Remembering and knowing are two subjective states of awareness associated with memory. *Remembering* refers to intensely personal experiences of the past—those in which we seem to recreate previous events and experiences with the awareness of reliving these events and experiences mentally. Remembering entails mental time travel that intimately engages one's sense of self. *Knowing* refers to other experiences of the past, those in which we are aware of knowledge that we possess but in a more impersonal way. There is no awareness of reliving any particular events or experiences. Knowing includes the general sense of familiarity we have about more abstract knowledge. Knowing also includes awareness of events that we have personally experienced when we are aware of those events as facts, without reliving them mentally. Throughout this chapter the terms remembering and knowing are used only to refer to these conscious states and to the responses subjects make when reporting them.

**General Background**

The idea that remembering and knowing could be studied in the memory laboratory was suggested by Endel Tulving (1985), who proposed that the two states of awareness reflect autonoetic and noetic consciousness, two types of consciousness that respectively characterize episodic and semantic memory systems (see, too, Tulving, 1983, 1989; Wheeler, Stuss, & Tulving, 1997). He reported illustrative experiments in which subjects were instructed to report their states of awareness at the time they recalled or recognized words they had previously encountered in a study list. If they remembered what they experienced at the time they encountered the word—something they thought of at that time—they made a remember response. If they were aware they had encountered the word in the study list but did not remember anything they experienced at that time, they made a know response. The results indicated that participants could quite easily distinguish between experiences of remembering and knowing.

Though Tulving (1985) used free-recall, cued-recall, and recognition tests, it was recognition memory that became the most commonly used remember/know paradigm, not least because recognition memory is most likely to be associated with experiences of knowing, as well as remembering, especially when recognition is accompanied only by feelings of familiarity. Moreover, the two states of awareness captured by remember and know responses seemed at the time addition-
ally relevant to dual-component theories of recognition memory, which held that recognition could be accomplished by either one of two independent processes, recollection and familiarity (e.g., Mandler, 1980).

The major premise underlying the use of remember and know responses is that the subjective states of awareness they measure cannot be reliably inferred from more conventional measures of performance (see Tulving, 1989). For example, proportion correct may be equivalent in two different experimental conditions, or in two different subject groups, yet proportions of remembering and knowing may differ. One cannot tell what subjects experience mentally from purely objective measures of their performance. If one wants to be able to take into account subjective awareness of memory, there is no alternative to the use of subjective reports. This does not, of course, mean that such reports have to be accepted at face value, since they can obviously be confabulated (see e.g., Dalla Barba, 1993). They have to be interpreted carefully, in conjunction with other evidence.

Remember and know responses are not intended as introspective measures of any underlying hypothetical constructs, such as memory systems or processes. Their use also differs from classical introspection in that all that is required is that subjects distinguish between kinds of mental experiences, rather than report the details of those experiences. Importantly too, however, when subjects are additionally asked to describe their experiences in more detail, the results confirm that remember responses reflect awareness of what was experienced when a word was encountered in a study list and know responses do not, but reflect only awareness of recent but unremembered encounters that are attributed to the study list (see Gardiner, Ramponi, & Richardson-Klavehn, 1998a).

In the remember/know paradigm, it is usual to give subjects written instructions about the two kinds of awareness measured by remember and know responses, to discuss these instructions with them, after they have read them, to ensure understanding and also to have subjects explain an arbitrary selection of their responses after the test, to check that instructions have been followed. It is quite unusual to find subjects whose explanations indicate that they have not followed the instructions. For an example of instructions used recently in our laboratory, see Appendix 1. These instructions include an important ex-

tension to the procedure, which is that subjects are required to report awareness of guessing, as well as of remembering and knowing. The implications of this extension of the original paradigm are discussed later in the chapter.

Major Findings

Studies that followed Tulving (1985) discovered various experimental manipulations that dissociate remembering from knowing. Many independent variables were found to influence remembering but not knowing, particularly variables that engage more conceptual and more elaborative processing, like level of processing, and generating versus reading at study (Gardiner, 1988; see also Gardiner, Java, & Richardson-Klavehn, 1996a). Other variables, though not nearly so many, were found to affect knowing but not remembering, particularly variables that engage perceptual processing. These variables include the presentation of a test word being preceded by an identical, masked test prime, compared with its being preceded by a masked but unrelated test prime (Rajaram, 1993), and same versus different study and test modalities following a highly perceptual orienting task (Gregg & Gardiner, 1994; see also Gardiner & Gregg, 1997). More examples of variables that influence knowing, and not remembering, have been discovered recently (e.g., Dewhurst & Hitch, 1997; Mäntylä & Raudsepp, 1996).

Some variables were found to have opposite effects on remembering and knowing. These variables include studying nonwords compared to words. Nonwords led to increased knowing and less remembering (Gardiner & Java, 1990). Massed versus spaced repetition of items within a study list was found to have a similar effect. Massed repetition led to more know responses and fewer remember responses than spaced repetition (Parkin & Russo, 1993).

