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Conscious versus Unconscious Cognition

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Conscious and Unconscious Cognition

The cognitive revolution made the study of consciousness respectable again, if only in the form of studies of attention, primary memory, and imagery. The legitimation of consciousness was not inevitable, however: one of the dirty secrets of cognitive psychology is that many of those who practice it can get along perfectly well without displaying any interest in consciousness at all. Flanagan (1991) has pointed out four reasons for this state of affairs:

Positivistic Reserve: Cognitive psychology inherited some of the methodological assumptions of the behaviorism it replaced, in particular an emphasis on publicly observable behavior as the window into the mind. Because consciousness is inherently private, as well as somewhat metaphysical, it still seems somehow beyond the pale of a science of the mind.

Piecemeal Approach: Furthermore, even among those cognitive psychologists who affirm an interest in consciousness, there is a tacit assumption that an understanding of consciousness will emerge, in a bottom-up fashion, from studies of individual phenomena. Many cognitive psychologists have made their careers by studying the phenomena of consciousness, such as attention, episodic memory, and imagery, without ever referring to consciousness itself. The effect has been to marginalize consciousness, as a topic that, perhaps like pornography, is too embarrassing to discuss in polite company even if we might admit privately that it's something we're really interested in.

Conscious Inessentialism: To make things even worse, the doctrine of computational functionalism, which underlies so much contemporary modeling of cognitive processes and systems, assumes that we can produce a perfectly adequate description of human information processing

solely in terms of the functional relations between stimulus inputs and response outputs, with perhaps a hidden layer or two in between. After all the effort to get past behaviorism, this apparent throwback to the connectionism of Edward L. Thorndike and the radical formulations of B. F. Skinner renders consciousness, once again, inessential to the study of the mind.

Epiphenomalist Suspicion: Finally, many of those computational functionalists who, however grudgingly, admit that consciousness is part of the human experience, nonetheless argue that consciousness is the end product of cognitive functioning, and plays no causal role in human experience, thought, and action—thus rendering us merely conscious automata. For example, connectionist analyses of cognition state or imply that conscious awareness is the last thing that happens, after the network has settled into a steady state—that is, after all of the interesting and important work is done. The thrust of this argument is that while we humans may happen to be conscious, nothing much hangs on this fact, and things wouldn't be any different if we weren't conscious at all.

All this sounds pretty bad if one is interested in consciousness, but the upside is that conscious inessentialism and the epiphenomenalist suspicion, taken together, provide cognitive psychologists with ample motivation for exploring the psychological unconscious—that is, the idea that conscious experience, thought, and action are influenced by percepts, memories, and other mental states inaccessible to phenomenal awareness and independent of voluntary control. So it is one of the ironies of contemporary cognitive psychology that many of those who might have made a science of consciousness have instead gravitated, knowingly or not, toward a science of the mind that gives precedence to unconscious processes.

Automatic versus Controlled Processing

So far as modern psychology is concerned, the psychological unconscious began life as a kind of mental wastebasket: it was the repository for unattended inputs, memories rendered unavailable by decay or displacement, and latent knowledge not currently being utilized by the cognitive system. Consider the multistore *modal models* of memory of the sort proposed by Waugh and Norman (1965) and Atkinson and Shiffrin (1968), depicted schematically in figure 6.1 (for a review, see Healy & McNamara, 1996).

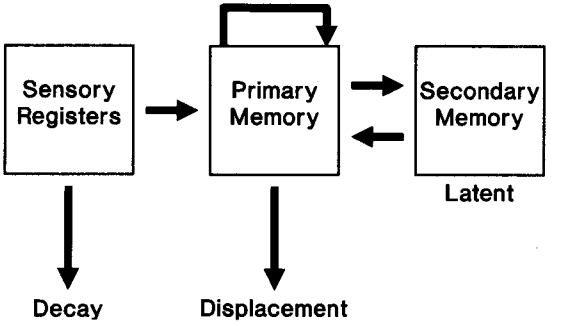

Figure 6.1
Schematic description of the three-store modal model of memory, with the psychological unconscious reserved for items lost from the sensory registers by decay or from primary (short-term) memory by displacement, or residing in a latent state in secondary (long-term) memory.

Although its advocates rarely discussed the topic as such (a reflection of the piecemeal approach described by Flanagan), the modal model essentially identifies consciousness with attention and short-term memory. Thus, mental representations enter short-term memory when attention is paid to them; only at this point are they accessible to phenomenal awareness (Posner, 1980, 1982)—a condition they retain only so long as they are rehearsed. From this perspective, debates about unconscious processing generally take the form of questions about how much information can be processed preattentively (Neisser, 1967).

The earliest *filter* theories (e.g., Broadbent, 1958) proposed that attentional selection occurred early in cognitive processing and was based on perceptual features. According to these models, preattentive semantic analysis was not possible, and so there could be no preconscious processing of meaning. Consider, for example, the dichotic listening paradigm, in which the subject is presented with a different auditory message in each ear, but told to attend to only one of them. Treisman's (1960) discovery of semantic intrusions from the unattended channel in dichotic listening led to the replacement of the filter with an *attenuator,* so unattended information is not completely filtered out. Still, the implication was that semantic processing occurred only after information had passed through an attentional bottleneck—hence, no preattentive semantic

processing. Finally, there emerged a number of *late selection* theories of attention (Deutsch & Deutsch, 1963; Norman, 1968), which allowed for full semantic processing of the unattended channel, permitting attentional selection to be based on the pertinence of information to ongoing tasks. The question of preattentive semantic processing came to a head with Marcel's (1983) demonstration of masked semantic priming and with the subsequent debate (e.g., Holender, 1986) over whether semantic processing could occur in the absence of attention and conscious identification.

