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The Self-Regulation of Memory: For Better and For Worse, With and Without Hypnosis

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A great and beautiful invention is memory, always useful both for learning and for life.
Dialexeis, c. 400 B.C.

Memory is great and beautiful, but its contents and underlying processes are also complex. Memory stores knowledge in a variety of formats (Anderson, 1983; Tulving, 1983): procedural knowledge of cognitive and motor skills, sometimes organized into systems of productions; as declarative knowledge of semantic relations and episodes, sometimes organized into schemata; as perception-based images preserving the spatial configurations of objectives and their components; and as linear strings preserving the ordinal relations among objects and events. Memory can be expressed explicitly, by recall or recognition of some piece of knowledge; or it can be expressed implicitly, in terms of a change in the person's experience, thought, and action attributable to that knowledge (Schacter, 1987). Because explicit and implicit memory are dissociable, implicit expressions of memory provide clear examples of the unconscious influence of a past event on current functioning (Kihlstrom, 1987, 1990; Kilhstrom, Barnhardt, & Tataryn, 1992).

To some extent, what we remember and what we forget depends on processes that operate automatically in the course of information processing. Some memories fade with the passage of time; others persist forever despite our desire to have them disappear; and still others pop unbidden into the mind. On the other hand, learning and remembering are also intentional, skilled activities that depend critically on our goals and strategies. We can do things to help ourselves remember, and to prevent the occurrence of forgetting, but are there things we can do to help ourselves forget, and to prevent the occurrence of remembering? And are there

*The point of view represented in this chapter is based on research supported by Grant MH-35856 from the National Institute of Mental Health. We thank Jill Booker, Jeffrey Bowers, Jennifer Dorfman, Elizabeth Glisky, Martha Glisky, Lori Marchese, Susan McGovern, Sheila Mulvaney, Robin Pennington, Michael Polster, Barbara Routhieux, Victor Shames, and Michael Valdessari for their comments.

things we can do to bring forgotten events back to mind? In this chapter we explore some of the possibilities for the self-regulation of memory—of gaining intentional, strategic control over both remembering and forgetting.

SEVEN PRINCIPLES OF MEMORY FUNCTION

By way of background, we summarize here some general principles that seem to govern the operation of the memory system, as abstracted from the research literature.[1] In analyzing the success or failure of any attempt at remembering (or, for that matter, at forgetting), it is convenient to divide memory processing into three stages. *Encoding* has to do with the acquisition of knowledge—in the general case, the creation of a memory trace representing some experience. *Storage* has to do with the retention of trace information over a period of time. *Retrieval* has to do with the utilization of stored information in the course of experience, thought, and action. In principle, any instance of remembering or forgetting can be attributed to processes occurring at any of these stages, alone or in combination. Thus, an event can be forgotten because it has not been encoded; because it was lost from storage during the retention interval; or because an available memory was not retrieved.

Traditional theories of memory, as represented by the work of Ebbinghaus and the entire passive-association tradition of S-R learning theory, emphasize the role of repetition and rehearsal in memory encoding. However, more recent work supports a distinction between maintenance rehearsal, or rote repetition, which maintains items in an active state, and elaborative rehearsal, which links new items to preexisting knowledge. These experiences illustrate the *elaboration principle* (Anderson & Reder, 1979; Craik & Lockhart, 1972): *The probability of remembering an event is a function of the degree to which that event was related to preexisting knowledge during processing.*

The elaboration principle applies to the processing of individual events; but memory is also improved if we connect individual events to each other. This effect is illustrated by other classic studies on the role of associative clustering, category clustering, or subjective organization. That is, list items tend to be reorganized in memory, so that items associatively or conceptually related tend to be recalled together regardless of their order of presentation. Subjective organization is a similar phenomenon, except that the order of recall tends to be determined by an image or narrative that is idiosyncratic to the subject, rather than widely shared semantic relationships. All three phenomena illustrate the *organization principle* (Bower, 1970; Mandler, 1967, 1979): *The probability of remembering an event is a function of the degree to which that event was related to other events during processing.* The

[1]Space does not permit complete documentation of each of the assertions that follow. For a thorough treatment of the cognitive psychology of memory, see the texts by Anderson (1990), Baddeley (1976, 1990), Crowder (1976), Ellis and Hunt (1989), Klatzky (1980), and G. R. Loftus and E. F. Loftus (1976).

difference between elaborative and organizational processing corresponds to the distinction between *item-specific information*, which increases the distinctiveness of each item, and *relational information*, which highlights the similarities between items (Hunt & Einstein, 1981).

Assuming that a memory trace has been adequately encoded, it is now available for use. As long as attention is devoted to the item, it remains in a high state of readiness and is extremely likely to be retrieved; when the trace is no longer an object of attention, the probability of successful retrieval progressively diminishes. This empirical fact, known since Ebbinghaus, may be summarized as the *time-dependency principle: The probability of remembering an event is a negative function of the length of time between encoding and retrieval.* Of course, there are instances in which knowledge is preserved at remarkably high levels over extremely long periods of time, raising the question of a "permastore" (Bahrick, 1984).

In general, there are two accounts of what happens over the retention interval. One view, which may be attributed to the S-R tradition in memory research, emphasizes the passive decay of unrehearsed memories, just as footprints are washed away by wind and tide. Another view, which forms the basis for the interference tradition in memory, asserts that other items, especially those newly encoded during the retention interval, weaken the target memory traces, or otherwise compete with their retrieval. Interference is dramatically illustrated in the *fan effect*, in which increases in the number of facts associated with a concept increase the time required to retrieve any one of these facts. Although there is some evidence for trace decay, and for the actual destruction of memory traces once a trace has been encoded in memory (Loftus & Loftus, 1980), the chief cause of forgetting appears to be some sort of proactive or retroactive interference.

The implication of interference is that once a trace has been consolidated in memory, its storage is essentially permanent. Assuming that a memory trace has been adequately encoded, and has been preserved over the retention interval, it must be retrieved in order to answer a query or used in other information-processing functions. However, memory fluctuates from trial to trial, and items that appear forgotten on a test of free recall can be retrieved on a test of cued recall or recognition. Such findings illustrate the distinction between *availability* and *accessibility* (Tulving & Pearlstone, 1966): *Items that are available in memory may not be accessible on any particular attempt at retrieval.*

To some extent, accessibility is affected by encoding and storage factors: Elaborate, organized memories are more reliably accessible than those that are not; and recent memories are more reliably accessible than remote ones. However, accessibility is also determined by factors present at the time of retrieval. One important determinant of accessibility is the amount of cue information supplied with the query. In free recall, the cue (e.g., "What were the words on the list you learned?") is very impoverished: At best, it specifies only the spatiotemporal context of the to-be-remembered event; in cued recall, additional information is supplied about the nature of the target event (e.g., "What were the animal names on the list?"); in recognition, the cue is a copy of the event itself (e.g., "Was one of the words

LION or BEAR?). Such comparisons yield the *cue-dependency principle* (Tulving, 1974): *The probability of remembering an event increases with the amount of information supplied by the retrieval cue.*

But effective retrieval cues must also contain the right kind of information, as well as the right amount. Thus, the word AMBER, studied in a list of words including ORANGE and RED, may be retrieved when cued by the category COLOR, but not when cued by the category FIRST NAME OF A GIRL OR WOMAN. This finding illustrates the *encoding specificity principle* (Tulving & Thomson, 1973): *The probability of remembering an event is a function of the extent to which cues processed at the time of encoding are also processed at the time of retrieval.* Encoding specificity appears to underlie the phenomena of state-dependent retention, in which psychoactive drugs such as alcohol or barbiturates are administered during encoding or retrieval: In these cases, memory is best when there is a match between the state in which the material was studied, and the state in which memory is tested (for a review, see Eich, 1980; 1989). Similar effects have been found for environmental setting (e.g., Smith, 1988), and emotional state (e.g., Eich & Metcalfe, 1989). Such "context-dependent memory" effects are themselves cue-dependent: They are typically found with free-recall tests, and only rarely on tests of cued recall and recognition. This suggests that contextual information is relatively weak and can be swamped by other cues. Students taking multiple-choice exams are not aided by being seated in the same room in which they heard the lecture (and, in any event, much of the test concerns textbook material, which presumably was encoded in the library or dormitory). Nevertheless, such context effects do illustrate the importance of congruence between encoding and retrieval conditions, which is what the encoding specificity principle is all about.

Memory for particular events is importantly determined by our expectations and beliefs, represented as generic knowledge structures known as *schemata*. The first to appreciate this point was Bartlett (1932), in his attack on the associationistic tradition represented by Ebbinghaus and Thorndike. The important role played by organized preexisting knowledge illustrates the *schematic processing principle* (Hastie, 1981): *The probability of remembering an event is a function of the degree to which that event is congruent with preexisting expectations and beliefs.* It turns out, however, that the precise relationship between event and schema is important. Some events are schema-congruent, meaning that they would be expected by the schema in place; others are schema-incongruent, or counterexpectational; still others are schema-irrelevant, meaning that they do not bear on the schema one way or the other. Although considerable research converges on the conclusion that schema-congruent events are remembered better than schema-irrelevant ones, Hastie has pointed out that schema-*in*congruent items are remembered best of all. The U-shaped function relating schema-congruence and memorability appears to find its explanation in two different processes. Because of their surprising value, schema-incongruent events receive extra processing at the time of encoding, as the perceiver tries to take account of them. And at the time of retrieval, the subject can draw on the schema itself to generate cues that will help gain access to

schema-congruent events. By contrast, schema-irrelevant events enjoy neither of these advantages, and thus are poorly remembered.