Gardiner, Gawlik, and Richardson-Klavehn (1994) found a pattern of results that is analogous to showing a double dissociation between remembering and knowing within a single experiment. This experiment used an item-by-item directed forgetting paradigm to functionally manipulate the relative amounts of elaborative and maintenance rehearsal. It was assumed that elaborative rehearsal would be focused on to-be-learned, rather than on to-be-forgotten, items. Maintenance rehearsal
was manipulated by varying the delay between the presentation of the item and the subsequent cue that designated it as to-be-learned or to-be-forgotten. Because it is not in the interests of subjects to rehearse items elaboratively until they are told whether the items are to be learned or to be forgotten, it was assumed also that the longer the delay, the longer the period of maintenance rehearsal. The results bore out these assumptions. Lengthening cue delay increased know but not remember responses. But item designation influenced remember but not know responses, with more remembering for the to-be-learned items. These results are summarized in table 15.1.

And there are a few studies that have found a fourth pattern of results, in which the variable has parallel effects on remembering and knowing. In one such study English subjects heard excerpts either from Polish folk songs or from classical music, either once or three times in succession (Gardiner, Kaminska, Dixon, & Java, 1996b). Both know and remember responses were greater after three presentations rather than one for the folk songs. Only remember responses, however, increased after three presentations of classical music; know responses were not affected. In another study, Gardiner, Ramponi, and Richardson-Klavehn (1998b) trained subjects to respond either 500 ms or 1500 ms after test words appeared, and found that both remember and know responses increased in parallel following the longer response deadline.

The foregoing results are summarized, along with some others, in table 15.2. The summary is illustrative rather than exhaustive. Many of the earlier findings were reviewed by Gardiner and Java (1993). Richardson-Klavehn, Gardiner, and Java (1996), Rajaram and Roediger (1997), and Gardiner and Conway (in press) provide more recent, though more selective, reviews. Table 15.2 additionally serves to underscore an important conclusion from all this evidence. The fact that the overall pattern of results demonstrates that some variables affect one or other of the two states of awareness, that some variables have opposing effects on them, and that some variables have parallel effects on them, indicates that the two states of awareness are functionally independent. This seems a remarkable discovery and its full theoretical significance has yet to be appreciated.

In addition to evidence about the ways in which various independent variables influence remembering and knowing, there is evidence about differences in remembering and knowing with respect to a number of different subject variables. Age was the first such variable to be investigated, where the general finding is of reduced remembering in elderly adults compared to young adults (Parkin & Walter, 1992; see also Mäntylä, 1993; Perfect & Dasgupta, 1997; Perfect, Williams, & Ander-eton-Brown, 1995; Java, 1996), but little change in knowing except under certain specific conditions in which knowing apparently increases (see Perfect et al., 1995). Young children, too, show less remembering than young adults (Toplis, 1997; see also Perner & Ruff- man, 1995).

Other subject variables include Alzheimer's disease, amnesia, autism, epilepsy, and schizophrenia. With these subject variables the general finding has been that, compared to matched controls, there is less remembering, and in some cases increased or decreased knowing. Remembering is much reduced in amnesic and Alzheimer's patients, for example, and knowing is relatively unaffected (Dalla Barba, 1993, 1997; Knowlton & Squire, 1995; Schacter, Verfaellie, & Anes, 1997a), though some experiments have found differences in knowing also (e.g., Knowlton & Squire, 1995). Schizophrenic patients showed reduced remembering and little difference in knowing (Hurton et al., 1995). Epileptic pa-

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Short Learn</th>
<th>Short Forget</th>
<th>Long Learn</th>
<th>Long Forget</th>
<th>Not Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remember</td>
<td>.50</td>
<td>.23</td>
<td>.40</td>
<td>.26</td>
<td>.03</td>
</tr>
<tr>
<td>Know</td>
<td>.18</td>
<td>.20</td>
<td>.27</td>
<td>.29</td>
<td>.10</td>
</tr>
<tr>
<td>Overall</td>
<td>.68</td>
<td>.43</td>
<td>.67</td>
<td>.55</td>
<td>.13</td>
</tr>
</tbody>
</table>

Table 15.1 Proportions of Responses from Gardiner et al. (1994).
Table 15.2 Summary of Effects of Experimental Manipulations.

