

Introduction to "Implicit memory: Multiple perspectives"

DANIEL L. SCHACTER
University of Arizona, Tucson, Arizona

Psychological studies of memory have traditionally assessed retention of recently acquired information with recall and recognition tests that require intentional recollection or explicit memory for a study episode. During the past decade, there has been a growing interest in the experimental study of *implicit* memory: unintentional retrieval of information on tests that do not require any conscious recollection of a specific previous experience. Dissociations between explicit and implicit memory have been established, but theoretical interpretation of them remains controversial. The present set of papers examines implicit memory from multiple perspectives—cognitive, developmental, psychophysiological, and neuropsychological—and addresses key methodological, empirical, and theoretical issues in this rapidly growing sector of memory research.

The papers that follow were presented at a symposium entitled "Implicit memory: Multiple perspectives," held at the annual meeting of the Psychonomic Society in Atlanta on November 17, 1989. The symposium represents something of a milestone, in the sense that if someone had suggested organizing an implicit memory symposium a decade ago, he or she probably would have been met with a blank stare. That stare would have reflected two important facts: first, because the term "implicit memory" was not introduced until 1985, nobody would have known what a symposium on implicit memory was supposed to be about; and second, prior to the past decade, little research existed concerning the kind of memory that many would now describe as implicit memory.

Implicit memory refers to memory for information that was acquired during a specific episode and that is expressed on tests in which subjects are not required, and are frequently unable, to deliberately or consciously recollect the previously studied information or the episode itself (Graf & Schacter, 1985; Schacter, 1987). Implicit memory contrasts with explicit memory, which involves conscious or deliberate recollection of recent episodes on the recall and recognition tests that have long been the staple of experimental psychology.

Implicit memory is a descriptive concept, and does not refer to a hypothetical underlying memory system (Graf & Schacter, 1985; Schacter, 1985, 1987). Thus, implicit memory differs from such terms as procedural memory (Squire, 1987) or semantic memory (Tulving, 1983), which refer to hypothetical memory systems. Although it has been argued that different memory systems are involved in implicit and explicit memory (e.g., Hayman & Tulving, 1989; Schacter, in press; Schacter, Cooper, &

Delaney, 1990; Tulving & Schacter, 1990), it is also possible to adopt a unitary or single-system view of memory and still make use of the implicit/explicit distinction (e.g., Roediger, Weldon, & Challis, 1989; Witherspoon & Moscovitch, 1989).

The distinction between implicit and explicit memory is also closely related to the distinction between "direct" and "indirect" tests of memory (Johnson & Hasher, 1987). Direct tests (e.g., recall, recognition) are roughly equivalent to explicit tests, whereas indirect tests are roughly equivalent to implicit tests. However, as pointed out by Richardson-Klavehn and Bjork (1988), whereas the implicit/explicit distinction is used to refer both to the tests and to hypothetical forms of memory, the indirect/direct distinction refers solely to the tests; it does not entail any assumptions about the form of memory tapped by the tests. Richardson-Klavehn and Bjork suggested that it is preferable to use the indirect/direct distinction with regard to the tasks themselves, because it is not always certain whether an "implicit" task is performed solely on the basis of implicit memory: Some subjects may become aware of the prior study episode when performing an allegedly implicit task, thus raising questions about whether it is appropriate to use the term "implicit memory test" in such instances (for further discussion of awareness and implicit memory, see Bowers & Schacter, 1990; Schacter, Booker, & Bowers, 1989). Thus, Richardson-Klavehn and Bjork pointed out—quite correctly—that a *nominally* implicit test may not always be a *functionally* implicit test.

It is crucial to emphasize, however, that the same point can be made about the indirect/direct distinction: Although a task such as stem completion may be a nominally indirect test in the sense that subjects are not required to think back to the study episode, it is always possible that some subjects who "catch on" concerning the nature of the task adopt intentional, explicit retrieval strategies, thereby turning the indirect test into a direct test.

Correspondence concerning this article should be addressed to Daniel L. Schacter, Department of Psychology, University of Arizona, Tucson, AZ 85721.

Schacter et al. (1989) have suggested an empirically based *retrieval intentionality criterion*, which provides a basis for addressing the foregoing problems. The key point, however, is that the indirect/direct distinction suffers from the same potential problem as the implicit/explicit distinction: The nominal characterization of the task may not always accurately describe subjects' functional treatment of it. Accordingly, the mere existence of this problem does not constitute a compelling reason to use the indirect/direct distinction rather than the implicit/explicit distinction when characterizing tasks. In his discussion of the present symposium, Roediger delineates a number of other problems that arise when attempting to use the indirect/direct distinction. Thus, even though the two distinctions overlap considerably, it seems simpler and less problematic to use the implicit/explicit distinction to refer both to tasks and to forms of memory, much as has been done with the recall/recognition distinction.