Bartlett's view of memory as schema-driven lies at the foundation of his view of remembering as *reconstructive* rather than reproductive. Just as perceiving an object is sometimes more like painting a picture than inspecting a photograph, so remembering an event is more like writing a book than retrieving one from the shelf. Some evidence for the reconstructive nature of remembering is provided by studies by Loftus (1980) and others on the effects of leading questions and other misinformation on eyewitness testimony. Although Loftus's notion that post-event misinformation overwrites and replaces event information in memory has been strongly challenged (e.g., McCloskey & Zaragoza, 1985), nothing contradicts the notion that memory can be misled, confused, and biased by changes in perspective and other events occurring after the fact. These errors, confusions, and biases illustrate the *reconstruction principle* (Bartlett, 1932): *Memory of an event reflects a blend of information retrieved from a specific trace of that event with knowledge, expectations, and beliefs derived from other sources.*

These seven principles—elaboration, organization, time-dependency, cue-dependency, encoding specificity, schematic processing, and reconstruction—provide a type of user's manual for the human memory system. We will have many occasions to observe their operation as we examine the prospects for the self-regulation of memory.

FORGETTING THE MEMORABLE

Mnemonic devices are strategies for ensuring that something that is supposed to be remembered is in fact retained. To the extent that they are effective, mnemonic devices seem to work by strengthening the encodings given to items at the time they occur, and enriching the supply of cues by which they are retrieved. Another problem in the self-regulation in memory is the strategic forgetting of events that otherwise would be remembered. In principle, this should be possible by working in reverse: by contradicting, or merely failing to follow, those seven principles that promote remembering.

Directed Forgetting

In the traditional psychology of memory, forgetting was generally construed in passive terms, as something that happened to the person as a kind of accidental by-product of some other event: Memory traces decay over time; unpracticed associations are weakened; one association interferes proactively or retroactively with another; the environment fails to provide adequate cues. But, clearly, some kind of intentional forgetting must go on. Every time we update our memories, clearing our minds of useless knowledge, we forget quite thoroughly things that we used to know quite well. Who remembers now the telephone number of your high-school sweetheart—the one you called every night during senior year? Or the

telephone number of the last place you lived, before your current residence? Or last year's locker combination at your health club?

In the late 1960s and early 1970s, a number of investigators developed a simple experimental paradigm for studying directed forgetting (for reviews, see Bjork, 1972, 1978, 1989; Bjork & Bjork, 1991, in press; Epstein, 1972; Kihlstrom, 1983). Subjects study (but do not master) a list of words (List A), and then are told they can forget them; then they study a new list of words (List B). The effectiveness of the instruction is shown not just by diminished recall of List A (as tested in occasional catch trials), which after all could reflect nothing more than response withholding, but also by improved memory for List B, compared to subjects who are told to remember both. Although recall levels in the to-be-forgetten (TBF) group are not always equivalent of control subjects who study List B alone, they are close, and the relative release from proactive interference is convincing evidence that at least some portion of List A has, in some cases, been forgotten.

Directed forgetting paradigms. There are a number of different directed-forgetting paradigms that may be classified into a 2 × 3 scheme depending on the arrangement of to-be-remembered (TBR) and to-be-forgotten (TBF) items, and also on the placement of the cue to remember or forget (Kihlstrom, 1983). The first dimension involves the temporal relationship between TBR and TBF items: In the method of *cuing by item sets*, the TBF and TBR items are presented in blocked fashion, and the subjects receive a cue directing them to forget one set and remember the other; in the method of *item-by-item cuing*, the two sets are intermixed, and the subjects are cued to remember or forget each item in turn. The second dimension involves the point at which the forget cue is presented: In the method of *preinput cuing*, the cue is given before the item or set is presented; in *intraserial cuing*, it separates the TBF and TBR items or sets; in *postinput cuing*, it is given after both types of items have been presented.

It should be noted that in all cases known to us, the items in question are presented only once, with relatively brief study times and relatively rapid interstimulus intervals, and retention is tested almost immediately; there appear to be no experiments on directed forgetting of material that has been learned to a stricter criterion of mastery. Moreover, TBF items almost always precede TBR items (the reverse order only makes sense in the case of postinput cuing). Thus, the effectiveness of the forget cue is usually assessed in terms of proactive interference of List A on List B, not retroactive interference of List B on List A. The different methods of presenting the items and cues influence the effectiveness of the instruction to forget. The most popular method, perhaps because it works best, is intraserial cuing by item sets. Preinput cuing, whether of sets or of items, is also effective, but in this case it is impossible to distinguish forgetting, after encoding, from simple inattention at the time of presentation—in other words, a failure to encode the material properly in the first place. It is unclear whether postinput cuing is effective in either reducing recall of List A or releasing interference on List B (Bjork, 1970; Epstein, 1969, 1970; Reed, 1970).

Mechanisms of directed forgetting. Aside from mere response withholding, several mechanisms have been advanced for the effectiveness of directed forgetting procedures (Bjork, 1972; Epstein, 1972). The first of these is *selective rehearsal*: Once the subjects receive the forget cue, they stop rehearsing TBF items and devote all their rehearsal time to TBR items. Such an encoding mechanism can account for both the success of preinput and intraserial cuing, and the relative ineffectiveness of postinput cuing: Preinput cues signal the subject not to rehearse TBF items at all; intraserial cues permit the subject to stop rehearsing List A items, and devote correspondingly more attention to List B items; but by the time the postinput cue has been presented, rehearsal of both lists has been accomplished.

A second process, *list segregation*, also has been proposed as a complement to selective rehearsal: When subjects receive the cue, the items in question are tagged with their TBR or TBF status. Once labeled, there are two further possibilities, which have not been adequately distinguished to date. Possibly, the differential grouping of the items reduces interference (Bjork, 1972); alternatively, subjects are able to focus their retrieval efforts on one set and ignore the other (Epstein, 1972). Either variant of the list-segregation hypothesis may be preferred to differential rehearsal on the grounds of generality alone: List-segregation can account for positive results in all the directed-forgetting paradigms, while differential rehearsal cannot. Perhaps intraserial cuing works better, and more reliably, than postinput cuing because the former profits from both selective rehearsal and list segregation.

More recently, Geiselman, Bjork, and their colleagues (Bjork, 1989; Bjork & Bjork, 1991, in press; Geiselman & Bagheri, 1985; Geiselman, Bjork, & Fishman, 1983) have proposed a third explanation, retrieval inhibition. The idea here is not just that List B is selectively recalled, but that access to List A is actively denied. Preliminary evidence for this notion came from a study by Geiselman, MacKinnon, Fishman and others (1983), which employed two types of items: Learn items, which were studied in anticipation of a future memory test; and Judge items, which were subject only to an evaluative decision. Geiselman, MacKinnon, Fishman and others (1983) found diminished recall and release from proactive interference on Judge as well as Learn items. This result is inconsistent with the selective rehearsal hypothesis: Judge items from List A are remembered worse than Judge items of List B, although neither one is rehearsed by the subject. And it is consistent with both the list segregation and retrieval inhibition hypotheses: Apparently Judge items are grouped into Lists A and B along with their Learn counterparts; and when retrieval of Learn items from List A is inhibited, the suppression affects the corresponding Judge items as well.

The notion of retrieval inhibition implies that there may be circumstances in which retrieval can be *dis*inhibited, and in fact there is some evidence for the reinstatement of memory for TBF items (Bjork & Bjork, 1991). For example, subjects who do not recall TBF items typically are able to recognize them (e.g., Block, 1971; Geiselman, MacKinnon, Fishman and others, 1983). This finding makes sense under classical two-process theories of memory, which hold that recall requires retrieval, but recognition does

not. If a cue to forget affects retrieval, and recognition has no retrieval component, then a cue to forget should not affect recognition. However, it is somewhat anomalous in light of later theories, which hold that recall and recognition both require retrieval but differ in the amount of cue information supplied to the subject—an anomaly to which we return later. In any event, proactive interference is restored if, prior to the recall test, subjects receive a recognition test in which TBR items serve as targets and TBF items serve as lures (Bjork & Bjork, 1991). Note, in this latter case, that subjects are not asked to recognize TBF items themselves; rather, they merely encounter TBF items in the course of attempting to recognize TBR items. Interestingly, however, retrieval apparently cannot be disinhibited by the simple expedient of asking the subject to remember TBF items: Retention levels are low on catch trials where subjects are surprised with a request to recall the TBF items.

The fact that unrecalled TBF items are successfully recognized, and that proactive interference can be reinstated, indicates that these items remain available in memory, even if they cannot be retrieved. Accordingly, the question arises whether memory for TBF items can be expressed implicitly even if these items cannot be recalled explicitly. Of course, it is possible that much or all of the success in recognition tests reflects priming-based feelings of familiarity, a phenomenon closely related to implicit memory. In the first experiment to address this question directly, MacLeod (1989) found that directed-forgetting instructions impaired performance on both explicit (recall and recognition) and implicit (stem completion and lexical decision) memory tasks. Unfortunately, MacLeod did not include a measure of proactive interference in his experiments for comparison with stem completion and lexical decision; moreover, because his explicit and implicit tests differed in the amount of cue information provided to the subjects, it is impossible to compare their outcomes directly. On the other hand, Bjork & Bjork (1991) have reported both unimpaired fragment completion of TBF items and release from proactive interference on TBR items (however, they too failed to match the explicit and implicit tests). Interestingly, fragment-completion of TBF items, unlike recognition, does not appear to reinstate proactive interference.