<table>
<thead>
<tr>
<th>Effects of Manipulation</th>
<th>Examples of Variables</th>
</tr>
</thead>
</table>
| Variable increases remember responses but does not affect know responses | • Deep versus shallow level of processing (Gardiner, 1988)  
• Generating versus reading at study (Gardiner, 1988)  
• Low versus high word frequency (Gardiner & Java, 1990)  
• Undivided versus divided attention at study (Gardiner & Parkin, 1990)  
• Shortening retention interval, if under a day (Gardiner & Java, 1991)  
• Vocalization at study, compared with silent reading (Gregg & Gardiner, 1991)  
• Intentional versus incidental learning (Maken & Hampson, 1993)  
• More versus less elaborative rehearsal (Gardiner et al., 1994)  
• Serial position in the study list (Jones & Roediger, 1995)  
• Listening to excerpts from famous compared with obscure pieces of classical music (Java, Kaminska, & Gardiner, 1995)  
• Orthographically distinctive versus orthographically common words (Rajaram, 1998)  
• Solving difficult compared with easy anagrams at study (Dewhurst & Hitch, 1999) |
| Variable increases know responses but does not affect remember responses | • Identical versus unrelated test primes (Rajaram, 1993)  
• Same versus different study and test modalities following a highly perceptual orienting task (Gregg & Gardiner, 1994)  
• More versus less maintenance rehearsal (Gardiner et al., 1994)  
• Suppression of focal attention (Mäntylä & Raudsepp, 1996)  
• Cohort activation from a previous lexical decision task (Dewhurst & Hitch, 1997) |
| Variable increases know responses and decreases remember responses | • Nonword versus word presentation (Gardiner & Java, 1990)  
• Massed versus spaced repetition of study list items (Parkin & Russo, 1993)  
• Gradually revealing test words, rather than showing them all at once (LeComte, 1995)  
• Encoding faces in terms of their similarities versus encoding them in terms of their differences (Mantyla, 1997) |
| Variable has parallel effects on remember and know responses | • Lengthening retention interval, if over a day (Gardiner & Java, 1991)  
• Three versus one study trials with highly unfamiliar music (Gardiner, Kaminska et al., 1996)  
• Long versus short response deadline (Gardiner et al., 1998b) |

Table 15.3 Proportions of Responses from Bowler et al. (1998).

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Control Group</th>
<th></th>
<th>Autistic Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Studied</td>
<td>Not Studied</td>
<td>Difference</td>
<td>Studied</td>
</tr>
<tr>
<td>Remember</td>
<td>.46</td>
<td>.06</td>
<td>.40</td>
<td>.36</td>
</tr>
<tr>
<td>Know</td>
<td>.11</td>
<td>.03</td>
<td>.08</td>
<td>.25</td>
</tr>
<tr>
<td>Overall</td>
<td>.57</td>
<td>.09</td>
<td>.48</td>
<td>.61</td>
</tr>
</tbody>
</table>
tients showed huge differences between remembering and knowing (with visuo-spatial materials). Left temporal lobe epileptics largely made know rather than remember responses, and right temporal lobe epileptics largely made remember rather than know responses (Blaxton & Theodore, 1997).

Such evidence of differences in awareness in different clinical populations confirms that, in a variety of disorders, remembering is selectively impaired and knowing is relatively spared. These findings have important implications for diagnosis and remediation.

Some results from a study of autism (Bowler, Gardiner, & Grice, 1998) are summarized in Table 15.3. High-functioning individuals with autism were compared with matched controls. Overall recognition performance in the two groups was very similar. But the reported states of awareness differed markedly. In the autistic group, there was less remembering and more knowing. The results shown in Table 15.3 were collapsed over a manipulation of word frequency. Both subject groups showed the usual advantage to low-frequency words in remember responses and no word frequency effect in know responses (e.g., Gardiner & Java, 1990; Strack & Forster, 1995; Gardiner, Richardson-Klavehn, & Ramponi, 1997), thereby supporting the inference that autistic and control group subjects interpreted remember and know responses similarly.

A third category of evidence is from psychopharmacological treatments and from physiological measures of brain function. Both lorazepam (Curran, Gardiner, Java, & Allen, 1993) and alcohol (Curran & Hildebrandt, in press) greatly reduce remembering and leave knowing relatively unchanged. Some recent event-related potential (ERP) findings (Düzel, Yonelinas, Mangun, Heinze, & Tulving, 1997) provide somewhat more convincing evidence for qualitatively (as opposed to quantitatively) distinct patterns of neural activity in remembering and knowing than previous studies (e.g., Smith, 1993), particularly over earlier time windows. Moreover, Düzel et al. (1997) found that ERP measures of this neural activity were indistinguishable for accurate and inaccurate identification of studied words. The fact that ERPs were predicted by the subjectively reported states of awareness, and not by the studied/unstudied status of the items, provides strong physiological evidence for the psychological reality of the two kinds of awareness.

Before turning shortly to the major theoretical accounts of remembering and knowing, it should be emphasized that remember and know responses can be used without commitment to any theory, but simply to provide information about how various memory phenomena, including memory disorders, are characterized experientially.

Another particularly good example of this has been the use of these responses to characterize illusions of memory, especially false recognition effects. For example, in their revival of the procedure introduced by Deese (1959), Roediger and McDermott (1995) showed that the nonpresented words that are falsely recognized, after studying lists of words that are highly associated to them, are typically remembered, rather than known. Conversely, Schacter et al. (1997a) found that another illusion of memory, perceptually induced by presenting sets of rhyming words, increased knowing, rather than remembering (see also Dewhurst & Hitch, 1997; Mäntylä & Raudsepp, 1996). Thus it seems that both states of awareness are susceptible to illusions of memory. Moreover, the ERP study by Düzel et al. (1997) had used an extended version of the Deese/Roediger-McDermott procedure. So their physiological evidence demonstrated conjointly the psychological reality of the illusion of memory and of the neural activity that gives rise to it.