At about the same time, however, theories of attention underwent a shift from filter to capacity theories (Kahneman, 1973; Posner, 1980; for an account of this shift, see Kahneman & Treisman, 1984). According to this view, attention is equated with mental effort, cognitive resources are held to be limited, and the perceiver's ability to process information depends on the resources required by the task(s) at hand. If these tasks are undemanding, several can be carried out simultaneously, so long as there is no structural interference between them. The success of the capacity view quickly led to a distinction between *automatic* and *controlled* cognitive processes (LaBerge & Samuels, 1974; Posner & Snyder, 1975; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977).

As defined by Posner and Snyder (1975), automatic processes are—in a word—*automatic:* they are initiated independently of the person's conscious intentions, and they cannot be terminated until their execution has been completed. Controlled processes, by contrast, are initiated and terminated voluntarily. Moreover, whereas we are phenomenally aware of our controlled processes, automatic processes are executed outside of awareness. Automatic processes might be innate, or they may have become automatized by virtue of extensive practice (Anderson, 1982; LaBerge & Samuels, 1974; Logan, 1988); but the models for automatic processes seem to be the innate, incorrigible stimulus-response connections familiar to psychobiologists: spinal reflexes, which can occur without the involvement of "higher" cortical centers; taxes, the gross orientation responses observed in many invertebrates; instincts, species-specific responses to specific patterns of stimulation; and the habits acquired through classical and instrumental conditioning. In principle, at least, automatic processes are *unconscious* in the strict sense of the term

because they are executed outside phenomenal awareness and are independent of voluntary control.

Intentionality and Cognitive Resources

Of course, the positivistic reserve carried over from functional behaviorism still makes many cognitive psychologists nervous about defining their concepts in terms of such private, mentalistic constructs as *awareness* and *intention.* Perhaps for that reason, certain other attributes were quickly added onto the concept of automaticity. So, for example, Posner and Snyder (1975) asserted that automatic processes consumed no attentional resources, while Schneider and Shiffrin (1977) argued that they were carried out in parallel rather than in series. Hasher and Zacks (1979, 1984) elaborated the concept of automaticity still further. According to their definition, a process was automatic if performance was (1) insensitive to intentions; (2) equivalent under intentional and incidental conditions; (3) not modified by training and feedback; (4) invariant with respect to individual differences (e.g., in intelligence); (5) invariant with respect to age; and (6) unaffected by arousal, stress, or the requirements of simultaneous tasks.

Some of these additional properties, especially the idea that automatic processes consume no attentional resources, have become part and parcel of the very notion of automaticity. However, they are better construed as empirical questions than as definitional criteria. There is no a priori reason, for example, why an automatic process should consume no attentional resources; it is easy to imagine a process whose execution, though independent of conscious intention, necessarily requires cognitive resources. Even thermostats draw electricity, as do the furnaces and air conditioners they automatically regulate.

An attempt to break out of the positivistic reserve, and define automatic processes solely in terms of intentionality, has been proposed by Jacoby (1991), in terms of his *process dissociation framework.* According to Jacoby, an automatic process is one that occurs despite the person's intention that it should not do so. For example, if prior study of a word list automatically primes performance on a word stem completion task, this influence would persist even if subjects were specifically instructed to complete word stems with items that were not on the studied

list. Thus, intention, not the consumption of resources, is the defining feature of automaticity. Jacoby's process dissociation framework has become enormously influential, at the same time that it has also come under severe criticism. For example, it rests on the assumption that the exclusion task is a pure measure of automatic influence, which may not be true (for other criticisms, see Curran & Hintzman, 1995). However, in the present context what is appealing about the framework is Jacoby's attempt to develop an operational definition of automaticity strictly in terms of subjects' conscious intentions, while relegating such matters as the consumption of cognitive resources to the status of empirical questions.

Toward a Psychology of Zombies?

The distinction between automatic and controlled processes is somewhat muddied by the fact that in principle, even deliberate, conscious actions are mediated by unconscious, automatic processes. Thus, driving a car over a familiar route may be automatic, in the sense that one can carry on a complex conversation while driving and arrive at one's destination without any awareness of various turns, gearshifts, and speed changes made along the way. But the decision to get in the car and drive it from point *A* to point *B* is surely a conscious one. Still, the attractions of conscious inessentialism are so strong that some psychologists and other cognitive scientists have argued that automatic processing dominates mental life and interpersonal behavior. For example, Dennett's (1991) Multiple-Drafts Model, based on a strong version of computational functionalism, explains consciousness as merely a snapshot of one of the many discriminative states that continuously arise between stimulus input and behavioral response. Computers have consciousness in this sense, according to Dennett's theory, and so do zombies. Consciousness is a momentary by-product of a cognitive machinery that is grinding away automatically; it plays no special role in mental life; we might as well be zombies ourselves (and we probably are!).

The embrace of automaticity is particularly visible within social psychology, where some theorists have argued that certain critical interpersonal processes are automatic and thus both unconscious and uncontrollable. Thus, Nisbett and Wilson (1977) have argued that our

conscious beliefs are simply after-the-fact explanations that have nothing to do with why we do what we do because our behavior is mediated by processes that are themselves unconscious. Similarly, Berkowitz (1993) has argued that aggressive responses to frustration are automatically triggered by particular cues in the environment; and many theorists concerned with stereotyping and prejudice have concluded that the negative views that men hold of women, whites of blacks, Anglos of Hispanics, and so on, reflect an automatic evocation of negative stereotypes leading to prejudicial behavior (e.g., Devine, 1989; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Greenwald & Banaji, 1995).