The effect of forget cues on standard implicit memory tasks is a matter of considerable importance, because proactive interference *also* counts as an expression of implicit memory (Booker, 1991). Presumably, if MacLeod (1989) had tested for proactive interference, he would have found it increased following a remember cue, and decreased following the forget cue: In other words, the two measures of implicit memory—fragment completion (or lexical decision) and proactive interference—would have gone up and down together. But the Bjork & Bjork (1991) study did test for proactive interference and found a dissociation: priming on fragment completion (indicating implicit memory was spared) but release from proactive interference (indicating that implicit memory was impaired).

Unfortunately, the studies by MacLeod (1989) and Bjork and Bjork (1991) differed markedly in terms of their procedures. For example, MacLeod used item-by-item cuing, whereas Bjork and Bjork used intraserial cuing

of item sets. For this reason, no firm conclusions can be drawn at this point about the effect of directed forgetting on implicit memory. In other cases of amnesia and forgetting, however, we know that events that seem lost on explicit memory tests may nevertheless make themselves felt on implicit memory tests. The same may be true of directed forgetting. Thus, those who would seek to use forget cues to control memory must be prepared for the possibility that such cues affect only conscious recollection, and not the expression of the target memories outside of awareness.[2]

An alternative approach to the issue of explicit and implicit memory is presented by Paller (1990), who examined the fate of event-related potentials (ERP) elicited by TBF and TBR items. This study is also important because it is the first to match the cues (three-letter stems) used in explicit and implicit memory tests. Using a variant on the method of item-by-item preinput cuing, Paller found that directed forgetting impaired stem-cued recall of TBF items but had no effect on the use of TBF items as responses on a stem-completion test—contrary to the findings of MacLeod (1989), but congruent with those of Bjork and Bjork (1991). Interestingly, Paller obtained the usual difference in late-component positivity (Dm) between remembered and forgetten items, but only for free and stem-cued recall measures of explicit memory; there was no such difference for the stem-completion measure of implicit memory. Differences in Dm between TBR and TBF items are difficult to document because so few TBF items are recalled. Presumably, to the extent that preinput cuing controls encoding activity, there would be differences in late-component positivity between TBR and TBF items. It would be interesting to determine the fate of these ERP components in other directed-forgetting paradigms, especially those involving postinput cuing.

Hypnotic Amnesia

Hypnosis is a social interaction in which one person (the hypnotist) offers suggestions to another person (the subject) for imaginative experiences involving alterations in perception and memory. Among the most dramatic of these is posthypnotic amnesia: Following an appropriate suggestion, subjects cannot remember the events and experiences that occurred while they were hypnotized (for reviews, see Coe, 1978; Coe & Sluis, 1989; Cooper, 1979; Kihlstrom, 1978b, 1985; Kihlstrom & Evans, 1979; Kihlstrom & Hoyt, 1990; Schacter & Kihlstrom, 1989; Spanos, 1986). The amnesia suggestion can be tested during hypnosis as well, but the posthypnotic form is more common; in what follows, we treat hypnotic amnesia and posthypnotic

[2]Students of social judgment, including jury and juror decision making, have also investigated the effects of instructions to *disregard* information, perhaps because it is confidential, perhaps because it is incorrect (e.g., Golding, Fowler, Long, & Latta, 1990; Schul & Burnstein, 1985; Wyer & Budesheim, 1987). Instructions to disregard information are not the same as instructions to forget it—for one thing, it may be necessary to remember what we are supposed to disregard. Still, such information can influence subsequent impressions, in a manner closely resembling implicit memory tests. Direct comparison of instructions to disregard and to forget promise to be very interesting.

amnesia as interchangeable phenomena. The analogy between posthypnotic amnesia, and the amnesia that follows a night's sleep, is one of the phenomena that gave hypnosis its name. Not everyone experiences amnesia: It is most common, and most dense, in those subjects who are most highly hypnotizable; in subjects of more moderate hypnotizability, the effects of the amnesia suggestion can be seen in vague and fragmentary recollections of hypnotic experiences (Kihlstrom & Evans, 1978). The amnesia does not occur unless it has been explicitly or implicitly suggested (Cooper, 1979; Hilgard & Cooper, 1965), and it is not reversed merely by the reinduction of hypnosis (Kihlstrom, Brenneman, Pistole, & Shor, 1985). Both these features distinguish the hypnotic case from instances of state-dependent retention.

In the most highly hypnotizable subjects, who typically experience the amnesia as something outside their control, posthypnotic amnesia resists deliberate attempts to breach it by exhortations for increased effort or admonitions for honesty in reporting (Kihlstrom, Evans, Orne, & Orne, 1980). The extent of breaching is greater for those subjects who experience their amnesia as something that happens to them, rather than as something they have achieved by means of strategies such as self-distraction (Coe & Sluis, 1989; Coe & Yashinski, 1985; Howard & Coe, 1980; Schuyler & Coe, 1981); it is also greatest in subjects who believe that amnesia is breachable (Silva & Kirsch, 1987). As is the case for other hypnotic phenomena, such as suggested analgesia and deafness, amnesia is also breached by means of Hilgard's (1977) "hidden observer" technique (Spanos, Radtke, & Bertrand, 1984). The fact that posthypnotic amnesia can be breached is not inconsistent with the proposition that the forgetting is subjectively compelling. Most of us remember things better if we try harder; but it does underscore the fact that the locus of the amnesia is somewhere in the retrieval process.

Even in the absence of increased effort, posthypnotic amnesia also shows some degree of remission with repeated trials (Kihlstrom, Easton, & Shor, 1983; Kihlstrom and others, 1980). There is some question whether this reflects an effect of trials or a dissipation with time (Bertrand, Spanos, & Parkinson, 1983; Spanos, Tkachyk, Bertrand, & Weekes, 1984). In any event the phenomenon seems analogous to the reminiscence and hypermnesia discussed later in this chapter. Typically, however, full recovery awaits administration of a prearranged signal to cancel the amnesia suggestion (Kihlstrom & Evans, 1976)—although even in this case, some residual amnesia may persist (Kihlstrom & Evans, 1977).

Disrupted retrieval processes. The fact of reversibility marks posthypnotic amnesia as a phenomenon of retrieval rather than a failure of encoding or a loss from storage. More specific cognitive accounts of the mechanism of posthypnotic amnesia have focused on various aspects of the memory retrieval process. One line of research has examined processes underlying free recall, which is most seriously impaired by amnesia suggestions. Another has compared free recall to recognition, which is relatively spared.

The hypothesis that posthypnotic amnesia reflects some sort of in-

terference with (if not necessarily an inhibition of) normal retrieval processes has been pursued in a number of different ways. One series of studies, initially inspired by classic two-process theories of memory retrieval, tested the hypothesis that amnesia involved a disruption of normally organized memory search processes. In the paradigm introduced by Evans and Kihlstrom (1973), those subjects with the densest posthypnotic amnesia are excluded from consideration, on the simple grounds that they remember too little of the critical material to permit an analysis of organization. For the remaining subjects, who remember at least some critical material despite a suggestion for complete amnesia, it is assumed that highly hypnotizable subjects are experiencing at least the partial effects of the amnesia suggestion, compared to others who are not susceptible to hypnosis.

In their first studies, Kihlstrom and Evans (1979; Evans & Kihlstrom, 1973) focused on the fate of temporal organization in the recall of a series of hypnotic suggestions. During amnesia, they found that insusceptible subjects generally recalled these events in the chronological order in which they occurred, while hypnotizable subjects were much less likely to do so. If the amnesia suggestion was omitted from the procedure, both groups showed equal and high levels of temporal sequencing. Geiselman, MacKinnon, Fishman and others (1983) also observed this effect. In response to other investigators' failure to replicate, and certain methodological criticisms (e.g., Radtke & Spanos, 1981; St. Jean & Coe, 1981), Kihlstrom & Wilson (1984) confirmed the effect in a more conventional verbal learning paradigm. Subjects memorized a list of words by an incremental procedure that guaranteed that they would impose a serial organization on the items as they learned them. During suggested posthypnotic amnesia, subjects of high, but not medium or low, hypnotizability showed a dramatic loss of temporal sequencing; when the amnesia suggestion was canceled, serial organization returned to baseline levels.

An analogous effect has been found in studies of other forms of organization. For example, Radtke, Spanos, and their colleagues found similar disruptions of category clustering for conceptually related words (e.g., Spanos & Bodorik, 1977) and subjective organization for ostensibly unrelated items (Tkachyk, Spanos, & Bertrand, 1985). Although Radtke, Spanos, and their colleagues have replicated these effects on several occasions, Wilson and Kihlstrom (1986) raised some question about their generalizability (for further discussion, see Spanos, Bertrand, & Perlini, 1988; Kihlstrom & Wilson, 1988). It should be noted that disruption of one type of organization does not necessarily entail disruption of other forms of organization. To paraphrase Gertrude Stein, organization is not necessarily organization. Temporal sequencing is based on the chronological relations among items, arranged as it were along a linear string; by contrast, category clustering and subjective organization are based on the semantic relations among items, either imposed by the experimenter in the construction of the list or discovered by the subject in the course of learning. G. Mandler (1979) has distinguished among coordinate, subordinate, and pro-ordinate forms of organization, corresponding roughly to subjective, categorical, and temporal structures. Similarly, J. Mandler (1979) has contrasted categorical (language-based) and schematic (temporal) organiza-

tional structures, corresponding roughly to Anderson's (1983) distinction between meaning-based and perception-based mental representations. It is entirely possible that an amnesic process could exert a selective disruption of organized recall, resulting in a dissociation between one form of organization and another.