To sum up, at least three converging sources of evidence—evidence of dissociative effects of independent variables, evidence of dissociations in subject variables (particularly in various clinical populations), and evidence of differences associated with the effects of drugs and with physiological measures of brain function—all provide strong empirical support for the validity of the distinction between remembering and knowing.

Major Theories

The first major theory advanced specifically to account for remembering and knowing was Tulving’s (1983, 1985) original proposal that remembering and knowing are expressions of two kinds of consciousness, autonoetic and noetic, which are properties of different memory systems, episodic and semantic memory. The distinction between episodic and semantic memory systems is, of course, supported by a number of other converging sources of
evidence (Nyberg & Tulving, 1996), and the proposal that autonoetic consciousness is a property of the episodic system is particularly well supported (Wheeler et al., 1997). But the idea that noetic consciousness is a property of the semantic system even in recognition memory studies, where know responses refer to a single recent encounter with a test item, seems more controversial.

The theory assumes that encoding into different systems is serial, and that events have first to be encoded into semantic memory before they can be encoded into episodic memory (Tulving, 1994). This assumption suggests that know responses could reflect encoding that is adequate for the semantic system, but inadequate for the episodic system.

Gregg and Gardiner (1994; see also Gardiner & Gregg, 1997) devised a procedure designed to largely prevent encoding into episodic memory, but to still allow encoding into semantic memory. In this procedure, studied words were presented visually at an extremely rapid rate in conjunction with a highly perceptual orienting task. Recognition performance was quite poor following these study conditions, and very largely characterized by knowing. In addition, test modality was manipulated. Visual was compared with auditory presentation at test. Recognition performance was considerably better in the visual test, where the test mode corresponded with study mode, than it was in the auditory test, where test and study modes differed. And this modality effect occurred in know responses, not in remember responses.

The finding that following such study conditions recognition memory can be based largely on knowing, with little or no remembering, suggests that all that is necessary for encoding into the semantic system is some initial awareness of the events, however fleeting. In contrast, encoding into episodic memory must depend on greater conscious elaboration of the events. Hence the relative preservation of knowing, with normal aging, for example, and in the various clinical conditions in which remembering is greatly reduced, can be interpreted in terms of relatively unimpaired encoding into semantic memory, but impaired encoding into episodic memory because there is less conscious elaboration of events.

Conway, Gardiner, Perfect, Anderson, and Cohen (1997) investigated the acquisition of conceptual knowledge by undergraduate students, a situation that seems less controversially to involve semantic memory. Students in this study were, however, allowed to distinguish “just know” responses from “familiarity” responses, which were defined rather in the way know responses had previously been defined—that is, as feelings of some recent but unremembered encounter. One finding was that students who scored highly in initial multiple-choice questions of knowledge acquired from lecture courses remembered more correct answers than their fellow students, and that in a retest some months afterwards, there was a remember-to-know shift. These same high-scoring students now outperformed their fellow students by just knowing more correct answers, rather than by remembering more (see figure 15.1). Good memory initially meant good episodic memory, which can presumably facilitate the development of more schematized conceptual knowledge in semantic memory. Such knowledge gives rise to just knowing, rather than knowing of recent but unremembered encounters as measured by the familiarity responses.

Though Conway et al. (1997) argued that just know and familiarity responses both reflect varieties of noetic awareness (see also Gardiner & Conway, in press), there is as yet little compelling evidence that transient feelings of familiarity relating to a recent encounter reflect the same memory system that supports highly familiar long-term knowledge, and this remains a problem for the systems account.

A second major theory is the distinctiveness/fluency framework that has been developed by Rajaram (1996, 1998). This grew out of the earlier suggestion that remembering is influenced by conceptual processes, and knowing is influenced by perceptual processes, as conceived in the transfer-appropriate processing framework (see Rajaram, 1993). While this correspondence between the predominant type of processing and the state of awareness provided a reasonable summary of many of the earlier findings—including those of Gregg and Gardiner (1994), which can also be interpreted in terms of greater fluency, less distinctiveness—more recent evidence indicates that the relationship between the process distinction and the awareness distinction is more accurately regarded as orthogonal.

One perceptual factor that increases remembering is the reinstatement of identical pictorial stimuli at study and test, compared with changing the pictorial format (Rajaram, 1996). And Rajaram (1998) has shown that orthographically distinct words are more likely
to be recognized than orthographically common words and that this effect too occurs in remembering, not knowing. Conversely, Mäntylä (1997) found that examining similarities among faces by grouping them into one of several conceptual categories, a relational task that presumably depends on the use of schemas in semantic memory, increased know responses. He also showed that studying faces by rating the distinctiveness of their features increased remembering.

