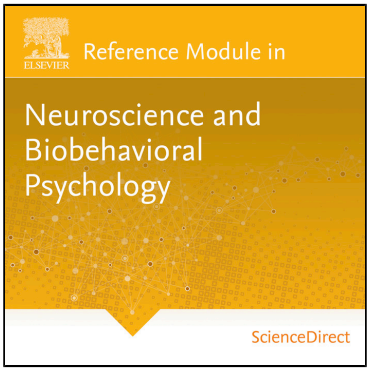




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# Unconscious Cognition☆

**John F Kihlstrom,** University of California, Berkeley, CA, United States





As psychology developed as an empirical science, theory and research focused on those mental states that were accessible to consciousness, as represented by classical psychophysics (with its interest in sensory thresholds), the structuralists' method of introspection, and William James' classic essay, in the *Principles of Psychology*, on the stream of consciousness. Following the onslaught of radical behaviorism, interest in consciousness declined precipitously in the years after World War I. Woodworth's work on the span of apprehension is an exception, and consciousness is the subtext of the Gestalt approach to perception. But serious scientific interest in consciousness had to await the cognitive revolution, with its interest in attention, short-term memory, and mental imagery.

Even the 19th century, however, psychologists recognized that the mental structures and processes underlying experience, thought, and action were not completely encompassed within the span of conscious awareness. Herbart's *limen* made room for Leibniz's *petites perceptions*, and of course Helmholtz argued that conscious perception was based on unconscious inferences. Perhaps the most forceful advocate of nonconscious mental life was William James, who (again in the *Principles*) held that mental states could be unconscious in at least two different senses. First, a mental event can be deliberately excluded from attention or consciousness: "We can neglect to attend to that which we nevertheless feel" (p. 201). These unattended, unconscious thoughts and feelings are themselves mental states. Second, and more important, James drew on clinical observations of cases of hysteria and multiple personality to argue for a division of consciousness into primary and secondary (and, for that matter, tertiary and more) consciousnesses (*sic*), only one of which is accessible to phenomenal awareness at any point in time. To avoid possible oxymoron in the negation of consciousness, James preferred to speak of *co-conscious* or *subconscious* mental states, rather than *unconscious* ones. There, was, in fact, considerable interest in unconscious mental life in the early 20th century – even setting aside the work of Sigmund Freud (Ellenberger, 1970). But, as with consciousness, the entire topic was banished from serious discourse by behaviorism.

History repeated itself in the latter half of the 20th century, as the "consciousness revolution" which followed on the cognitive revolution spun off an interest in unconscious mental life as well. This happened slowly. For a long time, if the unconscious was discussed at all, it was construed merely as a repository for unattended percepts and forgotten memories. But in addition to this wastebasket view of the unconscious, the classic multistore model of information processing made room for the unconscious by identifying unconscious mental life with early, "preattentive" mental processes that occur prior to the formation of a mental representation of an event in primary memory. However, by implicitly identifying consciousness with "higher" mental processes, the classic multistore model left little or no room for a more interesting view of the *psychological unconscious* – complex mental structures and processes, and full-fledged mental states, that influence experience, thought, and action, but which are nevertheless inaccessible to phenomenal awareness, insusceptible to voluntary control, or both.

The rediscovery of the unconscious by modern scientific psychology began with comparisons between automatic and effortful mental processes and between explicit and implicit memory. Since then, it has continued with the extension of the explicit-implicit distinction into the domains of perception, learning, and thought. Taken together, this literature describes the *cognitive unconscious* (Kihlstrom, 2012; see also Dehaene et al., 2006; Underwood, 1996).

## Attention, Automaticity, and Unconscious Processing

Although attention and consciousness seem almost synonymous, the two concepts are to some extent distinct (Koch and Tsuchiya, 2007). The earliest information-processing theories of attention, such as those proposed in the 1950s by Broadbent and others, were based, to one degree or another, on the metaphor of the filter. Information which made it past the filter was available for "higher" information-processing activities, such as semantic analysis, while information which did not make it past the filter was not. This same attentional filter was also the threshold which had to be crossed for information to be represented in phenomenal awareness.