Under classic two-process theories of retrieval, recall involves both a search process to generate candidate items, and a decision process to discriminate between those that were encountered in the past and others that were not; recognition tests obviate the need for memory search, and rely only on decision. While the two-process, generate-decide theory of memory retrieval has been questioned by some investigators (e.g., Lockhart, Craik, & Jacoby, 1976; Tulving, 1976; but see Rabinowitz, Mandler, & Patterson, 1977), in the context of hypnosis it led to the prediction that recognition would be spared during posthypnotic amnesia. Although recognition is generally higher than recall during posthypnotic amnesia, it is also generally lower than the level of performance observed in nonamnesic subjects (Barber & Calverley, 1966; Kihlstrom & Shor, 1978; Spanos, James, & deGroot, 1990; Williamsen, Johnson, & Eriksen, 1965). Similarly, cued recall tends to be higher than free recall but does not abolish amnesia entirely (Radtke, Thompson, & Egger, 1987).

In fact, in subjects of very high hypnotizability, recognition can be extremely poor. In two studies, McConkey and Sheehan (1981; McConkey, Sheehan, & Cross, 1980) confronted amnesic subjects with videotapes of their behavior during hypnosis—arguably the richest retrieval cues imaginable. Roughly half the hypnotized, amnesic subjects in each study continued to show some degree of recognition failure. Moreover, many of the subjects were unable to recall specific details of the items that they recognized. This inability to remember details shows up in free recall as well (Kihlstrom & Evans, 1978) and may underlie the observation that hypnotizable, partially amnesic subjects do not show the pattern of differential recall of passed and failed items (the "Zeigarnik effect") characteristic of insusceptible, nonamnesic subjects (for an overview, see Kihlstrom & Hoyt, 1990).

Explicit and implicit memory. It has long been recognized that amnesia suggestions have highly selective effects on memory. For example, a number of studies in Hull's (1933) laboratory found that posthypnotic amnesia had little or no effect on savings in relearning a stylus maze, paired associates, and complex mental addition. Similarly, the amnesia has little effect on proactive and retroactive interference (e.g., Coe, Basden, Basden, & Graham, 1976; Coe, Taul, Basden, & Basden, 1973; Dillon & Spanos, 1983; Graham & Patton, 1968). Although these sorts of findings are sometimes interpreted as casting doubt on the veracity of the subjects' claims of being amnesic, this is not the only possible conclusion. Savings and interference may be largely independent of conscious recollection. For example, Nelson (1978) showed clearly that even unhypnotized subjects could show significant savings in relearning for items that they could neither recall nor recognize.

In an extremely interesting series of studies, Evans and Thorn (1966;

Evans, 1979, 1988; see also Cooper, 1979) found that some amnesic subjects recalled world-knowledge (e.g., the color an amethyst turns when exposed to heat; or the difference between the antennae of moths and butterflies) taught to them during hypnosis, although they did not remember the circumstances in which they acquired this information. Evans and Thorn called this phenomenon *source amnesia*, distinguishing it from recall amnesia, because subjects remember facts but not their sources in experience. Although the methodology of the Evans and Thorn study has been criticized (Coe, 1978; Spanos, Della Malva, Gwynn, & Bertrand, 1988), it is interesting to note that an analogous phenomenon has been documented in neurological patients with the amnesic syndrome as well (Schacter, Harbluk, & McLachlan, 1984; Shimamura & Squire, 1987). Along with the notion of demand characteristics (Orne, 1962), source amnesia is one of the most salient examples of a concept developed in hypnosis research that has become part of the common parlance of psychological theory.

Although these effects were once interpreted as reflecting a dissociation between procedural and declarative knowledge or between episodic and semantic memory (Kihlstrom, 1985), they are best construed as part of a larger class of dissociations between explicit and implicit expressions of memory. These dissociations may be illustrated by two pairs of experiments. In the first pair, Kihlstrom (1980) found that hypnotizable subjects were unable to recall the items in a word list that subjects had memorized during hypnosis. However, they remained able to use these same items as responses on free-association and instance-generation tasks (a dissociation between episodic and semantic memory; see Tulving, 1983). More important, production of these items as free associations and category instances was facilitated, compared to control items that had not been learned; and the level of priming observed was the same as that shown by nonamnesic subjects. This effect was confirmed by Spanos and his associates (Bertrand, Spanos, & Radtke, 1990; Spanos, Radtke, & Dubreuil, 1982), although they prefer to interpret the results in terms of the demands conveyed by test instructions rather than dissociations between explicit and implicit memory.

In the first study of the second pair, Huesmann, Gruder, and Dorst (1987) taught hypnotized subjects to solve Luchins' classic "water jar" problem in such a manner as to create a particular problem-solving set. After a suggestion for posthypnotic amnesia, the subjects did not remember the learning experience; nevertheless, their earlier mental set influenced their performance on a new series of water-jar problems. A companion study showed that free-association performance was biased by the context in which stimulus words were presented during hypnosis, even though the subjects did not remember the biasing experience itself. Of course, free-association, instance-generation, and problem-solving tasks fit the definition of implicit memory tasks, in that they do not require conscious recollection of any particular episode from the past. The fact that performance on these tasks is spared while recall and recognition are impaired illustrates the same dissociation between explicit and implicit memory that has been documented in neurological patients with the amnesic syndrome.

The dissociation between explicit and implicit memory observed in

posthypnotic amnesia may account for the puzzling relationship between recall and recognition. As Mandler (1980) has noted, recognition may be mediated by two quite different processes: a feeling of familiarity, based on the activation of a memory trace by the recognition query; and the recollection of the context in which the trace was encoded. The difference is between the experience that occurs when someone's face or name "rings a bell" and the ability to remember the actual circumstances in which we encountered that person in the past. Recognition by familiarity is conceptually related to the priming effects emblematic of implicit memory, whereas conscious recollection of the circumstances is clearly central to explicit memory. For this reason, it seems possible that successful recognition in posthypnotic amnesia is mediated by priming or similar effects reflecting implicit memory. The case for this conclusion is strengthened by the fact that similar recall-recognition differences have been found in neurological patients suffering the amnesic syndrome (Hirst, Johnson, Kim, Phelps, Risse, & Volpe, 1986).

Directed Forgetting and Posthypnotic Amnesia Compared

Based on the evidence of retrieval inhibition in directed forgetting, and the clear disruption of retrieval in posthypnotic amnesia, Geiselman, MacKinnon, Fishman and others (1983) suggested that posthypnotic amnesia and directed forgetting shared a common underlying mechanism, namely retrieval inhibition. At the same time, however, the two paradigms differ considerably in terms of methods and results, suggesting that they may differ in terms of underlying mechanisms as well (Kihlstrom, 1983). For example, in procedural terms posthypnotic amnesia most closely resembles postinput cuing: The items to be forgotten have already been encoded when the amnesia suggestion has been administered; but postinput cuing is not particularly effective in reducing recall in directed forgetting. Moreover, amnesia suggestions can be effective even when the study list has been learned to a strict criterion of mastery, while the forget cues in directed forgetting target items that have been studied only once, and briefly. Finally, there is nothing comparable to a prearranged reversibility cue in directed forgetting.

Of course, the comparison between posthypnotic amnesia and directed forgetting is also an empirical matter. Geiselman, MacKinnon, Fishman and others (1983) found evidence for retrieval inhibition in both directed forgetting and posthypnotic amnesia, but the evidence in the two conditions was not comparable. In directed forgetting, retrieval inhibition was reflected by impaired recall of judge as well as learn items; in posthypnotic amnesia, it was reflected in the temporal disorganization of recall. Interestingly, posthypnotic amnesia and directed forgetting were positively correlated.

Coe and his colleagues (Coe, Basden, Basden, Fikes, Gargano, & Webb, 1989) attempted to perform a more direct comparison of intraserial cuing of item sets, with lists and cues presented in or out of hypnosis. In terms

of recall of forget items, hypnotic amnesia was correlated with hypnotizability, as expected, but directed forgetting was not (if anything, the correlation was negative); moreoever, directed forgetting released the proactive inhibition of forget items on remember items, as expected, but hypnotic amnesia did not. These discrepant results suggest that, despite certain superficial similarities, posthypnotic amnesia and directed forgetting have different underlying mechanisms. This conclusion is supported by a study by Davidson and Bowers (1991), who used a variant of the postinput cuing of item sets. The suggestion was effective, even though the subjects had memorized the list items to a strict criterion of learning; this contrasts markedly with the mixed results obtained with this procedure in directed forgetting, with only a single presentation of the target items. Clearly, however, further research is required on this topic.

RECOLLECTING THE FORGOTTEN

Mnemonic devices facilitate remembering, while forget cues and amnesia suggestions promote forgetting. Is there anything that can be done to enable people to remember the things they have forgotten? The distinction between availability and accessibility, and the principles of cue-dependent forgetting and encoding specificity, would seem to imply an answer in the affirmative. After all, if items are permanently stored in memory, and most forgetting reflects retrieval failure, it ought to be possible to recover them somehow.

Reminiscence and Hypermnesia

According to the time-dependency principle, memory for events deteriorates over time—a phenomenon that Ebbinghaus termed *oblivescence*. However, even Ebbinghaus noted a number of instances in which the reverse occurred; and almost 30 years later, Ballard (1913, p. 1) wrote that "oblivescence is at least partly counteracted by an opposing tendency towards reminiscence. We not only tend to forget what we have once remembered, but we also tend to remember what we have once forgotten." Ever since Ballard's paper, reminiscence, defined as "the remembering again of the forgotten without re-learning" (Ballard, 1913, p. v), has been the object of considerable inquiry and controversy. For most of this time, a variety of investigators sought to replicate Ballard's results and isolate the mechanisms responsible for the phenomenon (for recent reviews, see Erdelyi, 1984, 1988). These experiments occasionally were successful in producing the effect, but in general reminiscence eluded capture in the laboratory. Memory for any single item may fluctuate over trials (e.g., Brown, 1923; Tulving, 1964), but in general intertrial recovery proves to be less than or equal to intertrial forgetting, so that net memory diminished (as Ebbinghaus had observed) or at best remained stable over trials. Investigators were largely unable to find conditions that would yield levels of intertrial recovery that

were reliably greater than intertrial forgetting, yielding net increments in recall over trials.