Distinctiveness of processing, whether conceptual or perceptual, presumably engages a greater degree of conscious elaboration at study, and thereby enhances remembering. Knowing, in contrast, reflects fluency in processing, in either conceptual or perceptual processes. This processing framework provides a useful summary of much of the available evidence, and it is in many respects complementary to, rather than alternative to, the systems theory. For example, evidence that knowing is affected by conceptual as well as perceptual factors strengthens the semantic memory interpretation of this state of awareness just as much as it strengthens the distinctiveness/fluency framework. The two theories nonetheless differ more in their explanations of knowing than in their explanations of remembering. The notion of fluency of processing may seem more plausible when it refers to a single previous encounter with a studied item than does the notion of semantic memory. But, by the same token, the notion of semantic memory seems more plausible than does that of processing fluency when it refers to the acquisition of conceptual knowledge (Conway et al., 1977).
Both these theories have recently been challenged by a signal-detection model in which remembering reflects stronger traces and more conservative response criteria, and knowing reflects weaker traces and more lenient response criteria (Donaldson, 1996; Hirshman & Master, 1997; Inoue & Bellezza, 1998). This model can apparently mimic the various kinds of empirical relations observed between remembering and knowing by the appropriate placement of response criteria. But it does not explain why the criteria are affected by different independent and subject variables in the ways that they have to be to fit the data. Nor does it explain the states of awareness as such—how, for example, subjectively distinct states of awareness can be produced simply by shifting response criteria in one direction or another over the same memory trace. It seems capable only of modeling the responses.

There is, moreover, evidence that refutes the model’s most important prediction with respect to the responses, which is that estimates of the strength of the memory trace should be the same regardless of the response criteria used in estimating it. Results from the procedure introduced by Gregg and Gardiner (1994), for example, show that estimates of the strength of the memory trace are much greater when derived from remember plus know responses than when derived only from remember responses, and meta-analyses of many different experimental conditions show highly consistent differences in the same direction (Donaldson, 1996; Gardiner & Gregg, 1997). These results show that even according to tests of the model, knowing reflects an additional source of memory, not merely a difference in response criteria. And there is other evidence that the detection model does not fit (for more discussion, see Gardiner & Gregg, 1997; Gardiner, Richardson-Klavehn, & Raponi, 1998; Gardiner & Conway, in press).

Mandler proposed that recognition memory is mediated by two independent processes—elaboration, and integration—that these two processes were respectively associated with the experiences of recollection and familiarity, and that the second of these two processes was also responsible for perceptual priming in implicit memory tasks such as word stem completion (Mandler, 1980; Graf & Mandler, 1984). Almost inevitably, given this theory, among earlier suggestions for interpreting remembering and knowing was that they might reflect the independent processes of elaboration and integration. This in turn led to the expectation that there might be parallel effects between knowing in recognition memory and what happens in perceptual priming (Gardiner, 1988). The fact that level of processing typically influences neither knowing nor perceptual priming seemed promising for this hypothesis, and there are other parallels. For example, serial position effects occur in remember, not know responses (Jones & Roe-diger, 1995), and they occur in stem cued recall, but not in primed stem completion (Brooks, 1994).

But there are also inconsistencies. For example, the finding that word frequency influences not knowing, but remembering (e.g., Gardiner & Java, 1990), does not parallel what happens in perceptual priming because perceptual priming and recognition show similar word frequency effects (e.g., Jacoby & Dallas, 1981). There is other evidence that undermines any presumed correspondence between familiarity in recognition and perceptual priming (e.g., Snodgrass, Hirshman, & Fan, 1996; Wagner, Gabrieli, & Verfaellie, 1997).

Jacoby’s (1991) process dissociation procedure retains the idea of two independent processes, and the idea that similar processes may operate in recognition and in perceptual priming. But the contrast now is between controlled and automatic processes, and it is assumed that recollection is a controlled process and familiarity is an automatic process.

Furthermore, in the process dissociation procedure as applied to recognition memory, estimates of these two independent processes are derived from what amounts to a source monitoring task (see Buchner, Erdfelder, Steffens, & Martensen, 1997). Subjects study two discriminable sets of items and are tested in an inclusion task, in which targets are defined as items from both sets; and in an exclusion task, in which targets are defined as items from one set, not the other. The difference be-
between proportions of the critical set of targets that subjects identify rightly in the inclusion task, and wrongly in the exclusion task, is taken to reflect their conscious control and hence the recollection process. Errors in the exclusion task are taken to reflect the automatic familiarity process, but the process itself is estimated by a simple correction for independence.

Jacoby, Yonelinas, and Jennings (1997) argued for an independence remember/know model and suggested that if remembering is equated with the recollection process, and knowing with the familiarity process, but similarly corrected for independence, then the results from the remember/know procedure fall into agreement with those from the process dissociation procedure. And indeed Jacoby et al. (1997) showed examples of such convergence between the two procedures.