Berkowitz and Devine (1995) have been especially astute in seeing the close relationship between a modern social psychology whose cognitive components are largely automatic and an earlier one based on S-R associationism. Bargh (1997) has brought cognitive social psychology full circle by explicitly embracing Skinner's (1953) rejection of free will and conscious choice as determinants of behavior. At the beginning of his essay he writes that "Much of everyday life—thinking, feeling, and doing—is automatic in that it is driven by current features of the environment . . . as mediated by automatic cognitive processing of those features, and not mediated by conscious choice or reflection" (pp. 2).

And toward the end, he concludes:

> Automaticity pervades everyday life, playing an important role in creating the psychological situation from which subjective experience and subsequent conscious and intentional processes originate. Our perceptions, evaluations, and the goals we pursue can and do come under environmental control. Because these perceptual interpretations, likes and dislikes, and reasons for our behavior are not consciously experienced, we make sense of them in terms of those aspects of which we are consciously aware, and our theories as to what would have caused us to feel or act that way. (pp. 50)

Bargh especially seems to be leading us toward a psychology of a special class of zombies, creatures who are not quite unconscious, but for whom consciousness has no function other than to erect personal theories—quite literally afterthoughts—concerning our own experience, thought, and action that are wholly irrelevant to what actually goes on in our minds and our lives. One can only wonder whether, when the reduction of mental life to automatic mental processes (e.g., Dennett, 1991), and then to brain processes (e.g., Churchland, 1995) is complete,

there will be any place left for conscious awareness and control in James's (1890/1981, p. 1) science of mental life.

Implicit versus Explicit Memory

No such concerns attach to the concept of *implicit memory* (Graf & Schacter, 1985; Schacter, 1987), which along with automaticity has been largely responsible for the revival of interest in the cognitive unconscious. This is because implicit memory has a specific contrast in *explicit memory*. Explicit memory refers to the conscious recollection of some past event (as revealed, for example, in recall and recognition), whereas implicit memory refers simply to any effect on a person's experience, thought, or action that is attributable to a past event (as revealed, for example, in priming effects), independent of conscious recollection of that event. By acknowledging that there are two expressions of memory, one with and the other without conscious awareness of the past, theories of implicit memory do not seek, even by implication, to banish consciousness to the realm of folk psychology. Moreover, Jacoby's (1991) process dissociation procedure, which evolved in the context of research on implicit memory, asserts a specific role for consciousness in behavior. That is, conscious awareness of the past allows us to exercise conscious control over the automatic influence of the past on our current experience, thought, and action.

Although the explicit-implicit distinction drawn in memory had many precursors in both philosophy and psychology (reviewed by Schacter, 1987), its more immediate sources were experimental studies that revealed evidence of learning and transfer even though subjects had no recollection of what they had learned. For example, Warrington and Weiskrantz (1968) found that while amnesic patients were unable to recall recently presented words, they produced these items at higher than baseline rates when asked to complete stems and fragments with words. Even earlier, Evans and Thorn (1966; see also Evans, 1979) found that subjects displaying posthypnotic amnesia could answer trivia questions based on information acquired while they were hypnotized—a phenomenon they termed *source amnesia* and which has since been explored in amnesic patients as well. Later, Nelson (1978) found that normal subjects

showed savings in relearning paired-associate items that they could neither recall nor recognize from a prior study trial. Finally, Jacoby and Dallas (1981) found repetition priming effects on the perceptual identification of words that were independent of subjects' conscious recollection of their prior presentation. In these and other ways, research showed that implicit memory could be spared even though explicit memory was grossly impaired; or, alternatively, that implicit memory was in some sense independent of explicit memory, so the two expressions of memory could be functionally dissociated in terms of the experimental manipulations that affected them.

Taxonomy of Memory Tasks

Research on implicit memory has suffered from a considerable degree of terminological confusion (Roediger, 1990a). At roughly the same time that Graf and Schacter (1985) announced the distinction between explicit and implicit memory, Johnson and Hasher (1987) and Richardson-Klavehn and Bjork (1988) articulated a distinction between *direct* and *indirect* tests of memory. And even earlier, Cohen and Squire (1980) had already adopted the distinction, originally drawn by Bergson (1911) and Ryle (1949), between *knowing that* and *knowing how*—which later became a distinction between *declarative* and *procedural* memory (Squire & Cohen, 1984) and then evolved into a distinction between *declarative* and *nondeclarative* memory (Squire & Knowlton, 1995).

It should be noted, however, that the declarative-procedural distinction refers to two different types of knowledge, rather than two different expressions of memory. As formulated by Winograd (1972, 1975) and Anderson (1976, 1983), declarative knowledge is factual in nature and can be represented in terms of sentencelike propositions; by contrast, procedural knowledge concerns mental and behavioral operations and can be represented in a production system of condition-action rules. There is an assumption that declarative knowledge is available to conscious introspection whereas procedural knowledge is unconscious, but this does not mean that unconscious influences should be identified with procedural knowledge. After all, declarative knowledge—in the form of propositional networks and the like—is just as unconscious as procedural knowledge is. We have no direct introspective access to the perception-based

and meaning-based structures that comprise our fund of declarative knowledge—they, too, are known only by inference. What is conscious are the percepts, memories, images, and thoughts that come to mind when unconscious procedural knowledge operates on unconscious declarative knowledge. By identifying declarative knowledge with conscious recollection, and relegating all unconscious influences to the realm of the procedural (or merely nondeclarative), Squire and his colleagues seem to have conflated the technical meaning of declarative, which refers to the format in which knowledge is represented, with the ordinary-language definition, in terms of what knowledge can be reported.