In more recent years, experiments by Erdelyi and his colleagues, and those by Roediger and co-workers, have demonstrated that net improvements in memory can be produced reliably in the laboratory (for reviews, see Erdelyi, 1984, 1988; Klein, Loftus, Kihlstrom, & Aseron, 1989; Payne, 1987; Roediger & Challis, 1989). For example, Erdelyi and Becker (1974) gave subjects one-study presentation of a set of 60 pictures or words, followed by a series of free-recall trials. Memory for pictures improved systematically from the first to the last of the series. This finding has been confirmed repeatedly by Erdelyi, as well as by several other investigators. Because of the multiple meanings attributed to the term "reminiscence" by Ballard and others, Erdelyi (1984, 1988) has suggested that the phenomenon be renamed "hypermnesia," referring to cases where the intertrial recovery of forgotten items is greater than the intertrial forgetting of remembered items, resulting in a net improvement in memory.

Although the phenomenon of hypermnesia is no longer in doubt, controversy continues over the mechanisms responsible for the effect. For example, Roediger and his colleagues have suggested that hypermnesia is mediated by the increased time permitted for recall (Roediger & Thorpe, 1978) and increasing practice with retrieval (Roediger & Payne, 1982). Similarly, early findings from Erdelyi's laboratory yielded hypermnesia when pictures, but not words, served as the to-be-remembered items (Erdelyi & Becker, 1974). This situation led Erdelyi (1982, 1984, 1988) to suggest that pictorial materials were privileged with respect to hypermnesia, and to speculate that imaginal processing is an important mediator of the effect. However, some experiments (e.g., Belmore, 1981; Erdelyi, Buschke, & Finkelstein, 1977; Roediger & Thorpe, 1978) have obtained hypermnesia for verbal materials, so the difference between verbal and nonverbal representations, or verbal versus nonverbal processing, cannot be critical.

Experiments by Mross, Klein, and Kihlstrom have shed more light on the conditions under which hypermnesia for words, and perhaps hypermnesia in general, occurs (Klein, Loftus, Kihlstrom, & Aseron, 1989; Mross, Klein, Loftus, & Kihlstrom, 1991). Mross and colleagues (1990), replicating the procedures of Erdelyi and Becker (1974), found significant hypermnesia for both pictures and words, although the magnitude of the effect was greater in the former case. In a second study, their stimulus materials shifted from words and pictures representing concrete objects to trait adjectives representing highly abstract personality descriptors. Following the "levels of processing" paradigm of Craik and Lockhart (1972), independent groups of subjects studied the items under one of four conditions: orthographic, phonemic, semantic, and self-referent. They then completed a series of two or three recall trials without any further study of the list. Significant hypermnesia was observed only in the self-referent condition. A third study replicated this finding, substituting an imagery task for the phonemic condition of Experiment 2. A fourth experiment compared just the phonemic and self-referent condition and found evidence of hypermnesia only in the latter. A final experiment by Klein and

others (1989) showed that pleasantness ratings (an elaborative task involving the processing of single items) increase the intertrial recovery component of hypermnesia, while category sorting (an organizational task involving the processing of interitem associations) decreases the intertrial forgetting component. Hypermnesia results from a net advantage of intertrial recovery over intertrial forgetting. Thus, both elaborative and organizational processing promote hypermnesia, though the end is accomplished by different means in the two cases.

The findings of these experiments speak to a number of theoretical controversies concerning the nature of the hypermnesia effect. For example, Erdelyi (1982, 1984, 1988) has suggested that imaginal (nonverbal) processing is critical for the occurrence of hypermnesia. Mross and others (1990) obtained hypermnesia for words in four separate experiments, and Klein and colleagues (1989) added a fifth, even though no imagery instructions were given to the subjects. Of course, it might be the case that the subjects spontaneously engaged in such a recoding process. However, the use of highly abstract personality trait terms as stimuli in the work of Mross and others (1990), and the failure of explicit imagery instructions to produce hypermnesia, diminish this possibility to a considerable extent. The effects of imaginal processing may be mediated by a more general effect of elaborative processing at the time of encoding. Imaginal processing may be a highly effective way to produce elaborate encodings, but other processing tasks could be equally or more effective in this regard (Belmore, 1981; Klein and others, 1989).

In the final analysis, experiments by Mross and Klein indicate that the amount of hypermnesia observed with words, at least, is a function of the manner in which they are processed: Self-referent processing yielded hypermnesia, whereas orthographic, phonemic, and semantic processing did not. Elaborative processing promotes intertrial recovery, while organizational processing prevents intertrial forgetting. These results join those of others who have found effects of encoding variables on hypermnesia within an intentional-learning paradigm—although they differ in that significant hypermnesia was not obtained in the semantic condition of Experiment 2 (Belmore, 1981; Roediger, Payne, Gillespie, & Lean, 1982).

On the other hand, Roediger and colleagues have argued that retrieval factors are critical in producing hypermnesia. Roediger (1982; Roediger and others, 1982; see also Roediger & Thorpe, 1978) noted that cumulative recall functions, of which hypermnesia could be considered a special case (in which intertrial recovery exceeds intertrial forgetting), have the property that the higher the asymptote of recall, the more slowly that asymptote is approached. Thus, according to their argument, hypermnesia is more likely to be shown in cases where initial levels of recall are high. Pictures generally show higher initial recall than do words; and words subject to imaginal or elaborative encoding show higher initial recall then those that are not. However, these researchers argue that hypermnesia is not due to encoding conditions per se; rather, any condition resulting in high initial levels of recall would have the same effect. Thus, they showed that high levels of cumulative recall—their characterization of hypermnesia—is more

likely to be obtained on a semantic memory task involving the generation of instances from large rather than small categories (Roediger and others, 1982).

On the other hand, Mross and co-workers (1990, Experiment 4) arranged their stimulus materials in such a way as to reverse the normal relation between level of processing and level of recall. Paralleling the set-size manipulation of Roediger and colleagues (1982), four times as many items were presented for a phonemic judgment as for a semantic one. More phonemic than semantic items were recalled on both the initial trial and overall, thus indicating that asymptotic levels of recall were higher in the phonemic condition. Nevertheless, no hypermnesia was observed in the phonemic condition. These results are not consistent with the hypothesis that level of recall determines the extent of hypermnesia; but they are consistent with the hypothesis that encoding factors play an important role.

Of course, as Erdelyi (1982) argued and Roediger and Challis (1989) now agree, cumulative recall is *not* the same as hypermnesia (see also Payne, 1986, 1987). Almost any set of conditions will show an incremental recall function, reflected in the appearance of new items over trials, but not all conditions yield hypermnesia, reflected in a net increase in recall from trial to trial. In terms of the usual repeated-testing procedure, cumulative recall is sensitive only to intertrial recovery. The problem is that intertrial recovery is necessary, but not sufficient, for hypermnesia to occur. What is needed additionally is either for intertrial forgetting to be reduced, or for intertrial recovery to exceed intertrial forgetting. Intertrial *forgetting* is the key to hypermnesia, and cumulative recall functions ignore this factor altogether.

In any event, the findings of the set-size experiment by Roediger and colleagues may be amenable to an alternative explanation in terms of encoding rather than retrieval processes. For example, the important factor may not be the number of items in the set, but rather the richness of the associative network linking the items to each other. Consistent with this point, research by Klein and others (1989) indicates that tasks promoting well-organized and richly elaborated encodings are powerful determinants of hypermnesia for verbal material. In the Klein study, reliable hypermnesia for word lists was found with tasks encouraging either elaborative or organizational processing at encoding; and when encoding conditions encouraged *both* elaborative and organizational processing, more hypermnesia was found than for either type of processing alone. It should be recalled that the recovery of previously unrecalled items is ubiquitous in multitrial experiments; thus, cumulative recall always increases across trials, and hypermnesia occurs in those instances where intertrial recovery exceeds intertrial forgetting. In the final analysis, Klein and co-workers found that both elaborative and organizational activity contributed to hypermnesia; elaborative activity promotes intertrial recovery, whereas organization prevents intertrial forgetting.

In summary, studies of hypermnesia offer a new perspective on the enhancement of memory by showing that items, once lost, are not necessarily gone forever. Continued efforts at retrieval will almost always yield previously forgotten material, even in the absence of changes in cue in-

formation provided to the subject (such as are accomplished by shifts from free recall to cued recall or recognition). However, clear limits exist on the magnitude of this effect. Under ordinary circumstances, the number of initially forgotten items that are subsequently recovered is equalled, or even surpassed, by the number of initially remembered items that are subsequently forgotten. Thus, in many cases, net recall remains constant at best; more likely it decreases, producing the phenomenon of time-dependent retrieval. But just as there are strategies that can be employed to promote good initial recall, there are also strategies that enhance intertrial recovery and diminish intertrial forgetting. Item gains are enhanced by elaborative activity, which produces a rich, distinctive memory trace that is more likely to be contacted by search and retrieval processes. Similarly, item losses are reduced by organizational activity, which focuses on the similarities among items and thus enhances the likelihood that recollection of one item will serve as a cue for the retrieval of another one.