But there are also examples of convergence in the absence of any correction for independence (Richardson-Klavehn et al., 1996). The effects of age, for instance, and of divided versus undivided attention, leave knowing invariant and so lead to increased familiarity estimates by the independence remember/know model. But familiarity estimates for these effects are largely invariant in the process dissociation procedure. So adopting an independence remember/know model leads to divergence, not convergence, between the two procedures. Moreover, adopting an independence remember/know model sometimes leads to similar conclusions to those drawn without adopting it. For example, LeComte (1995) showed that the revelation effect, which is the increased likelihood of identifying words as previously studied if they are revealed gradually at test, rather than shown all at once, increases familiarity regardless of whether familiarity is defined simply by know responses or by know responses assuming an independence model.

The problem of the relation between the two procedures has been considered at length elsewhere (e.g., Richardson-Klavehn et al., 1996; Jacoby et al., 1997). Here we make only two other general points. First, remembering is not equivalent to the source monitoring required in exclusion tasks. Second, remembering is not equivalent to conscious control.

Remembering is broader than the source monitoring required in exclusion tasks. People remember aspects of the studied words that are not relevant to the exclusion task. Precisely this problem led Yonelinas and Jacoby (1996) to distinguish "criterial" from "noncriterial" recollection. Noncriterial recollection is recollection that does not allow successful exclusion, and so enters into estimates of familiarity. Hence recollection consists in two components, one identified with control, the other not, and familiarity also consists in two components, if it includes automatic, irrelevant recollection. Mulligan and Hirshman (1997) made a similar point in distinguishing "diagnostic" from "nondiagnostic" recollection, where diagnostic and nondiagnostic are equivalent to criterial and noncriterial. Since noncriterial or nondiagnostic recollection will contribute to remember, not know responses, in the remember/know paradigm, the extent to which estimates of recollection in the process dissociation procedure correspond with remembering must presumably reflect the relative proportions of the two kinds of recollection.

This modification to the process dissociation procedure concedes that recollection cannot be equated with control. Other evidence distinguishing between consciousness of memory and control comes from some recent studies of perceptual priming in stem completion tasks, where it is possible to separate involuntary retrieval accompanied by awareness that the words retrieved were from a studied list, and involuntary retrieval not accompanied by such awareness (see, e.g., Richardson-Klavehn & Gardiner, 1996, 1998). Awareness of retrieval volition is dissociable from awareness of having encountered words in the study list, and that awareness of memory includes both remembering and knowing (see Java, 1994, 1996).

In autobiographical memory, involuntary remembering happens quite frequently. Much of what comes to mind in more natural settings seems more under stimulus control than under the conscious control of the person (Berntsen, 1998). Little has been done, however, to bring together related work on autobiographical memory in more natural settings and laboratory work on remembering and knowing, except for a long-term diary study of remembering and knowing in memory for actual and imagined events by Conway, Collins, Gathercole, and Anderson (1996; see also Brewer, 1992).

There is some evidence of involuntary autobiographical remembering in the laboratory. In their detailed analysis of explanations subjects provided for earlier recognition decisions, Gardiner, Ramponi et al. (1998a) found
that about one-third of all decisions accompa-
nied by remember responses reflected being
reminded of some autobiographical event when
words appeared in the study list, rather than
the deliberate use of list learning strategies.
Conway and Dewhurst (1995) showed that de-
liberate self-reference at study considerably
increases subsequent remembering, which
suggests that whatever is involuntarily re-
membered at study is also very likely to be re-
membered again at test.

Similar outcomes to that found by Gardi-
ner, Ramponi et al. (1998a) had been found in
two other studies. Huron et al. (1995) found
that remembering that could be classified as
autobiographical was relatively unimpaired in
schizophrenic patients. Curran, Schacter, Nor-
man, and Galluccio (1997) found that remem-
bering that could be classified as autobiogra-
phical was relatively unimpaired in a patient with
a right frontal lobe infarction. In
both studies, the more general impairments in
remembering appeared to reflect the less effec-
tive use of list-learning strategies. Thus it
would be misleading to characterize these im-
pairments merely as impairments in remem-
bering, because they reflect reduced levels
only of remembering that was associated with
the deliberate use of list-learning strategies.
The implications of this suggestion need to be
followed up.

Remembering and source monitoring are
obviously related. Source monitoring judg-
ments (needed to exclude the critical set of
studied items in the process dissociation pro-
cedure), such as those involving presentation
modality, or speaker's voice, or orienting task,
can be regarded as finer grained judgments
within the state of awareness defined as remem-
bering. Schacter, Koutstaal, Johnson, Gross,
and Angell (1997) demonstrated false
remembering in older, but not younger, adults
induced by reviewing photographs of events
related to, but not shown in, an earlier videotape.
But in addition to making remember and
know responses, participants made a number of
further judgments in a Memory Characteristics
Questionnaire (MCQ). These included judgments about what an object looked like,
where it appeared, and whether there was a
strong feeling of familiarity or a weak feeling
of familiarity. This finer grained analysis re-
vealed that the false remembering in older
adults appeared to reflect poorer source moni-
toring. Mather, Henkel, and Johnson (1997) re-
port a similar analysis of false memories,
though only in young adults, in which remem-
ber and know responses were combined with
MCQ ratings in order to provide a fuller char-
acterization of memory experiences.