Although the direct-indirect contrast is generally considered to be tantamount to the explicit-implicit one (e.g., Roediger & McDermott, 1993), an interesting classification of memory tasks emerges when the two distinctions are treated as independent (table 6.1; see also Barnhardt, 1993). Thus, explicit and implicit tasks differ from each other in terms of whether they require conscious recollection of some event, whereas direct and indirect tasks differ in terms of whether studied items are presented at the time of the memory test. Recall and recognition tests are both explicit and direct because they require the subject to consciously recollect previously studied items. In stem completion, subjects are presented with the initial letters of a word, while in fragment completion, they are presented with some letters of a word, interspersed with blanks. In either case, when asked to complete the stem or fragment with the first word that comes to mind, they will often do so with an appropriate word from a previously studied list—an effect known as priming. Stem-completion

Table 6.1
Fourfold classification of memory tasks

Memory Task	Explicit	Implicit
Direct	Free recall, cued recall	Stem completion
	Recognition	Fragment completion
	Savings in relearning (?)	Savings in relearning (?)
Indirect	Proactive inhibition	Free association
	Retroactive inhibition	Category generation

Source: After Barnhardt (1993).

and fragment-completion tests are both direct, because they present at the test the same items that were studied; but implicit, because they do not require conscious recollection of the study episode. Proactive inhibition (PI) and retroactive inhibition (RI) tests are explicit because they require conscious recollection (of the interpolated or the original list, respectively), but indirect because these effects reveal memory for items (on the original or the interpolated list, respectively) that are not themselves presented at the test. Semantic priming is both implicit and indirect because the items presented at test are not those presented at study and because subjects are not required to recollect study items at all. The classification of savings in relearning is variable, depending on how the test is presented. If on the relearning trials the subject is told of the relation between the first and second lists, and instructed to use his or her memory of the first list in order to learn the second, the test is both direct and explicit (this is also true for PI and RI). If this information is withheld from the subject, and the second list is presented as if it were new, the test is direct but implicit.

In fact, there is some evidence for dissociations between implicit and indirect memory tasks. For example, Barnhardt (1993) conducted a directed forgetting experiment in which subjects studied two lists, *A* and *B;* between these phases one group of subjects was directed to forget list *A,* while the other was instructed to remember it. Testing list *B* by stem-cued recall showed that administration of the forget cue reduced the PI of list *A* on list *B;* but testing list *A* by stem completion showed no effects of the forget cue on priming. Thus, even though PI is commonly considered to be an implicit memory test, assessment of PI indicated that list-*A* items had been forgotten, while assessment of priming indicated that these same items had been remembered.

This classification of memory tasks, viewed in the context of Barnhardt's (1993) results, reminds us that we know little about the relations among various implicit and indirect tests of memory. In particular, we know little about the relations between priming effects, on the one hand, and procedural knowledge on the other—for the simple reason that the vast bulk of literature on implicit memory focuses on priming. The reason for this is that priming procedures allow investigators to devise explicit and implicit memory tests that are equivalent in terms of the cues

presented to the subject at the time of retrieval and differ only in terms of the task to be performed. Thus, in both stem-cued recall and stem completion, subjects are presented with three-letter stems; in the former case, they are asked to use the stems as cues for recall of previously studied list items; in the latter, to complete the stems with the first word that comes to mind. This procedural elegance is missing in tests of procedural knowledge, where—for example—subjects must recall a learning experience for the explicit memory test, but demonstrate what they have learned for the implicit memory test.

Furthermore, it turns out that we know little about priming effects themselves, for the simple reason that the recent literature on priming has been almost completely dominated by studies of repetition effects of the sort observed on lexical decision, perceptual identification, and stem and fragment completion tasks. As will become clear, this strategic choice may have severely distorted our theoretical understanding of the nature of implicit memory.

Theories of Implicit Memory

The currently prominent theories of implicit memory may be arranged in the two-way classification depicted in figure 6.2, depending on whether they postulate single versus multiple memory systems, or whether they emphasize the activation and integration of preexisting knowledge or the acquisition of new knowledge.

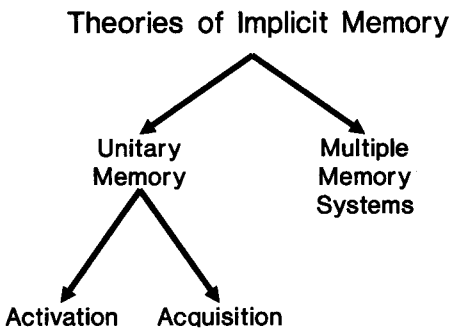

Figure 6.2
Taxonomy of current theories of implicit memory.

The most popular theories among cognitive neuroscientists are those that argue that explicit and implicit memory reflect the operation of separate memory systems, mental modules that have their biological substrates in separate brain systems. For example, Tulving and Schacter (1990) argue that implicit memory is based on several *perceptual representation systems* (PRSs) that store modality-specific representations of the perceptual structure, but not the meaning, of a stimulus. Explicit memory is based on other systems serving semantic and episodic memory. The best evidence favoring the PRS view is provided by the repeated failure to find evidence of priming of impossible figures—two-dimensional projections that cannot be constructed in three-dimensional space. Tulving and Schacter (1990; Schacter, 1995) have so far presented evidence for three different PRSs: a *visual word form system,* which represents the orthographic features of printed words, associated with the extrastriate cortex; a *structural description system,* representing the relations among the parts of objects, associated with the inferior temporal cortex; and an *auditory word form system,* representing acoustic and phonological properties of spoken words, and associated with the perisylvian cortex.