The filter theories of attention, in turn, raised questions about how permeable the attentional filter was, and how much information processing could occur preattentively. Was preattentive – preconscious – processing limited to elementary physical features of the stimulus, or could it extend to the meaning of the stimulus as well?

In part to solve these problems, the notion of an attentional filter was replaced by the notion of attentional capacity. Capacity theories, such as the one proposed by Kahneman in the early 1970s, began with the assumption that human information-processing capacity is limited, and proposed that the ability to perform one or more task(s) depended both on the resources available and the resources required by the task(s) themselves. Whereas the filter models conceived of information processing as serial in nature, the capacity models implied that several tasks could be carried out simultaneously, so long as their attentional requirements did not exceed available resources.

The capacity view, in turn, led in the mid-1970s to a distinction between two types of cognitive processes, *controlled* and *automatic*. Controlled processes are conscious, deliberate, and consume cognitive capacity – they are what most people mean by cognition. By contrast, automatic processes are more involuntary. That is, they are *inevitably evoked* by the presentation of specific stimulus inputs, regardless of any intention on the part of the subject. And once evoked by an effective environmental stimulus, they are *incorrigibly executed*, in a ballistic fashion. Automatic processes are *effortless*, in that they consume little or no attentional capacity. And they are *efficient*, in that they do not interfere with other ongoing mental activities. Perhaps because they are fast, or perhaps because they do not consume cognitive capacity, automatic processes are unconscious in the strict sense that they are inaccessible to phenomenal awareness under any circumstances.

Automatic processes are exemplified by the Stroop color-word task, in which subjects must name the color of ink in which words are printed: Subjects show a great deal of interference when the word names a color that is different from that in which the word is printed. Apparently, subjects simply cannot help reading the words. Helmholtz's unconscious inferences may be viewed, in retrospect, as an early foreshadowing of the concept of automaticity. More recently, linguists such as Chomsky have argued that the universal grammar that underlies our ability to use language operates unconsciously and automatically.

Over subsequent decades, the concept of automaticity has evolved further (Bargh and Ferguson, 2000; Hassin, Uleman and Bargh, 2005). For example, some theorists proposed that automatic processes have properties other than the four canonical ones outlined above. Others have suggested that the features represent continuous dimensions, so that processes can be more or less automatic in nature. There has been some question as to whether all the canonical features must be present to identify a process as automatic: the four canonical features might comprise a kind of prototype of automaticity, rather than being singly necessary and jointly sufficient to define a process as automatic (Moors and DeHouwer, 2005). Even the automaticity of the Stroop effect has been cast into doubt. Challenges to capacity theory, from which the earliest ideas about automaticity emerged, have led to alternative theoretical conceptualizations in terms of memory rather than attention. Nevertheless, the concept of automaticity has gained a firm foothold in the literature of cognitive psychology, and investigators have sought to develop methods, such as Jacoby's *process-dissociation procedure*, to distinguish between the automatic and controlled contributions to task performance.

## Implicit Memory

While automatic processes may be considered to be unconscious, the mental contents on which they operate, and which they in turn generate, are ordinarily thought to be available to conscious awareness – just as Helmholtz's unconscious inferences took consciously accessible stimulus information and operated unconsciously to generate the conscious perception of distance and size. Thus, we generally assume that people notice and can describe the salient features of an object or event, even if they cannot articulate the way in which those features have been integrated to form certain judgments made about it, or cannot control their response to it. The further possibility, that cognitive processes can operate on mental states – percepts, memories, and the like - that are not themselves accessible to conscious awareness, was first raised in modern psychology by observations of priming in neurological patients with the *amnesic syndrome* resulting from bilateral damage to the medial temporal lobe, including the hippocampus. These patients could not remember words that they had just studied, but nevertheless show normal levels of priming on tasks such as word-fragment completion and stem completion.