Some Current Problems

Both remembering and knowing define gen-
eral states of awareness that may each be bro-
ken down into varieties of experiences (Gardi-
ner & Conway, in press). Just as remembering
can be broken down into more specific source
monitoring judgments, other recent studies
have broken down know responses into addi-
tional response categories, allowing guess re-
sponses to be reported as such, and just know
responses to be reported separately from fa-
miliarity, as in Conway et al. (1997). This de-
velopment partly reflects particular concern
about the interpretation of know responses,
which has perhaps been the most vexatious
problem in the remember/know paradigm.

Where knowing is the default response, it
is clearly open to abuse by subjects, who may
use know responses to reflect various judg-
mental strategies that do not involve any
awareness that the selected items were from
the study list (Strack & Forster, 1995). Many
earlier studies largely controlled for this by
strongly discouraging guessing. Allowing sub-
jects to report guesses instead seems a better
solution to this problem (see Gardiner, Java et
al., 1996a; Gardiner, Kaminska et al., 1996b;
Gardiner et al., 1997; Gardiner, Ramponi et
al., 1998a; Gardiner & Conway, in press) and
guessing can still be strongly discouraged,
even when it is allowed as a response. Evi-
dence from these studies shows that it is guess
responses, rather than know responses, that
then reflect various other judgmental strate-
gies. These strategies appear to reflect aware-
ness of the circumstances prevailing during
the memory task, such as the general charac-
teristics of the item or the frequency of previ-
ous responses.

The evidence from these studies also shows
that guess responses are more likely than
know responses to be constrained by high lev-
els of performance, as one would expect if
know responses are valid measures. One dra-
matic demonstration of this is in Gardiner,
Java et al. (1996a, exp. 1), whose results are
summarized in table 15.4. The standard find-
ing that level of processing influences remem-
bering, and not knowing, was replicated, de-
spite the obvious impact on guess responses of
high performance following the semantic task.
Table 15.4 Proportions of Responses in Gardiner, Java et al. (1996a, exp. 1).

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Level of Processing</th>
<th>Not Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Semantic</td>
<td>Graphemic</td>
</tr>
<tr>
<td>Remember</td>
<td>.72</td>
<td>.15</td>
</tr>
<tr>
<td>Know</td>
<td>.18</td>
<td>.20</td>
</tr>
<tr>
<td>Guess</td>
<td>.05</td>
<td>.24</td>
</tr>
<tr>
<td>Overall</td>
<td>.95</td>
<td>.59</td>
</tr>
</tbody>
</table>

If test conditions encourage, or compel, the use of very lenient response criteria, as in tests of a signal detection model (see, e.g., Jacoby et al., 1997; Hirshman & Henzler, 1998), and subjects are only allowed to report remember and know responses, then know responses are likely to include many guesses that subjects would report as such were they allowed to do so. Consider the pattern of data in table 15.4 had subjects included guesses in know responses, rather than reported them, and adopted the same lenient recognition response criteria.

In tests of several models, Yonelinas, Dobbins, Szymbanski, Dhalliwal, and King (1996) showed that a dual-process model in which recollection depends on threshold, but familiarity depends on signal detection, provides a better fit than either a pure threshold model or a pure detection model. They also showed that the independence remember/know model can predict the observed receiver operating characteristics (ROCs). But despite this success for the model, the confidence judgments as used to estimate ROCs do not correspond with knowing. A string of studies has shown dissociations between confidence judgments and know, as well as remember, responses (e.g., Gardiner & Java, 1990; Rajaram, 1993; Perfect et al., 1995; Mäntylä, 1997; Holmes, Waters, & Rajaram, 1998; Gardiner & Conway, in press). And there is discontinuity between knowing and guessing, because know responses reveal memory whereas guess responses do not (e.g., Gardiner, Java et al., 1996a, 1996b; Gardiner & Conway, in press; and see table 15.4).

The study by Conway et al. (1997) that distinguished between a just know response and a familiarity response showed that these finer grained judgments can be dissociated from each other, just as different source memory judgments can. The remember-to-know shift in that study occurred in just know responses, not in familiarity responses, which like guess responses were largely unchanged between the initial test and the retest (see figure 15.1).

Dissociations at this level are important, but they do not require any modification to the distinction between autonoetic and anoetic forms of awareness (Tulving, 1983, 1985). They only require a distinction to be made between the varieties of experience that each state of awareness may encompass (Gardiner & Conway, in press). But there is the theoretical problem of which dissociations should be taken to justify distinctions between states of awareness rather than between varieties of experience. This same kind of problem arose in relation to dissociations of implicit compared with explicit test performance and distinctions between different memory systems (see, e.g., Roediger, 1990). And there hasn't really been any satisfactory resolution of it there. Even if one accepts that its resolution will depend on many different but converging sources of evidence (Nyberg & Tulving, 1996), it's the novelty of what point, and by what criteria, the weight of evidence will favor one resolution rather than another. The same seems true—by the same token—with respect to states of awareness and varieties of experience.