On the other hand, Squire (Squire & Cohen, 1984; Squire & Knowlton, 1995) has argued that explicit memory is based on a *medial-temporal lobe memory system* consisting of the hippocampus and other nearby structures. The two theories are not, of course, incompatible: it may be that the role of medial-temporal structures is to link discrete perceptual representations into an integrated memory of an event.

In contrast to the multiple-system theories of Tulving, Schacter, and Squire, other theories assume (sometimes tacitly) that explicit and implicit memory reflect the operation of a single memory system, the difference between the two expressions of memory being that they make different requirements on that single system. Single-memory-system views of implicit memory come in two forms, depending on whether they emphasize *activation* or *acquisition.* The activation view, exemplified by the work of Mandler (1980; see also Morton, 1969), holds that encoding a memory entails the activation and integration of preexisting knowledge and then the elaboration of this activated material into a representation of the event itself. In this view, implicit memory is the product of activation and integration, whereas explicit memory is the product of elaboration.

The acquisition view essentially holds that encoding entails the formation of a new representation of each experience, and this view comes in two principal forms. According to Roediger's (1990b; Roediger & McDermott, 1993) *transfer-appropriate processing* view, most explicit memory tasks are conceptually driven, whereas most implicit memory tasks are perceptually driven. According to Jacoby's (1991) *process dissociation* view, described earlier, most implicit memory tasks require only automatic processing, whereas most explicit memory tasks require conscious processing as well.

The distinctions among these theories should not be drawn too sharply. For example, the perceptual representations view appears to agree with the transfer-appropriate processing view that implicit memory is mediated by representations of a perceptual, structural, and presemantic nature. And both types of view have difficulty accounting for evidence that implicit memory extends to semantic and conceptual priming of a sort that cannot be mediated by perceptual representations and data-driven processing—for example, semantic priming, observed in both subjects during posthypnotic amnesia (Kihlstrom, 1980) and amnesic patients (Gardner, Boller, Moreines, & Butters, 1973; Graf, Shimamura, & Squire, 1985; Shimamura & Squire, 1984) on tests of free association and category generation. Although Tulving and Schacter (1990) acknowledge that semantic priming cannot be accomplished within a perceptual representation system, such empirical difficulties have gone largely unrecognized by the field as a whole, probably because of its infatuation with repetition priming effects.[1]

Furthermore, the perceptual representations view agrees with the transfer-appropriate processing view that implicit memory reflects the formation of new representations during encoding. Thus, the fate of unfamiliar events in implicit memory becomes critical to distinguishing between both these theories and the activation view proposed by Mandler and others: novel events cannot activate preexisting memory structures and so would seem to require the encoding of entirely new memory traces. An experiment by Diamond and Rozin (1984; but reported informally by Rozin, 1976) was perhaps the earliest attempt to perform this critical test. Amnesic patients and normal controls studied paired associates consisting of disyllabic words, such as *candy* and *number,* and disyllabic

pseudowords, such as *canber* and *numdy,* formed by repairing the syllables of the real words. Amnesics were severely impaired on tests of stem-cued recall for both types of items. On a stem completion test, however, the patients showed levels of priming comparable to the controls only on the real words and not the pseudowords.

Diamond and Rozin (1984; Rozin, 1976) interpreted their findings as consistent with the activation view: priming was preserved only when there were preexisting lexical representations of list items to be activated during the study phase. Subsequent studies, however, did demonstrate priming for novel materials—a fact consistent with the acquisition and perceptual representations views and apparently inconsistent with the activation view (for reviews, see Bowers, 1994; Dorfman, 1994a).

However, as Dorfman (1994a) has noted, these studies did not carefully analyze the relations between ostensibly novel events and preexisting knowledge. Because perceivers necessarily make sense out of new events in terms of what has been perceived before, percepts of new objects must be constructed based on representations acquired in the past and retained in memory until the present. According to Mandler's (1980) dual-process model of memory, for example, presentation of a word automatically activates sublexical components that make up the word and integrates them into a unified representation; this representation is then effortfully elaborated with respect to other activated structures (e.g., markers representing time, place, and the role of the self; see Kihlstrom, 1995a) to form a representation of the entire episode. Thus, from the activation point of view, the priming of novel materials such as nonwords depends intimately on how these materials are constructed. If they are constructed from components that have preexisting representations in memory, then priming is possible; if not, then priming should not occur.

To test the activation view, Dorfman (1994a) constructed novel words according to three rules: *morphemic* pseudowords (e.g., *genvive*) were constructed of actual English morphemes (*gen* as in *genius, general,* and *gender; vive* as in *survive, revive,* and *vivify*); *syllabic* pseudowords (e.g., *fasney*) were composed of nonmorphemic syllables (*fas* as in *fasten, fascinate,* and *fascist; ney* as in *chimney, journey,* and *kidney*); and *pseudosyllabic* pseudowords (e.g., *erktofe*) were constructed of letter strings that were neither morphemes nor syllables (e.g., *erk* and *tofe*). After a

single study trial, the subjects were presented with explicit and implicit memory tests. The explicit test was two-alternative forced choice recognition (2AFC); for the implicit test, the subjects were presented with items from the study list (targets) and control items (lures) and asked which item seemed to be the "better" English word. Across five experiments, Dorfman observed priming consistently for morphemic pseudowords, less consistently for syllabic items, and rarely for pseudosyllabic ones. Similar trends also were obtained with a standard perceptual identification task (Dorfman, 1994b). These findings are consistent with at least a weak version of the activation view: priming occurs more reliably when presentation of an item can activate preexisting knowledge structures.