While it is thus apparent that perfect agreement concerning terminology has not yet been achieved, it is beyond dispute that there has been a dramatic increase in research on implicit memory during the past few years. However, the phenomenon has been discussed by psychologists, neurologists, and philosophers from time to time over the past couple of centuries, even though they of course did not use the term "implicit memory" in their writings (for a historical review, see Schacter, 1987). In a little-known book published initially in 1804, the French philosopher Maine de Biran (1929) discussed various implicit memory phenomena and offered a multiple memory systems interpretation of them. Late 19th century neurologists (e.g., Korsakoff, 1889) described instances of implicit memory in patients with organic amnesia, and psychiatrists of the time (e.g., Janet, 1904) reported similar phenomena in patients with functional amnesias. The philosopher Bergson (1911) discussed implicit memory phenomena at length under the rubric of "habit" in his book, *Matter and Memory*. And Ebbinghaus (1885) himself noted the existence of what we would now call implicit memory phenomena in his classic treatise.

Impetus for the recent surge of research can be traced to two developments of the 1960s and 1970s. First, neuropsychological investigations revealed—quite surprisingly—that even severely amnesic patients show some preserved learning abilities: Milner, Corkin, and Teuber (1968) demonstrated that the famous amnesic patient H.M. could acquire new motor skills, and studies by Warrington and Weiskrantz (1974) indicated that amnesic patients showed normal performance—what we would now call priming—on fragment-completion tests. The truly remarkable aspect of these phenomena, of course, is that patients appeared to show little or no explicit memory for the study episode in which knowledge and skills were acquired. A second important precursor to current interest was provided by research on language processing (e.g., Kirsner & Smith, 1974; Scarborough, Cortese, & Scarborough, 1977), which attempted to use

recently discovered repetition priming effects as a tool to investigate issues concerning lexical access and representation.

Based in large part on these two areas of investigation, several papers appeared in the early 1980s that demonstrated dissociations between implicit and explicit memory in normal, nonamnesic subjects. Jacoby and Dallas (1981) provided evidence that various experimental manipulations (e.g., levels of processing) that had large effects on an explicit recognition test had no effect on the magnitude of priming effects that were observed on a word-identification test. Graf, Mandler, and Haden (1982) reported a similar pattern of results—levels-of-processing manipulations produced large effects on explicit memory and little or no effects on implicit memory—using free-recall and stem-completion tests, respectively. Tulving, Schacter, and Stark (1982) added to these findings of functional independence between implicit and explicit memory by demonstrating that priming effects on a fragment-completion test showed virtually no decay across a 1-week retention interval, whereas recognition-memory performance declined substantially over the same delay. They also reported *stochastic* independence between priming and explicit memory: there was no correlation between performance on the recognition and fragment-completion tests at the level of the individual item (see also Jacoby & Witherspoon, 1982). Although these studies were not the first demonstrations of implicit/explicit dissociations in normal subjects—Winnick and Daniel (1970) had provided such evidence in a frequently overlooked paper—they seemed to serve as a catalyst for what has now become a virtual avalanche of research.

The main purpose of the following papers is to provide a sampling of contemporary work on implicit memory from a number of different perspectives, including cognitive, neuropsychological, developmental, and psychophysiological. It is also hoped that the papers will capture some of the excitement that currently surrounds this area of investigation. Contemporary research on implicit memory certainly contains no shortage of unresolved theoretical controversies, thorny conceptual issues, and confusing empirical puzzles; but there is also a strong sense that this line of research has already revealed, and will continue to provide, new and important insights into the nature, structure, and function of memory.

The articles that follow contain some minor changes from, and several additions to, the actual symposium presentations. However, there is overall a close correspondence between what is published here and what was presented at the symposium. Forster, Booker, Schacter, and Davis consider the longevity of masked priming effects on stem- and fragment-completion tests, and address more generally the relation between masked and unmasked priming effects. Bentin and Moscovitch provide evidence that such psychophysiological measures as event-related potentials and skin-conductance responses can serve as useful indexes of implicit memory. Graf reviews and integrates a large number of studies on the develop-

ment and aging of implicit and explicit memory. Butters, Heindel, and Salmon provide neuropsychological evidence for dissociations among different forms of implicit memory in patients with distinct patterns of neurological impairment. Schacter, Cooper, and Delaney describe studies on structurally based priming of visual objects and argue that such effects depend on a presemantic system that has been delineated in neuropsychological research on object-processing deficits. Roediger provides an overview of the current state of implicit memory research and pays particular attention to the contentious issue of single versus multiple memory systems.

The articles will probably not answer all the questions that one might have about implicit memory. Nevertheless, they clearly illustrate the potential importance of implicit memory research for a number of areas of investigation, and also highlight some new and potentially promising directions for the field.

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