On the basis of results such as these, Schacter drew a distinction between explicit memory, which involves the conscious recollection of some past event, and implicit memory, which is revealed by any change in task performance that is attributable to that event. Explicit memory, in this view, is identified with the typical sorts of memory tasks, such as recall or recognition. Following Schacter (1987), we may define implicit memory formally as *the effect of a past event on the subject's ongoing experience, thought, and action, in the absence of, or independent of, conscious recollection of that event.* Implicit memory is, in these terms, unconscious memory.

Spared priming has also been observed in various other forms of amnesia, including the anterograde and retrograde amnesia associated with electroconvulsive therapy for depression; the anterograde amnesia produced by general anesthesia administered to surgical patients, as well as that associated with conscious sedation in outpatient surgery; memory disorders observed in dementia, including Alzheimer's disease, as well as those encountered in normal aging; hypnotic and posthypnotic amnesia following appropriate suggestions to hypnotizable subjects; and the "functional" or "psychogenic" amnesias encountered in genuine cases of dissociative disorder, including dissociative amnesia, dissociative fugue, and the interpersonality amnesia of dissociative identity disorder (also known as multiple personality disorder). In each of these cases, the memory disorder primarily impairs explicit memory and spares implicit memory, which is either wholly or relatively intact. It is in this sense that implicit memory can be observed in the absence of explicit memory.

However, implicit memory can be observed in individuals with normal memory functions as well. For example, normal subjects show significant savings in relearning for items that they can neither recall nor recognize. In principle, such phenomena as proactive

and retroactive interference might also be expressions of implicit memory, if the interference occurred in the absence of conscious recollection for the interfering list. For the most part, however, documented dissociations between explicit and implicit memory in individuals with normal memory function take the form of experimental dissociations, in which some variable is shown to affect explicit but not implicit memory, or vice-versa. For example, depth of processing has a substantial effect on explicit memory, but relatively little impact on many priming effects. Even when explicit memory is not impaired, implicit memory may be said to be independent of explicit memory, in that priming does not depend on whether the prime is consciously remembered.

The nature of implicit memory is the subject of continuing theoretical controversy surrounds the nature of implicit memory. The earliest view was that priming reflected the activation, through perception and attention, of stimulus-relevant knowledge already stored in memory. More recently, under the influence of the doctrine of modularity in cognitive neuroscience, explicit and implicit memory have been attributed to the operation of separate and independent (thus dissociable) memory systems in the brain – or, alternatively, to brain systems dedicated to perception, action, and conceptual analysis that have the capacity to learn. Other theories hold that explicit and implicit memory are the products of a single memory system, but differ in terms of the processes that are deployed at the time of encoding and retrieval. For example, many priming tasks are held to be perceptually driven, while recall and recognition is conceptually driven. Alternatively, priming may occur automatically, while recall and recognition require conscious effort in retrieval. Along these lines, some theorists have redefined implicit memory as involuntary memory, thus making conscious control rather than conscious awareness, the defining feature of the phenomenon. Other theories hold that explicit memory depends on encoding relational information – a function that depends on the hippocampus and other structures in the medial temporal lobes – while implicit memory does not.

The various theories have proved hard to test against each other. By and large, multiple-memory systems theories have emerged from studies of brain-damaged patients, while single-systems theories have been developed in the context of data collected from neurologically intact subjects. Activation theories seem to imply that priming cannot occur for novel materials, for which subjects have no pre-existing mental representations to activate. Priming can occur for novel materials, in apparent contradiction to the activation view; but priming is greatest for novel materials that are composed of familiar elements, lending support to the activation view after all.

Despite this theoretical controversy, the essential concept of implicit memory, including its dissociation from explicit memory, is now widely accepted within cognitive psychology. The theoretical debate is likely to persist until investigators in the field recognize that most subsequent research on implicit memory, whether in neurologically impaired patients or intact subjects, has been dominated by studies of repetition priming effects of the sort observed in lexical decision, perceptual identification, stem-completion, and fragment-completion tasks. However, there is more to priming than repetition priming. Semantic and conceptual priming effects can also be observed in amnesia, as on free association and category generation tasks. These priming effects require some analysis of the meaning of the stimulus, going beyond mere physical structure. Understanding the nature of implicit memory, when it is spared and when it is impaired, and the relations between implicit and explicit memory, requires research on these other expressions of unconscious memory.