In the final analysis, it may not be necessary, or even desirable, to choose among the competing theories of implicit memory. It may well be that the nature of implicit memory depends on the resources available to the subject at the time of encoding and retrieval. For example, the use of encoding conditions that do not favor semantic processing at the time of encoding make it unlikely that strong associative or conceptual priming effects will be observed on an implicit memory test. If novel stimuli are formed from sublexical components or their nonverbal analogs, such as the geons postulated by Biederman (1987) as the elementary components of pictorial representations, priming will be based on the activation and integration of preexisting knowledge; but when the construction process avoids such building blocks, priming necessarily will be based on whatever jury-rigged perceptual representation the cognitive system can form. Such a proposal may seem to lack parsimony, but it should be noted that current theories of implicit memory are based almost entirely on studies of repetition priming following impoverished encoding. It is not clear that theoretical parsimony achieved under such restricted research conditions is in fact a virtue.

Extensions of the Explicit-Implicit Distinction to Other Cognitive Domains

Theories aside, it should be understood that the explicit-implicit distinction in memory is primarily phenomenological. That is, explicit and im-

plicit memory are, first and foremost, different expressions of memory for some past event—different in terms of the role played by conscious awareness. Explicit memory involves conscious recollection of a past event, whether deliberate or involuntary; implicit memory entails the influence of such an event on subsequent experience, thought, and action in the absence (or, at least, independent) of conscious recollection. From this point of view, it would seem that the explicit-implicit distinction could be extended to other cognitive domains where the issue of consciousness arises.

Explicit versus Implicit Perception

Many effects often ascribed to implicit memory do not really count as expressions of memory per se—at least, not as expressions of secondary memory, defined as whatever trace remains of an event after the person has stopped attending to it (James, 1890/1991). Thus, in experiments by Marcel (1983) on masked semantic priming, and by Forster (1987) on masked lexical priming, the prime and target are separated by a period of seconds (or less); moreover, the masking conditions prevent the subject from consciously attending to the items in the first place. Under these conditions it seems inappropriate to think of implicit memory, but more natural to think of implicit *perception.* Kihlstrom, Barnhardt, and Tataryn (1992; see also Kihlstrom, 1996) offer a contrast between explicit perception, which entails the subject's conscious perception of the presence, location, form, identity, and activity of some object present in the current environment (or the very recent past), and implicit perception, which (by direct analogy to implicit memory) they define as any effect on experience, thought, and action attributable to a *current* event, in the absence of conscious perception of that event.

Implicit perception, so defined, includes the traditional category of *subliminal* perception, in which stimuli are too weak or too brief to be consciously perceived. It also includes cases where conscious perception is prevented by forward and/or backward masking of a stimulus, as in the classic experiments by Marcel (1983), and where a supraliminal stimulus is unattended, as in cases of dichotic listening or parafoveal viewing (in which a stimulus is presented in the periphery of the visual field). However, implicit perception also subsumes other cases where the stimulus is

in no sense subliminal. In blindsight (Weiskrantz, 1986), for example, some patients with damage to the striate cortex no longer have the conscious experience of seeing; nevertheless, they are able to respond at above-chance levels to visual stimuli presented in their scotoma. Similarly, in hypnotic analgesia, subjects do not feel the pain of an aversive stimulus; even so, they show by physiological and other responses that the stimulus has registered outside of conscious awareness (Hilgard, 1977). Finally, "hysterical" patients with functional blindness or deafness complain that they cannot hear or see, but they still respond appropriately to visual or auditory stimuli (e.g., Brady & Lind, 1961; Barraclough, 1966).

Memory for the events of anesthesia provides an opportunity to define the boundary between implicit memory and implicit perception (for reviews, see Cork, Couture, & Kihlstrom, 1997; Kihlstrom, 1993; Merikle & Daneman, 1996). By definition, adequately anesthetized surgical patients have no memory of events that transpired during their surgery; they are, to all intents and purposes, unconscious. Nevertheless, it has been demonstrated that such patients may show priming effects attributable to stimuli presented during surgery. In one experiment, for example, patients were played a tape recording consisting of paired associates of the form *ocean-water* (Kihlstrom, Schacter, Cork, Hurt, & Behr, 1990). On an explicit memory test, they were presented with the cue term and asked to produce the associated response; on an implicit memory test, they were asked to produce the first word that came to mind. The patients showed no cued recall, but they did show priming on the test of free association. Because memory in the present implies perception in the past, in this case preserved implicit memory also provides evidence for implicit perception: some degree of perceptual processing was performed by these unconscious patients (for reviews, see Cork, Couture, & Kihlstrom, 1997; Merikle & Daneman, 1996). The distinction between implicit memory and implicit perception is not simply a matter of the retention interval involved (e.g., seconds versus minutes, hours, or days). Perhaps implicit memory should be confined to those cases where the person was consciously aware of the event at the time of encoding; where such awareness is lacking, the effects—regardless of the retention interval—may be classified as evidence of implicit perception.