Hypnotic Enhancement of Memory

The popular reputation of hypnosis as a means of transcending one's normal voluntary capacity—as reflected in the "generation of hypers" noted by Marcuse (1959)—coupled with the fact that hypnotic suggestions can produce profound alterations in cognitive functioning, has led some investigators to suggest that it can be employed to enhance memory, over and above whatever effects can be achieved by the use of mnemonic devices and other strategies available to nonhypnotized subjects. This technique was employed by Breuer and Freud (1895/1955) in their *Studies on Hysteria*, and was revived in World War I and again in World War II as an adjunct to brief hypnotherapy for war neurosis (Grinker & Spiegel, 1945; Watkins, 1949; for a particularly vivid portrayal of this technique, see John Huston's 1944–1945 propaganda film, *Let There Be Light*). More recently, hypnotic techniques have been employed in "past lives therapy," an occult practice in which patients search for the source of their present troubles in the sins and misfortunes of their previous existences; and in forensic situations, where witnesses and victims, and even suspects and defendants, may be hypnotized in the process of gathering evidence in civil and criminal cases.

Hypnotic hypermnesia. Laboratory studies of hypermnesia have a history extending back to the beginnings of the modern period of hypnosis research (for other reviews, see Erdelyi, 1988; Smith, 1983). For example, Young (1925, 1926) taught his subjects lists of nonsense syllables in the normal waking state, and then subsequently tested recall in and out of hypnosis, each time motivating subjects for maximal recall. There was no advantage of hypnosis over the waking test. Later experiments employing nonsense syllables also failed to find any effect of hypnosis (Baker, Haynes, & Patrick, 1983; Barber & Calverley, 1966; Huse, 1930; Mitchell, 1932). By contrast, studies employing meaningful linguistic or pictorial material have sometimes shown hypermnesia effects. Stalnaker and Riddle (1932) tested college students on their recollections for prose passages and verse

that had been committed to memory at least one year previously. Testing in hypnosis, with suggestions for hypermnesia, resulted in a significant enhancement over waking recall. These findings have been confirmed by other investigators who tested memory for prose, poetry, filmed material, and real-world memories (DePiano & Salzberg, 1981; Hofling, Heyl, & Wright, 1971; Young, 1926). In the first direct comparison of nonsense with meaningful material, White, Fox, and Harris (1940) found that hypermnesia suggestions resulted in a striking improvement in memory for poetry and a travelogue, but had no effect on memory for nonsense syllables. Similar results were also obtained by Rosenthal (1944) and Dhanens and Lundy (1975), who compared nonsense syllables with poetry and with prose, respectively.

On the basis of this kind of evidence, it might be concluded that laboratory studies tend to support the positive conclusions from uncontrolled case studies. However, it should be noted that the effects achieved in the lab, while sometimes statistically significant, are rarely dramatic. Moreover, it is fairly clear that any gains obtained during hypnosis are not attributable to hypnosis per se, but rather to normal hypermnesia effects of the sort described earlier. Thus, at least four investigations (Nogrady, McConkey, & Perry, 1985; Register & Kihlstrom, 1987, 1988; Whitehouse, Dinges, Orne, & Orne, 1991), adapting the hypermnesia paradigm introduced by Erdelyi and Becker (1974), found significant increments in memory for pictures or words in trials conducted during hypnosis; but these increments were matched, if not exceeded, by gains made by control subjects tested without hypnosis. Two studies have observed small gains in memory attributable to hypnosis (Shields & Knox, 1986; Stager & Lundy, 1985), but neither finding has been replicated (Lytle & Lundy, 1988). Moreover, Register and Kihlstrom (1987, 1988) found that levels of hypermnesia were no higher in hypnotizable subjects than in those who were insusceptible to hypnosis—thus strengthening the inference that whatever improvements occurred were the result of nonhypnotic processes.

Most important, it seems clear that the increase in valid memory may be accompanied by an equivalent or greater increment in confabulations and false recollections. In the experiment by Stalnaker and Riddle (1932), for example, hypnosis produced a substantial increase in confabulation over the normal waking state, so that overall memory accuracy was very poor. Apparently the hypnotized subjects were more willing to attempt recall, and to accept their productions—however erroneous they proved to be—as reasonable facsimiles of the originals. These conclusions are supported by more recent experiments by Dywan (1988; Dywan & Bowers, 1983) and Nogrady and others (1985), who found that hypnotic suggestions for hypermnesia produced more false recollections by hypnotizable than insusceptible subjects. Whitehouse and others (1991) found that hypnosis increased the confidence associated with memory reports that had been characterized as mere guesses on a prehypnotic test. Dywan and Bowers (1983) have suggested that hypnosis impairs the process of reality monitoring, so that hypnotized subjects are more likely to confuse imagination with perception (Johnson & Raye, 1981).

Proponents of forensic hypnosis often discount these sorts of findings on the ground that they are obtained in sterile, laboratory investigations that bear little resemblance to the real-world circumstances in which hypnosis is actually used—an argument closely resembling that made by some researchers allied with the "ecological memory" movement (for a critique, see Banaji & Crowder, 1989, 1991; for a more positive view, see Bahrick, 1991; Loftus, 1991; Neisser, 1978). However, the evidence supporting this assertion is rather weak. Reiser (1976), a police department psychologist who has trained many investigators in hypnosis, has claimed that the vast majority of investigators who tried hypnosis found it to be helpful; but such testimonials cannot substitute for actual evidence. In fact, a remarkable doctoral dissertation by Sloane (1981), conducted under Reiser's supervision, randomly assigned witnesses and victims in actual cases being investigated by the Los Angeles Police Department to hypnotic and nonhypnotic conditions. The study found no advantage for hypnosis. A study by Timm (1981), in which police officers themselves were witnesses to a mock crime (after having been relieved of their firearms through a ruse!), gave similar results.

A later study by Geiselman, Fisher, MacKinnon, and Holland (1985), employing very lifelike police training films as stimuli and actual police officers as investigators, did show some advantage for hypnosis over an untreated control condition; however, the benefits of hypnosis were matched by unhypnotized subjects led through a "cognitive interview" capitalizing on various cognitive strategies (unfortunately, there was no comparison condition in which the cognitive interview was administered during hypnosis). Thus, the available evidence does not indicate that hypnosis has any privileged status as a technique for enhancing memory. To paraphrase Nogrady and others (1985), trying hypnosis seems to be no better than merely trying again.

In fact, trying hypnosis may make things worse, because hypnosis—almost by definition—entails enhanced responsiveness to suggestion. Therefore, if memory is tainted by leading questions and other suggestive influences, as Loftus's work suggests, these elements may be even more likely to be incorporated into memories that have been refreshed by hypnosis. Putnam (1979) was the first to demonstrate this effect. He exposed his subjects to a variant of Loftus's (1975) paradigm, in which subjects viewed a videotape of a traffic accident followed by an interrogation that included leading questions. Those subjects who were interviewed while they were hypnotized were more likely to incorporate the misleading post-event information into their memory reports. Similar results were obtained by Zelig and Beidelman (1981) and Sanders and Simmons (1983). Register and Kihlstrom (1987), employing a variant of Loftus's procedure introduced by Gudjonsson (1984), failed to find that hypnosis increased interrogative suggestibility; but errors introduced during the hypnotic test did carry over to subsequent nonhypnotic tests. An extensive and complex series of studies by Sheehan and his colleagues (for reviews, see Sheehan, 1988a, 1988b) found that subjects tested during hypnosis were more confident in their memory reports than were those tested in the normal waking state—regardless of the accuracy of these reports.

The situation is even worse, apparently, when the suggestions are more explicit, as in the case of hypnotically suggested paramnesias (for reviews, see Kihlstrom & Hoyt, 1990; Levitt & Chapman, 1979; Reyher, 1967). Laurence and Perry (1983) suggested (falsely, of course) to a group of hypnotized subjects that on a particular night they had awakened to a noise. After hypnosis was terminated, all the subjects remembered the suggested event as if it had actually occurred; almost half of the subjects maintained this belief even when told that the event had been suggested to them by the hypnotist. Similar results were obtained by a number of investigators (Labelle, Laurence, Nadon, & Perry, 1990; Lynn, Milano, & Weekes, 1991; McCann & Sheehan, 1988; McConkey & Kinoshita, 1985–1986; McConkey, Labelle, Bibb, & Bryant, 1990; Sheehan, Statham, & Jamieson, 1991; Spanos, Gwynn, Comer, Baltruweit, & deGroh, 1989; Spanos & McLean, 1985–1986a, 1985–1986b). Unfortunately, the precise conditions under which the pseudomemory effect can be obtained remain obscure. Equally important, it remains unclear whether the pseudomemories reflect actual changes in stored memory traces or biases in memory reporting—an issue that also has been raised in the post-event misinformation effect observed outside hypnosis (e.g., Loftus, Schooler, & Wagenaar, 1985; McCloskey & Zaragoza, 1985; Metcalfe, 1990; Tversky & Tuchin, 1989).

Hypnotic age regression. Direct suggestions for hypermnesia are often accompanied by suggestions for age regression: that the subject is reverting to an earlier period in his or her own life, reliving an event and acting in a manner characteristic of that age (for reviews, see Nash, 1987; O'Connell, Shor, & Orne, 1970; Perry, Laurence, D'Eon, & Tallant, 1988; Reiff & Scheerer, 1959; Yates, 1961). Most research on this phenomenon has addressed the question of whether the age-regressed adult reverts to modes of psychological functioning that are characteristic of the target age, typically in childhood. Upon closer examination, however, the naive concept of hypnotic age regression proves to be a complex blend of three elements: *ablation*, the functional loss of the person's knowledge, abilities, and memories acquired after the suggested age: *reinstatement*, a return to archaic, or at least chronologically earlier modes, of cognitive and emotional functioning (i.e., procedural and semantic knowledge); and *revivification*, improved access to memories (i.e., episodic knowledge) from the suggested age (and before).