## Implicit Learning

Closely related to implicit memory is the concept of *implicit learning* – a term introduced to psychological discourse by Reber's pioneering experiments on artificial-grammar learning. In these experiments, subjects first studied a set of letter strings which had been generated by an artificial grammar. Later, they were asked to examine a new set of letter strings, and identify those that conformed to the grammar. They were able to do so at better than chance levels, suggesting that they had induced the grammatical rule from the study set. Nevertheless, Reber reported that the subjects were not able to describe the grammar itself.

In a paradigm somewhat similar to artificial grammar learning, subjects have learned to identify instances of novel concepts, such as patterns of dots that vary around a prototype, without being able to describe the defining or characteristic features of the concepts themselves. They can also detect the covariation between two features, such as hair length and personality, even though they cannot identify the basis for their predictions. They can learn the sequence in which certain stimuli will occur, without being able to specify the sequence itself. And they can learn to control the output of a complex system by manipulating an input variable, without being able to specify the relationship between the two. In each case, subjects appear to have acquired new knowledge through experience – the very definition of learning – but were apparently unable to gain conscious access to this knowledge. Thus, it appears that explicit learning can be dissociated from implicit learning (Stadler and Frensch, 1998).

Following the model of implicit memory, implicit learning may be defined as *a relatively permanent change in knowledge, resulting from experience, in the absence of conscious awareness of what has been learned*. Demonstrations that amnesic patients retain the ability to learn, even though they do not remember the learning experiences themselves, have led some theorists to construe implicit learning as a variant on implicit memory. However, there is an important distinction between the two concepts: implicit memory is a feature of episodic knowledge, in which subjects lack conscious memory for a specific event in their lives. By contrast, in implicit learning subjects lack conscious access to certain pieces of semantic or procedural knowledge acquired through a learning experience. Cases where subjects are aware of knowledge acquired through a learning experience, but cannot consciously recollect the learning experience itself, are better classified as *source amnesia*, a variant on implicit memory. Implicit learning is also distinguished from merely *incidental* learning, in which new knowledge is acquired in the absence of instructions or intention to learn, but the subject retains conscious access to that knowledge. Incidental learning is unintended, just like involuntary memory is unintended; is but implicit learning is unconscious knowledge, just as implicit memory is unconscious memory.

Whether implicit learning can be dissociated from explicit learning remains an open question. The fact that subjects cannot articulate the Markov process by which grammatical strings were generated does not mean that they are unaware of what they

have learned. Above-chance classification performance could well result from partial knowledge which is consciously accessible. The same argument holds true for other paradigms in which implicit learning has been ostensibly demonstrated. The best that can be said, for now, is that the subjects in artificial grammar and sequence learning experiments often experience themselves as behaving randomly, without an awareness of what they are doing. However, this assumption rests on relatively informal evidence. The careful matching of explicit and implicit tasks that is characteristic of studies implicit memory has not generally been imported into the study of implicit learning. A major agenda item in the study of implicit learning is to carry out more detailed analyses of subjects' experiences in implicit learning situations, to make sure that they are really unconscious of what they evidently know and put into action.

It is sometimes claimed that implicit learning is more powerful than conscious knowledge acquisition – that, for example, subjects can learn more complicated things, and more quickly, implicitly than they can explicitly. There may be cases in which this is true – for example, the learning of one's native language(s). But for the most part, such claims are rarely supported by adequately designed experiments. Most studies of implicit memory are little more than demonstration experiments, demonstrating that something *can* be learned without any instructions or intention to do so, and with little conscious representation of what has been learned. But by and large they lack the careful control conditions that would enable the investigators to pit conscious and unconscious learning against each other.