Implicit perception, especially in "subliminal" cases, is a continuing hotbed of controversy. Thus, Eriksen (1960) criticized claims of subliminal perception by the New Look theorists and others on the grounds that their procedures for establishing threshold for detection or discrimination were inadequate. In the post-Marcel (1983) era, similar criticisms have been offered by Holender (1986) and by Shanks and St. John (1994). Such criticisms have elicited two different types of response. On the one hand, investigators such as Greenwald (e.g., Greenwald, Klinger, & Liu, 1989; Greenwald, Klinger, & Schuh, 1995) have gone to extreme lengths to establish that their stimuli are incontrovertibly subliminal. Another response has been simply to reject Eriksen's critique, on the ground that it defines implicit perception out of existence (Bowers, 1984). For example, Cheesman and Merikle (1985) argue that subliminal perception occurs in the space between the *subjective threshold* (the point at which the subject's *confidence* in his or her discriminative responses falls to zero) and the *objective threshold* (the point at which the *accuracy* of those choices falls to chance levels). In order to escape the criticism that the subjective threshold is just an underestimate of the true, objective threshold, Merikle and his colleagues further require that there be a qualitative difference between performance above and below the subjective threshold.

The most contentious issue concerning implicit perception is whether it can include semantic analyses of the stimulus (Holender, 1986). Most likely, the answer depends on the means by which conscious perception is denied to the subject. Only in the case of hypnotic blindness is there any evidence for long-lasting semantic priming effects (Bryant & McConkey, 1989). With truly subliminal stimulus presentations, the answer seems to be that the semantic-priming effects of masked stimuli are extremely weak and short lived (Greenwald et al., 1989, 1995). Moreover, they are analytically limited (Greenwald, 1992), in that priming can be produced by single words but not two-word phrases. However, it should be noted that Greenwald's experiments involve presentations that are as close to Merikle's objective threshold as it is possible to get; more substantial semantic priming may be possible with presentations that are closer to the subjective threshold. Semantic priming has not been obtained in the case of general anesthesia, where the stimuli are supraliminal but the

subject is unconscious: rather, the best evidence is for repetition priming, which reflects structural processing of a sort that could be mediated by a perceptual representation system. Although such results may disappoint those who advocate subliminal stimulation as a major vehicle for social influence, it should surprise nobody to learn that semantic-priming effects are weak under conditions that afford little opportunity for complex semantic analyses.

Explicit versus Implicit Thought

If there is evidence for implicit perception and memory, why not seek evidence for implicit *thought* as well? Put another way, is it possible to use paradigms initially employed in the study of implicit memory and perception to study the implicit effects of mental representations that are neither percepts nor memories, but rather something more akin to ideas and images? Anecdotal accounts of thinking (e.g., Wallas, 1926) offer such a possibility in their accounts of intuition, a form of metacognition (Nelson, 1996) in which problem solvers feel that a solution to a problem is forthcoming, even though they do not know what that solution is. Formal accounts of problem solving often refer to these intuitions as *feelings of warmth* (e.g., Newell, Simon, & Shaw, 1962/1979); something similar occurs in the *feelings of knowing* observed on semantic memory tasks (Hart, 1965).

Some evidence of implicit thought is provided by a series of experiments by Bowers and his colleagues (Bowers, Regehr, Balthazard, & Parker, 1995; Bowers, Farvolden, & Mermigis, 1990) with a variant of Mednick's (1962) Remote Associate Test (RAT). On the RAT, subjects view a set of three words, such as *goat, pass,* and *green,* and then must generate an associate that all three items have in common (*mountain*). In their experiments, Bowers et al. (1990, 1995) presented subjects with two RAT-like items, one soluble and the other insoluble. If the subject could not produce the answer to the soluble triad, he or she was asked to guess which triad was in fact soluble. Bowers et al. (1990) found that subjects were able to do this at better than chance levels, even though they were not aware of the solution to the triad they selected. Bowers et al. (1990) suggested that this ability was due to a priming effect of the sort observed in implicit memory. That is, processing of the cues activated

their corresponding representations in semantic memory, from which activation spread to other, associated representations; some of this activation converged on the representation of the associate common to the three cues. The level of activation attained by this common associate did not cross a threshold required for conscious awareness, but it was sufficient to influence subjects' choice behavior.

Some evidence favoring this spreading-activation account was provided by Bowers et al. (1990) themselves, who observed that their subjects' intuitions were correct above chance levels when the solution preserved its meaning across the three cues, but not when its meaning changed. In the former case, activation accrued at a node representing a single word; in the latter, activation spread to two or more different nodes representing different words with the same spelling. Further evidence for spreading activation was obtained by Shames, Forster, & Kihlstrom (1994), who adapted a paradigm initially developed by Yaniv and Meyer (1987) to study spreading activation in the feeling of knowing. Shames et al. (1994) presented RAT problems, followed by a lexical decision task in which subjects had to decide whether each of a series of letter strings was an English word. When the answers to unsolved RAT items appeared as targets for lexical decisions, response latency was speeded—a priming effect. Interestingly, this priming effect was not observed for RAT items which were solved. Shames et al. (1994) interpreted this difference as a sort of Zeigarnik (1927) effect, reflecting the persistence in memory of uncompleted tasks.

In the experiments of Bowers et al. (1990) and Shames et al. (1994), the subject's task performance (e.g., choosing the soluble triad) is affected by the correct solution to the problem, even though the subject is not consciously aware of what that solution is. This summary fits the generic form of the explicit-implicit distinction as applied to perception and memory. It should be understood, however, that whatever is affecting the subject's behavior is neither an implicit perception nor an implicit memory—for the simple reason that the solution itself is never presented to the subject, but is internally generated. If it is not a percept or a memory, it must be a thought—an *implicit* thought. Application of the explicit-implicit distinction to thinking and problem solving may afford a new perspective on a number of thorny issues (Dorfman, Shames, &

Kihlstrom, 1996; Kihlstrom, Shames, & Dorfman, 1996). For example, whereas intuition may reflect the influence of implicit thought, incubation may reflect the process by which an implicit thought gains strength outside of awareness, and insight the point at which an implicit thought becomes explicit and accessible to conscious awareness.