There is no evidence that the subject age-regressed to childhood loses access to his or her adult knowledge and abilities (O'Connell and others, 1970; Orne, 1951; Perry & Walsh, 1978). Thus, adults regressed to childhood, and asked to take dictation from the hypnotist, may write, in a childlike hand but without spelling errors, the sentence "I am conducting an experiment which will assess my psychological capacities"—a behavior that is clearly beyond the capacity of most children; alternatively, an adult who arrived in America as a monolingual child may reply in his native tongue to questions posed to him in English (Orne, 1951). Such conduct is one of the classic examples of what Orne (1959) called *trance logic*—the hypnotized subject's tendency to freely mix illusion and reality while re-

sponding to hypnotic suggestions. Although the interpretation of trance logic is controversial (e.g., McConkey, Bryant, Bibb, & Kihlstrom, 1991; Spanos, 1986), contradictions between childlike and adult behavior have been observed too often to sustain the notion that age regression involves the forgetting of adult procedural and declarative knowledge. It is possible, as Spanos (1986) has suggested, that trance logic reflects incomplete responding on the part of hypnotized subjects. On the other hand, it is also possible that the contradictions observed in age regression reflect the impact of adult knowledge that is denied to conscious awareness, but nevertheless continues to influence the behavior and experience of the age-regressed subject—much as in the manner of an implicit memory (Schacter, 1987).

In principle, however, the prospects for reinstatement are more promising: the hallucinated environment created by age regression may provide a context that facilitates the retrieval of procedural knowledge characteristic of childhood. Nevertheless, the evidence for reinstatement is ambiguous. One researcher (Å, 1962) found a college student who had spoken a Finnish-Swedish dialect until age eight, but who no longer remembered the language; his knowledge of the language improved somewhat under hypnotic age regression. More dramatic findings were obtained by Fromm (1970) in a *nisei* student who denied any knowledge of Japanese; when age-regressed, she broke into fluent, if childish, Japanese. In contrast, Kihlstrom (1978a) reported an unsuccessful attempt to revive Mandarin in a college undergraduate who had not spoken the language since kindergarten in Taiwan. What accounts for these different outcomes is not clear. Fromm's subject was highly hypnotizable, and had been imprisoned in an American internment camp during World War II (suggesting that her knowledge of Japanese had been covered by repression); Kihlstrom's subject was completely refractory to hypnosis.

In terms of experimental studies, Nash (1987) has found no convincing evidence favoring the reinstatement of childlike modes of mental functioning, whether these are defined in terms of physiological responses (e.g., the Babinski reflex, in which the toes fan upward in response to plantar stimulation), loss of mental age on IQ tests (e.g., the Stanford-Binet), reversion to preconceptual (Werner) or preformal (Piaget) modes of thought (e.g., failing to predict the order in which three spheres will emerge from a hollow tube after it has been rotated through half or whole turns; defining right or wrong in terms of what is rewarded or punished), or perceptual processes (e.g., changes in magnitude of the Ponzo and Poggendorf illusions; the return of eidetic imagery ostensibly prominent in children). Perhaps the most compelling evidence for reinstatement is studies by Nash and his colleagues (Nash, Johnson, & Tipton, 1979; Nash, Lynn, Stanley, Frauman, & Rhue, 1985), in which subjects regressed to age three and, imagining a frightening situation, behaved in an age-appropriate manner: searching for teddy bears and other "transitional objects." Interestingly, insusceptible subjects simulating hypnosis do not behave in this manner. However, these results are vitiated to some extent by interviews of the subjects' mothers, which revealed that the transitional objects chosen by the age-regressed subjects were not typically those actually possessed by

those subjects as children (Nash, Drake, Wiley, Khalsa, & Lynn, 1986). Thus, as Nash (1987) noted, age-regression may reinstate childlike modes of emotional functioning, but it does not necessarily revive specific childhood memories.

The revivification component of age regression is conceptually similar to the recovery of memory in hypermnesia; and, as with reinstatement, it is possible, at least in principle, that the hallucination of an age-appropriate environment might facilitate the retrieval of childhood memories. Everyone who has administered the Stanford Hypnotic Susceptibility Scale Form C, which includes a suggestion for age regression, has observed subjects who appear to relive episodes from childhood that have been forgotten, or not remembered for a long time. Supporting these observations, Young (1926) was able to elicit a substantial number of early recollections whose accuracy was independently verified in two hypnotizable subjects. And more recently, Hofling, Heyl, and Wright (1971) compared subjects' recall of personal experiences to actual diary entries made at the time. They found superior memory during hypnosis compared to a nonhypnotic session. Unfortunately, neither of these experiments examined false recollections that may have been produced by the subjects; and the obvious difficulty in obtaining independent verification effectively prevents many more studies of this sort from being done so as to understand better the conditions under which these improvements in memory might be obtained.

In the absence of independent confirmation, it should be understood that the apparent enhancement of memory occurring as a result of hypnosis may be illusory. But even independent confirmation does not guarantee that hypnosis itself is responsible for the appearance of revivification. The enhancement of memory may come from general world-knowledge or cues provided by the experimenter, rather than improved access to trace information. The salient cautionary tale is provided by True (1949), who reported that age-regressed subjects were able to identify at better than chance levels the day of the week on which their birthdays and Christmas fell in their fourth, seventh, and tenth years. Yates (1961) and Barber (1969) noted that the correct day can be calculated by the use of a fairly simple algorithm. However, it remains to be seen whether most, or even many, subjects know the formula in question; moreover, the procedure requires that subjects know the day of the week on which these holidays fall in the current year—information probably not known by most subjects. More to the point, it is now known that the experimenter in question knew the answers to the questions as they were asked; when the experimenter is kept blind to the correct answer, response levels fall to chance (O'Connell and others, 1970).

Notes on Forensic Hypnosis

Despite the poverty of evidence supporting the idea that memory can be enhanced by hypnotic suggestions, hypnosis has come to be used by police officers, attorneys, and even judges in an effort to refresh or bolster the memories of witnesses, victims, and suspects in criminal investigations. Their

belief in the utility of forensic hypnosis is bolstered by occasional cases in which the use of hypnosis was associated with the recovery of useful clues (e.g., Dorcus, 1960; Raginsky, 1969). One such case was the kidnapping, in Chowchilla, California, of a school bus filled with children: When hypnotized, the bus driver recalled a portion of a license plate that was eventually traced to a vehicle used by the kidnappers (Kroger & Douce, 1979). Such successes, when combined with reports of the hypnotic recovery of traumatic memories during psychotherapy (e.g., Breuer & Freud 1895–1955), led to the development of a virtual industry of forensic hypnosis.

Of course, Freud later concluded that the reports of his patients were fantasies, not veridical memories. And although the Chowchilla kidnapping is often counted as a success, it is often forgotten that the driver also recalled a license tag that had no connection to the crime; it was other evidence that led to the successful solution to the case. Then, too, Dorcus (1960) had reported as many successes as failures in his own experience. Reviewing his own cases, the operative factor seems to have been the extent to which the memories were encoded in the first place. Moreover, a number of instances have been recorded where the memories produced by hypnotized witnesses and victims have proved highly implausible or even false (for a sampling, see Orne, 1979).

The inherent unreliability of hypnotically elicited memories—the difficulty of distinguishing between illusion and reality, the susceptibility of hypnotically refreshed memory to distortion by inadvertent suggestion, and the tendency of subjects to enhance the credibility of memories produced through hypnosis—creates problems in the courtroom. These problems are enhanced by the possibility that investigators, and jurors, will give more credence than they deserve to memories refreshed by hypnosis (Labelle, Lemarche, & Laurence, 1990; McConkey, 1986; McConkey & Jupp, 1985, 1985–1986; Wilson, Greene, & Loftus, 1986). Thus, under the worst-case scenario, a hypnotized witness may produce an entirely false memory under hypnosis, testify to it convincingly, and be believed; even if the memory of the witness does not change under hypnotic interrogation, the fact that a particular item of information, true or false, is remembered both in and out of hypnosis may lead the witness, and jurors, to give more credibility to the testimony than would be warranted.

For these reasons, and in response to a number of cases that were prosecuted on the basis of evidence that later proved to be incorrect, both the medical establishment (American Medical Association, 1985) and the courts (Diamond, 1980; Kuplicki, 1988; Laurence & Perry, 1988; Orne, 1979; Orne, Dinges, & Orne, 1990; Orne, Soskis, Dinges, & Orne, 1984; Orne, Whitehouse, Dinges, & Orne, 1988; Udolf, 1983, 1990) have begun to establish guidelines for the introduction and evaluation of hypnotically elicited memories. By this time, the issue of hypnosis has been considered by American courts in more than half of the states (and by courts in Canada, Australia, and other countries as well). In a recent review, Scheflin and Shapiro (1989) cite more than 400 appellate cases from more than 40 states in which hypnosis has been involved in one way or another.

A full review of the legal status of forensic hypnosis is beyond the

scope of this chapter. In general, however, courts in the United States have taken one of three positions: (1) total exclusion of testimony based on hypnotically refreshed memory (e.g., *People* vs. *Shirley*, 1982; *State* vs. *Mack*, 1980); (2) total admission, with the weight of the evidence to be determined by the jury (e.g., *Harding* vs. *State*, 1968); and (3) admission of hypnotically refreshed memory, provided that certain procedural safeguards (such as those proposed by Orne, 1979; Orne and others, 1984; see also Ault, 1979) have been followed during the hypnotic session (e.g., *State* vs. *Armstrong*, 1983; *State* vs. *Hurd*, 1981). Perhaps the dominant position in the state courts is a per se exclusion of all hypnotically elicited evidence, and some courts have gone so far as to exclude from testimony even the prehypnotic memories of a witness who has been subsequently hypnotized (Kuplicki, 1988), on the grounds that hypnosis may distort prehypnotic as well as hypnotic memories—for example, by inflating the subject's confidence in what he or she had already remembered.