## Implicit Perception

Just as there are palpable effects on experience, thought, and action of past events that cannot be consciously remembered, there also appear to be similar effects of events in the current stimulus environment, which cannot be consciously perceived. By analogy with memory, explicit perception may be identified with the subject's conscious perception of some object in the current environment, or the environment of the very recent past, as reflected in his or her ability to report the presence, location, form, identity, and/or activity of that object. By the same token, implicit perception entails any change in the person's experience, thought, or action which is attributable to such an event, in the absence of (or independent of) conscious perception of that event. Implicit perception is exemplified by what has been called "subliminal" perception, involving stimuli that are in some sense too weak to cross the threshold (*limen*) of conscious perception.

In the earliest demonstrations of subliminal perception, the stimuli in question were of very low intensity – "subliminal" in the very strict sense of the term. Later, stimuli of higher, supraliminal levels of intensity were rendered "subliminal" by virtue of extremely brief presentations, or by the addition of a "masking" stimulus which for all practical purposes rendered the stimuli invisible. Subliminal perception quickly entered everyday vocabulary, as in the controversy over subliminal advertising and the marketing of subliminal self-help tapes. Almost from the beginning of this line of research, a variety of methodological critiques sought to undercut claims for subliminal perception. However, beginning with the now-classic studies of Marcel, followed by the work Merikle, Greenwald, and their associates, an increasing body of literature has demonstrated subliminal perception, broadly defined, in a manner that convincingly addresses these criticisms.

The adjective "implicit" is preferable to "subliminal", because there are many cases of unconscious perception in which the stimulus is not subliminal in the technical sense of the term. The most dramatic example is that of *blindsight* in patients with lesions in striate cortex (Weiskrantz, 1987). Implicit perception can also be observed in the syndromes of visual neglect resulting from temporoparietal damage, and in discriminative physiological responses to familiar and unfamiliar faces in cases of prosopagnosia. Priming and related effects have also been observed in the "functional" disorders of perception, such as cases of "hysterical" blindness and deafness (now relabeled "conversion disorder"), as well as in normal subjects given hypnotic suggestions for blindness and deafness. Also in normals, implicit perception has also been observed in subjects whose attention has been deflected from the stimulus, so that it is processed outside conscious awareness, as in parafoveal vision and dichotic listening. Priming has also been observed in normal failures of conscious perception such as *inattentional blindness*, as well as some forms of "attentional" blindness such as *repetition blindness*, the *attentional blink*, and *change blindness*.

As with implicit learning, implicit perception effects are sometimes discussed under the rubric of implicit memory. Indeed, the prime in most implicit perception studies does occur in the past, but it is the past of only a few moments ago, with no intervening distraction – what James called the *specious present*, and well within the span of primary memory. Implicit perception can be distinguished from implicit memory as follows: In implicit memory, the subject was perceptually aware of the event at the time it occurred; but the memory of that event has been lost to conscious recollection. In implicit perception, the subjects were unaware of the event at the time it occurred; conscious recollection may be vitiated by the failure of conscious perception, but it is the perception itself, not memory, that is unconscious. Preserved priming in general anesthesia might be construed as an instance of implicit memory, because the test of memory occurs sometime after the primes were presented; on the other hand, because the patients were not aware of the primes at the time they were presented, the same phenomenon should also count as an instance of implicit perception.

With subliminal and other forms of implicit perception now demonstrated to the methodological satisfaction of (almost) everyone, most the remaining controversy concerns the extent of its influence. Dramatic claims for the power of subliminal influence, popularized by Vance Packard's expose *the Hidden Persuaders* and revived in the American presidential election of 2000 by a Republican television advertisement that appeared to present the word *rats* subliminally when discussing the Democrats, appear to be grossly exaggerated. In the past, debate focused on whether subliminal perception was limited to the analysis of the physical characteristics of the subliminal stimulus, as in repetition priming, or could extend to meaning analyses, leading to

semantic priming. The work of Marcel, Merikle, and Greenwald come down squarely in favor of semantic priming, but even here subliminal perception appears to be analytically limited.