Unconscious Processes versus Nonconscious Contents

The cognitive study of mind and behavior is concerned with both content and the process—with declarative and procedural knowledge, in the terms of Winograd (1972, 1975) and Anderson (1976, 1983). Within this framework, it is common to argue that although cognitive contents—what we perceive, remember, think, and imagine—are conscious, the processes by which these cognitions arise are not. Thus, the content-process distinction contains within it a distinction between those aspects of cognition that are conscious and those that are unconscious. And, indeed, it seems that there is a class of *automatic* cognitive processes that appear to be unavailable to either the monitoring or controlling functions of consciousness. That is, they operate independent of conscious intention and can be known only through inference. These automatic processes are unconscious in the strict sense of the word.

If procedural knowledge is unconscious, then the contrast between declarative and procedural knowledge would seem to imply that declarative knowledge must be conscious or at least available to conscious introspection. But, as indicated earlier, this is not really the case. Declarative and procedural knowledge, as elements of cognitive architecture, are both unconscious in the strict sense of the term, in that they are unavailable to conscious introspection and can be known only by inference. What are ordinarily conscious are the percepts, memories, thoughts, and other mental states constructed by the operation of procedural knowledge on declarative knowledge structures. The burden of this chapter has been to argue that the psychological unconscious includes, in addition to strictly unconscious knowledge structures that compose the architecture of cognition, mental states corresponding to percepts, memories, and thoughts that influence experience, thought, and action outside of phenomenal awareness and voluntary control.

In contrast to unconscious procedural knowledge, which is unavailable to conscious awareness and control in principle, the declarative knowledge involved in these cognitive states of perception, memory, and thought is available to consciousness in principle, but inaccessible to consciousness under certain circumstances (Tulving & Pearlstone, 1966). Some of these inaccessible mental states may be described as *preconscious*—a term borrowed from Freud (1900/1953) to denote percepts, memories, and thoughts that have been degraded by circumstances affecting either the environment in which cognition takes place (e.g., subliminal presentation, divided attention, or other suboptimal encoding conditions; long retention intervals; or impoverished retrieval cues) or the person him or herself (e.g., brain damage or general anesthesia). Processing of preconscious percepts and memories appears to be analytically limited—in fact, this processing may be restricted to those operations that are performed automatically by the perceptual-cognitive system.

Preconscious percepts, memories, and thoughts reside on the fringes of consciousness. But other percepts, memories, and thoughts are inaccessible to phenomenal awareness even though environmental and personal circumstances would seem to favor awareness of them. The functional deafness and blindness observed in clinical cases of conversion disorder, for example, involve auditory and visual stimuli which are by any standard above the threshold required for conscious perception; the dissociative disorders of memory observed in psychogenic amnesia, fugue, and multiple-personality disorder involve experiences that normally would be memorable. These events are not consciously perceived and remembered, yet they influence the patients' experience, thought, and action outside of phenomenal awareness. In the hypnosis laboratory, otherwise normal subjects experience suggested amnesias, negative hallucinations, and amnesias that bear a phenotypic similarity to those observed in clinical syndromes of conversion and dissociation. These percepts, memories, and thoughts, cannot be classified as either unconscious (because they are available in principle to conscious awareness) or as preconscious (because their underlying representations have not been degraded by impoverished encoding conditions, brain damage, and the like). Following James (1890/1991) and Janet (1907), these mental states may be classified as *subconscious* or *coconscious*.

The phenomena of implicit memory, perception, and thought make it clear that the cognitive unconscious extends beyond the strictly unconscious procedural and declarative knowledge structures that provide the foundations of conscious perception, memory, and thought. Percepts, memories, and thoughts themselves may be inaccessible to consciousness. In the preconscious case, it appears that percepts, memories, and thoughts have not achieved a level of activation necessary for introspective phenomenal awareness. But studies of hypnotic phenomena indicate that consciousness is not a matter of activation levels any more than it is a matter of automaticity. Apparently, consciousness can be divided (Hilgard, 1977), so a stream of thought involving fully activated percepts, memories, and thoughts, as well as controlled, effortful processes, can proceed outside of phenomenal awareness.

The expansive description of the cognitive unconscious offered here should not be misunderstood as an argument for either the epiphenomenalist suspicion or conscious inessentialism. The distinction between conscious and unconscious mental life is fundamental to human cognitive architecture, and it has adaptive significance as well. Because conscious awareness is the prerequisite for conscious control, our ability to reflect on the past, present, and future liberates us from control by both the immediate stimulus and our histories of stimulus contingencies. At the same time, empirical evidence of preconscious and subconscious percepts, memories, and thoughts reminds us that we are not always aware of why we do what we do and that the difference that makes for consciousness is not merely a matter of activation or attentional effort.

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Note

1. Another conspicuous omission in the literature on implicit memory is any attempt to connect dissociations between explicit and implicit memory to computa-

tional models of memory such as ACT (Anderson, 1976, 1983) or search of associative memory (SAM; Shiffrin & Raaijmakers, 1992). Such an exercise would be interesting, if only because such models assume a single memory system and operate according to principles of activation. Evidence that ACT or SAM can produce explicit-implicit dissociations of the sort observed in the laboratory would provide additional evidence for the viability of the activation view of implicit memory.

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