The conflicting laws operative in different jurisdictions virtually guarantee that the issue of forensic hypnosis will eventually come before the U.S. Supreme Court. In fact, while a number of cases involving hypnotized witnesses and victims have been denied *certiorari*, a case involving a hypnotized defendant was recently decided: *Rock* vs. *Arkansas* (1987; for reviews of this case, see Kuplicki, 1988; Orne and others, 1990; Perry & Laurence, 1990; Udolf, 1990). By a hairline (5–4) majority, the U.S. Supreme Court (whose majority decision was authored by Justice Harry Blackmun) decided that a defendant's hypnotically refreshed memories are admissible in court, without any restrictions or constraints. However, a reading of the opinion makes it clear that the Court's decision rested more on a concern for the defendant's Fifth Amendment right to testify in his or her own behalf, than it did on any acceptance of hypnotic technique. Under the United States Constitution, defendants are given every opportunity to defend themselves, and this includes resort to hypnosis. In fact, the Court's opinion (especially the minority view, authored by Chief Justice William Rehnquist) clearly recognizes the problems posed by the use of hypnosis in the legal system. There are a number of different legal issues here (for early treatments, see Diamond, 1980; Warner, 1979; Worthington, 1979; for a recent overview, see Kuplicki, 1988).

First of all is the question of whether hypnosis, as a scientific technique for the enhancement of memory, meets the standards for the admission of scientific evidence. Under the *Frye* rule (*Frye* vs. *United States*, 1923), which currently governs the admissibility of scientific evidence, "the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field to which it belongs."[3] While

[3]It should be noted that the *Frye* rule is not mentioned in the 1975 *Federal Rules of Evidence*, which allows expert testimony regardless of the general acceptance of the process by which the conclusions are drawn. The emerging tort doctrine of liability science is creating a situation where ostensible experts, hired by opposing sides, are permitted wide latitude to testify to their conclusions, and judges and juries are left to decide between their competing claims. For a detailed review, see Huber (1991).

hypnosis is clearly established as a potentially efficacious treatment modality in medicine and psychotherapy (American Medical Association, 1958) and a legitimate topic for scientific research (as evidenced by the establishment of Division 30, Psychological Hypnosis, of the American Psychological Association), there is no consensus about the reliability of hypnotically enhanced memory. In fact, if there is such a consensus, it is represented by the recent position paper of a committee of the American Medical Association (1985): Hypnotically refreshed memory is inherently unreliable.

There are also constitutional issues at stake, particularly surrounding the Sixth Amendment, which gives criminal defendants the right to confront witnesses against them. After all, hypnosis has the potential to distort a witness's memory permanently—thus leading, in effect, to the destruction of potential exculpatory evidence. Hypnosis can increase the likelihood of both unintended confabulations and the influence of leading questions and other misinformation. The confusion between illusion and reality that is part and parcel of the hypnotic experience may be fascinating in the laboratory and perhaps useful in the clinic; but it is potentially fatal in the courtroom. The myths surrounding the wonders of hypnosis may lead witnesses inappropriately to inflate their confidence in what they remember; or they may lead jurors inappropriately to accept memories of witnesses as accurate. In any event, the result is a threat to the validity of the evidence presented to fact-finders.

Because defendants have rights that the state does not, the decision in *Rock* vs. *Arkansas* does not imply that testimony by hypnotized witnesses and victims will be allowed without restraint. The result is likely to be a bifurcated rule (Kuplicki, 1988) in which hypnosis is permitted to defendants with few restrictions, but severely constrained when used with witnesses and victims. For the present, however, those who use hypnosis forensically should be aware of the dangers posed by its use and should conform their procedures to the sorts of guidelines proposed by Orne (1979; Orne and others, 1984, 1988) and adopted by the FBI (Ault, 1979) and in many jurisdictions. The purpose of these procedural safeguards is twofold: (1) to minimize the possibility that the witness's independent memory will be contaminated by hypnosis; and (2) to maximize the likelihood that such contamination will be detected if it has occurred. Such standards are obviously difficult (though not impossible) to meet. For this reason, and because of the continuing constitutional controversy attached to forensic hypnosis, investigators are advised to confine their use of hypnosis to the gathering of investigative leads. Under these circumstances, hypnotically refreshed memories are not introduced into evidence, and the case is based solely on independently verifiable evidence.

PROSPECTS FOR THE STRATEGIC CONTROL OF MEMORY

The conclusion that emerges from this review is that the strategic self-regulation of memory is possible. The possibility of successful self-regulation flows naturally from the point of view that memory is a skilled activity

as well as a mental storehouse, and from the reasonable assumption that people can acquire and perfect both cognitive and motor skills. Certainly the principles that control memory function can serve as guides for successful self-regulation. We can remember things better by paying active attention to them at the time they occur, deliberately engaging in elaborative and organizational activity that will establish links between one item of information and another; and we can facilitate forgetting by neglecting to do so. Forgetting will increase with the passage of time, if we allow it to happen; but continued rumination about the to-be-forgotten material may prevent this natural process from occurring. Once-forgotten items can be recovered, too, if somehow we are able to find the right cues to gain access to them; and some spontaneous recovery is to be expected as well, especially if the information was well encoded in the first place. Remembering an event can be facilitated by returning to the environment, or mood state, present at the time the event occurred. Remembering is improved by taking generic world-knowledge into account, so that the person need not rely exclusively on trace information. And, perhaps, memories can be recoded, and thus altered, in the light of information acquired after the event in question. In the absence of conscious recollection, sheer guessing—influenced by implicit memory, which is much less constrained by the conditions of encoding and retrieval—may lead the person to better-than-chance levels of memory performance.

At the same time, there are clear constraints on what can be achieved through strategic remembering and forgetting. Aside from hope and luck, little can be done to improve the situation where encodings were poor, and the retrieval environment is impoverished. Elaborative and organizational activity both require active cognitive effort, and thus are affected by limitations on attentional resources. Retrieval cues help memory, but they must be the right sorts of cues, compatible with the way in which the information was processed at the time of its original encoding. World-knowledge, and post-event information, may distort a person's memory for what actually occurred, and attempts at deliberate forgetting, or the retrospective alteration of memories, may change accessibility but not availability. Thus the forgotten knowledge, or the original memory, may nonetheless continue to influence the person's experience, thought, and action in the form of implicit memory.

Hypnosis, for all its apparent wonders, does not eliminate these constraints. It can be a powerful technique for altering conscious experience, but it does so by following, rather than transcending, the laws that govern ordinary mental life. Thus, hypnosis presents some interesting possibilities for the self-control of memory, but it confronts the same sorts of limitations as well. Hypnotic suggestions for amnesia may be very effective in reducing the person's conscious awareness of some event, but—like nonhypnotic directed forgetting—it can be breached, to some extent, by deliberate efforts at recall, and by cued recall and recognition procedures. More important, the forgotten memories may still be expressed implicitly, outside of conscious awareness.

As far as we can tell, hypnosis does not, in and of itself, facilitate

learning; and it does not appear to add anything to the hypermnesia that occurs in the normal waking state. Although, in principle, a hypnotically hallucinated environment might supply new cues to facilitate remembering, it must be remembered that the cues in question are hallucinatory, not veridical, and thus may produce misleading results—the more so because hypnotized subjects are highly responsive to suggestions. Hypnosis, in its classic manifestations, has a profoundly delusional quality: Hence, the subjective conviction that accompanies hypnotic remembering should not be confused with accuracy. For this reason, the clinical and forensic use of hypnosis to refresh recollection is fraught with dangers, and is to be used, if at all, with considerable circumspection.

But the mere existence of limitations, and the sad fact that hypnosis cannot make us better than we are, should not deter us from acquiring, and deploying, our skills of remembering and forgetting. There is much that we can do in both respects.

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Handbook of Mental Control

DANIEL M. WEGNER
JAMES W. PENNEBAKER
Editors

Century Psychology Series

PRENTICE HALL, ENGLEWOOD CLIFFS, NEW JERSEY 07632

Library of Congress Cataloging-in-Publication Data

Handbook of mental control / Daniel M. Wegner, James W. Pennebaker, editors.
p. cm. — (Century psychology series)
Includes bibliographical references and index.
ISBN 0-13-379280-3
1. Mental discipline. 2. Self-control. I. Wegner, Daniel M., 1948- II. Pennebaker, James W. III. Series: Century psychology series (Englewood Cliffs, N.J.)
BF632.H253 1993
153.8—dc20 92-19592
CIP

Acquisitions Editor: Susan Brennan
Editorial/production supervision
and interior design: Marina Harrison
Copy Editor: James Tully
Prepress Buyer: Kelly Behr
Manufacturing Buyer: Mary Ann Gloriande
Editorial Assistant: Jennie Katsaros

Century Psychology Series
Walter Mischel
James J. Jenkins
Editors

Printed in the United States of America
10 9 8 7 6 5 4 3 2 1

ISBN 0-13-379280-3

Prentice-Hall International (UK) Limited, *London*
Prentice-Hall of Australia Pty. Limited, *Sydney*
Prentice-Hall Canada Inc., *Toronto*
Prentice-Hall Hispanoamericana, S.A., *Mexico*
Prentice-Hall of India Private Limited, *New Delhi*
Prentice-Hall of Japan, Inc., *Tokyo*
Simon & Schuster Asia Pte. Ltd., *Singapore*
Editora Prentice-Hall do Brasil, Ltda., *Rio de Janeiro*