## Implicit Thought

Thinking and consciousness are so closely related that the notion of unconscious thought seems to be a contradiction in terms – certainly James thought so. In line with Helmholtz's concept of unconscious inferences, it is now generally accepted that many of the thought processes that intervene between perception and action are automatic, and it is in this sense that we may say that at least some thinking can occur outside of awareness. However, there is some evidence that thoughts themselves, and not just the process of generating them, can be unconscious. In one example, Bowers and his associates found that subjects could distinguish between soluble and insoluble puzzles, without knowing what the solution to the soluble puzzle was. Subsequent research has showed priming effects on lexical decision from the solutions to word problem, even when subjects were unaware of the solution itself. It has also been shown that subjects can display changes in skin-conductance response when making objectively risky choices, even when they cannot subjectively distinguish between those that are risky and those that are safe – much as prosopagnosic patients show differential physiological responses to objectively familiar faces that they cannot recognize.

In some sense, the ability of Bowers' subjects to discriminate between soluble and insoluble puzzles resembles the ability of Reber's subjects to discriminate between grammatical and ungrammatical letter strings – with the exception that they have had no opportunity to acquire the distinction through learning. Similarly, Shames' semantic priming effect resembles those observed in implicit perception and memory – except that the prime is neither a perceptual representation of a current stimulus nor a representation available in memory of a stimulus presented in the past. The subjects in these experiments appear to experience a "feeling of knowing" analogous to that observed in metamemory tasks. Their choices are clearly being guided by something that is neither a percept (because the solution is not currently being presented to them) or a memory (because the solution has not been presented in the past). By analogy to implicit perception and memory, we may define *implicit thought* as a mental representation – an idea or an image, for example – that influences ongoing experience, thought, and action in the absence of conscious awareness of that representation (Kihlstrom et al., 1996).

Implicit thought may underlie the intuition stage of insight problem solving, when the subject has not yet consciously arrived at the solution, as a conscious insight, but knows that a solution is possible solution is unconscious. In this analysis, the incubation stage may be thought of as the process by which the transformation from unconscious influence to conscious access takes place. Siegler and Stern may have observed this transformation in children who were learning to solve a particular kind of problem, who showed by their reaction times that they had achieved an insight into the solution of the problem, even though their verbal reports indicated that they were not yet consciously aware of their insight. Although intuition is commonly viewed as a source of error in human judgment, it may also be an adaptive component of the creative process – gut feelings that motivate the problem-solver to keep working. In fact, Dijksterhuis and his colleagues have argued that a reliance on intuition, or unconscious thinking, may be especially valuable in situations involving complex decision-making (Dijksterhuis and Nordgren, 2006).

## The Unconscious Beyond Cognition

Intentional mental states go beyond cognitive states of perceiving, remembering, knowing, and believing: they also include affective states, such as feelings of pleasure and pain, and motivational states, such as the desire to approach or avoid. If cognitive states can be unconscious, perhaps affective and conative states can be unconscious as well. Certainly, conscious feelings and desires can be generated automatically, in response to the appearance of effective stimuli in the environment. In addition, conscious feelings and desires can emerge as expressions of implicit perception, memory, and thought - -as in the subliminal mere exposure effect, by which subjects come to prefer stimuli to which they have been exposed, even if they were not consciously aware of the exposures, and cannot consciously remember them. Although most authorities currently hold the view that unconscious feelings and desires are almost contradictions in terms, the general acceptance of the cognitive unconscious suggests that we should be prepared to accept the existence of an affective unconscious, and of a conative unconscious, as well. Evidence in this regard is just beginning to trickle in, but at this point neither unconscious emotion nor unconscious motivation has been as well established as unconscious memory and perception.

## Attention and Consciousness Revisited

One implication of research on implicit perception, memory, and thought is that consciousness is not as closely tied to attention as the distinction between automatic and controlled processing implies. It may seem obvious that attention is the means by which objects and events are brought into consciousness, and that consciousness entails paying attention to such things. But in the case of implicit perception, subjects may pay close attention to the spatial location where a stimulus will appear, without being aware of the stimulus itself. In implicit memory, subjects may have attended to the study list at the time of learning, but fail to consciously recollect it later. In implicit learning, subjects are attending to the manifest task which has been set for them, while being unaware of knowledge they may have acquired in the course of task performance. And in implicit thought, an insight may emerge into consciousness even though the subject has diverted attention away from the problem he is trying to solve. Attention, then, is neither necessary nor sufficient for consciousness.