Conclusions

Following Tulving's (1985) introduction of remember and know responses as subjective reports of two states of awareness of the past, the most fundamental empirical discovery is that remembering and knowing are functionally independent. They are influenced differently, in systematic ways, by different experimental manipulations. They vary systematically in different subject populations. They are differentially susceptible to the effects of drugs, and appear to be associated with at least partially distinct patterns of neural activity.

The addition of the guess response category is an important development in the remember/know paradigm that clearly has both methodological and theoretical advantages—especially with respect to previous attempts to model remember and know responses that encouraged guessing, but did not allow guesses to be reported. Awareness of guessing, unlike awareness of remembering or of knowing,
does not normally reflect memory for the specific items that elicit the response.

Remembering and knowing are not explained by a unidimensional signal detection model based on the concept of trace strength. Nor do remembering and knowing correspond to a number of other dichotomies with which they have been previously aligned. These dichotomies include (1) the distinction between explicit and implicit memory, which has sometimes been equated with conscious versus unconscious memory; (2) the distinction between conceptual and perceptual processes, from the transfer-appropriate processing framework; (3) the distinction between recollection and familiarity, conceived as independent processes in certain dual-process models of recognition; and (4) the closely related distinction between controlled and automatic processes, as represented in the process dissociation procedure.

Of theories that account for remembering and knowing, the fullest and most direct account is provided by Tulving's (1983, 1985) memory systems theory. The distinctiveness/fluency framework developed by Rajaram (1996, 1998) provides a valuable alternative account.

More generally, the evidence reviewed in this chapter strengthens considerably the case for arguing that psychology of memory should take on board subjective reports of conscious states and not just rely on more conventional measures of performance. This evidence has established that the essential subjectivity of remembering and knowing does not make reports of these states of awareness intractable to science.

Appendix 1:  
Written Test Instructions

In this test you will see a series of words, one word at a time. Some of the words are those that you saw yesterday. Others are not. For each word, click the YES button if you recognize the word as one you saw yesterday and click the NO button if you do not think the word was one you saw yesterday.

Recognition memory is associated with two different kinds of awareness. Quite often recognition brings back to mind something you recollect about what it is that you recognize, as when, for example, you recognize someone's face, and perhaps remember talking to this person at a party the previous night. At other times recognition brings nothing back to mind about what it is you recognize, as when, for example, you are confident that you recognize someone, and you know you recognize them, because of strong feelings of familiarity, but you have no recollection of seeing this person before. You do not remember anything about them.

The same kinds of awareness are associated with recognising the words you saw yesterday. Sometimes when you recognize a word as one you saw yesterday, recognition will bring back to mind something you remember thinking about when the word appeared then. You recollect something you consciously experienced at that time. But sometimes recognizing a word as one you saw yesterday will not bring back to mind anything you remember about seeing it then. Instead, the word will seem familiar, so that you feel confident it was one you saw yesterday, even though you don't recollect anything you experienced when you saw it then.

For each word that you recognize, after you have clicked the YES button, please then click the REMEMBER button, if recognition is accompanied by some recollective experience, or the KNOW button, if recognition is accompanied by strong feelings of familiarity in the absence of any recollective experience.

There will also be times when you do not remember the word, nor does it seem familiar, but you might want to guess that it was one of the words you saw yesterday. Feel free to do this, but if your YES response is really just a guess, please then click the GUESS button.

Note to Appendix. Subjects from certain clinical populations may find the terms remembering and knowing confusing and, if so, more abstract terms such as "Memory Type A" and "Memory Type B" can be used. The descriptions of these types of memory are the same as those used to describe remembering and knowing (see, e.g., Bowler et al., 1998).

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port. We also thank Cristina Ramponi for her help in the preparation of this chapter.

**Notes**

1. Classification is not always straightforward. Not all studies showing effects on remembering report analyses that permit conclusions about effects on knowing. Also, effects on remembering are sometimes accompanied by reverse effects on knowing that might reflect scale attenuation, and know responses tend to be more variable than remember responses for reasons we discuss later in the chapter.

2. Indeed, with a manipulation designed to encourage very lenient response criteria, Hirshman and Henzler (1998) found an increase in remember as well as in know responses. But this manipulation led to a remember false-alarm rate of 11% and a know false-alarm rate of 35%. Both false-alarm rates are exceptionally high. It seems likely that Hirshman and Henzler’s subjects were induced to confabulate some of their responses. Hirshman and Henzler also reported $A'$ estimates of memory that were consistently lower with the more lenient response criteria, which supports this interpretation even though the reduction in those estimates was not found to be statistically significant.

**References**


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