NJ: Erlbaum.

Richardson-Klavehn, A., Gardiner, J. M., & Java, R. I. (1996). Memory: Task dissociations, process dissociations, and dissociations of consciousness. In G. Underwood (Ed.), *Implicit cognition* (pp. 85–158). London: Oxford University Press.

Roediger, H. L., Wheeler, M. A., & Rajaram, S. (1993). Remembering, knowing, and reconstructing the past. In D. L. Medin (Ed.), *The psychology of learning and motivation* (pp. 97–134). San Diego, CA: Academic Press.

Schneider, W. (1990). *Micro-Experimental Laboratory* (v. 1.0). [Computer software]. Pittsburgh, PA: Psychology Software Tools.

Shapiro, S. I., & Palermo, D. S. (1968). An atlas of normative free association data. *Psychonomic Monograph Supplements, 2,* 218–250.

Toth, J. P. (1996). Conceptual automaticity in recognition memory: Levels-of-processing effects on familiarity. *Canadian Journal of Experimental Psychology, 50,* 123–138.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychologist, 26,* 1–12.

Verfaellie, M., & Cermak, L. (1999). Perceptual fluency as a cue for recognition judgments in amnesia. *Neuropsychology, 13,* 198–205.

Whittlesea, B. W. A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1235–1253.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29,* 719–732.

Whittlesea, B. W. A., & Williams, L. D. (1998). Why do strangers feel familiar, but friends don't? A discrepancy-attribution account of feelings of familiarity. *Acta Psychologica, 98,* 141–165.

Received May 19, 1999
Revision received December 8, 1999
Accepted December 15, 1999 ■