## The Cognitive Unconscious and Conscious Shyness

The discovery of the unconscious is commonly (and erroneously) attributed to Sigmund Freud, and there has been some tendency to claim that the literature on the cognitive unconscious provides support for the psychoanalytic conception of unconscious mental life. This is not the case: the unconscious percepts and memories revealed by contemporary cognitive psychology bear no resemblance to Freud's primitive, infantile, sexual and aggressive urges. Moreover, the distinction between conscious and unconscious mental life appears to be a matter of cognitive architecture, rather than of repression. Freud's metapsychological proposition that some aspects of mental life are unconscious is correct, but this is a proposition that is not unique to psychoanalytic theory. The more specific propositions of psychoanalytic theory, to the extent that they are testable at all, have all failed to find empirical support.

Still, just as Freud believed that unconscious processes dominated mental life, so some psychologists and other cognitive scientists have taken evidence of unconscious perception, learning, and memory as reason for thinking that conscious mental activity plays little or no role in behavior. For example, some personality and social psychologists have shifted from "dual-process" theories that some processes in social cognition and behavior are consciously controlled, and others unconscious and automatic, to a view that social cognition and behavior is dominated by unconscious, automatic processes, to the virtual exclusion of conscious, controlled ones. Some writers have gone so far as to replace Freud's view of the primacy of unconscious sexual and aggressive motives with the more modern concept of automaticity.

Actually, there is no evidence (such as might be provided by the process-dissociation procedure) supporting the proposition that automaticity dominates the conscious control of experience, thought, and action. Accordingly, the popularity of the view that it does reflects a persisting "shyness" about consciousness noted by the philosopher Owen Flanagan. At the very least, evidence for automaticity, and for unconscious perception, learning, and memory provide support for conscious inessentialism, which holds that consciousness is not necessary for adaptive cognition and action to occur. Conscious inessentialism, in turn, can lead to epiphenomenalism, or the view that consciousness has no causal function at all. But it should be understood that the literature summarized here only reveals the reality of unconscious cognition. It does not by any means negate consciousness.

## Neural and Psychological Correlates of Consciousness

The advent of brain-imaging research has added a new dimension to research on unconscious mental life, as researchers search for the neural correlates of conscious and unconscious processing. It seems clear, for example, that the striate cortex is required for conscious vision, but not for the unconscious vision revealed by blindsight. And the hippocampus and other portions of the medial temporal lobe appear to be necessary for conscious remembering, but not for priming and other aspects of unconscious memory.

More generally, comparisons of automatic vs. conscious processing, and of implicit vs. explicit perception, learning, and memory, may provide the comparison conditions necessary to identify the neural correlates of consciousness – which is to say, not the neural correlates of conscious wakefulness (as opposed to general anesthesia or sleep), but rather the neural correlates of conscious acts of perception, learning, memory, and thought. For example, automatic processing appears to activate the sensory and motor representation areas of the brain, such as the primary auditory cortex, while controlled processing is associated with areas of association cortex. Similarly, presentation of a masked visual stimulus activates areas of the visual cortex (naturally), while processing of the same stimulus unmasked activates a wider network of brain areas including parietal and frontal regions.

At the psychological level of analysis, unconscious priming effects underscore the first-person nature of the intentionality that underlies conscious perception and memory. As James noted in the *Principles*, every conscious percept, memory, or thought is part of a personal consciousness: The universal conscious fact is not "feelings exist" or "thoughts exist" but "*I* think" and "*I* feel". Similarly, when subjects complete tests of explicit perception and memory, their answers are always couched in the first person: *I* see, *I* hear, *I* recall, or *I* recognize X. By contrast, tests of implicit perception and memory are conducted in the third person: subjects are asked to complete a word stem or fragment, or identify a word, and by and large their answers lack this element of self-reference: *that word is* X. Certainly, the subjects are conscious, and conscious of what they are doing, but in general implicit expressions of perception, memory, learning, and thought lack the integration of the percept, memory, or thought with the self that seems critical for conscious awareness.

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