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## The Rediscovery of the Unconscious

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*To have ideas, and yet not be conscious of them,—there seems to be a contradiction in that; for how can we know that we have them, if we are not conscious of them? Nevertheless, we may become aware indirectly that we have an idea, although we be not directly cognizant of the same.*

— Immanuel Kant<sup>47</sup>

*Anthropology from a Pragmatic Point of View*

Perhaps the greatest mystery of the human mind is consciousness: how it is that a physical system, composed of biological structures interacting according to chemical and electrical principles, gives rise to such subjective experiences as perceiving, remembering, thinking, feeling, wanting, and willing. But the mystery of consciousness does not rest solely on our incomplete knowledge of how bodily processes are related to mental states. It also reflects the fact that while we may have direct introspective access to our own minds, we can know the minds of other people only through their self-reports and behaviors—indices whose reliability is unknown in principle. Put another way: we have direct and irrefutable evidence of our own consciousness, but the attribution of consciousness to other people (and, for that matter, other animals) must remain an inference. Finally, even our knowledge of our own minds is likely to be incomplete, to the extent that our experiences, thoughts,

and actions are governed by mental structures and processes that lie outside the scope of introspection.

These three problems—mind and body, other minds, and the unconscious mind—together summarize the scientific effort to understand the fundamental fact of human consciousness.<sup>16,22,26,79</sup> All three are important, but the one that interests me the most is the last one: whether it makes sense to talk about an unconscious mind and, if so, how best to characterize the relations between conscious and unconscious mental life.

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## 1. PROLOGUE: THE DISCOVERY AND REDISCOVERY OF CONSCIOUSNESS

First, a little deep background. As everyone knows, scientific psychology began in the nineteenth century as the study of consciousness. The sensory psychophysics of Fechner<sup>21</sup> and Helmholtz,<sup>30</sup> and the experimental introspection of Wundt<sup>94</sup> and Titchener,<sup>88</sup> were fundamentally concerned with the analysis and determinants of conscious experience. William James, in *Principles of Psychology*,<sup>43</sup> wrote that “The first fact for us, then, as psychologists, is that thinking of some sort goes on” (p. 224); and in *Psychology: Briefer Course*,<sup>44</sup> James followed Ladd<sup>62</sup> in defining psychology as “the description and explanation of states of consciousness as such” (p. 1).

Soon, however, the stimulus-response connectionism of Thorndike<sup>87</sup> turned into the behaviorism of Watson,<sup>90</sup> which in turn quickly came to dominance, and psychology—so the joke goes—lost its mind. But not completely: interest in conscious experience was maintained by the Gestalt psychologists and others interested in visual perception; by the work of Woodworth<sup>93</sup> and others on the span of attention; and by the purposive psychology of McDougall.<sup>68</sup> What is now known as the cognitive revolution<sup>3,24,39</sup> changed all that: the revolution was ushered in by the work of Cherry<sup>13</sup> and Broadbent<sup>8</sup> on selective attention, which can be identified with consciousness; later, the multistore model of memory, popularized by Atkinson and Shiffrin,<sup>2</sup> essentially identified consciousness with primary or short-term memory, itself the product of selective attention. Kamin<sup>46</sup> showed that even something as elementary as classical conditioning in rats could not be understood without attributing mental states of surprise and expectancy to the animals. The rediscovery of consciousness was consolidated by the development of an experimental approach to mental imagery by Paivio<sup>70</sup> and Shepard,<sup>81</sup> among others.

This history is familiar to most people, but I review it here because it is important to understand that the cognitive revolution need not have revived interest in consciousness at all. Consider two other sources of the cognitive revolution: information-processing theory and modern linguistics. There is nothing about information processing per se that necessarily entails consciousness at any point in

the sequence. Computers process information, and they have long served as models of the mind, but they are not conscious of the information that they process; in the most recent version of information-processing theory, variously known as connectionism (that Thorndikian term again!), parallel distributed processing, or neural network computation, consciousness is quite literally an afterthought.<sup>67,76</sup> Similarly, Chomsky<sup>14</sup> argued that language processing was performed by a set of structures and processes whose operation was completely inaccessible to consciousness, in principle. The listener does not consciously analyze the utterance of the speaker: all of this work is done automatically, by modules that have evolved for this specific purpose. Later, Fodor,<sup>23</sup> Jackendoff,<sup>41</sup> and others extended this notion of cognitively impenetrable modules to other domains, such as visual perception. The point is that cognition doesn't have to involve consciousness, and it is possible for respectable cognitive scientists to argue that consciousness has no functional significance at all—that it is a fixture of folk psychology that is better swept away.

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## 2. THE INITIAL DISCOVERY OF THE UNCONSCIOUS

A somewhat similar account can be given of the discovery, loss, and rediscovery of *the psychological unconscious*—by which I mean not a place in the mind, but rather a domain of mental structures and processes which influence experience, thought, and action outside of phenomenal awareness and voluntary control.<sup>50,52,53</sup> The notion that unconscious processes are important elements of mental life is very old.<sup>19,35,61,92</sup> For example, in his *New Essays on Human Understanding*,<sup>63</sup> the German philosopher Leibnitz wrote about how our conscious thoughts are influenced by sensory stimuli of which we are not aware:

...at every moment there is in us an infinity of perceptions, unaccompanied by awareness or reflection... That is why we are never indifferent, even when we appear to be most so... The choice that we make arises from these insensible stimuli, which...make us find one direction of movement more comfortable than the other. (p. 53)

Furthermore, Kant's *Anthropology from a Pragmatic Point of View*,<sup>47</sup> his last work and perhaps the first comprehensive textbook of psychology, had a major section "Of the ideas which we have without being conscious of them" (pp. 18–20).

Inspired by Kant's distinction between *noumena* and *phenomena*, the unconscious was apparently a popular theme in nineteenth-century German philosophy, especially among the Romantic philosophers. Schopenhauer, in *The World as Will and Idea*,<sup>78</sup> argued that human thought and action was driven by unconscious, irrational instincts of conservation and sex. Herbart,<sup>34</sup> drawing on Leibnitz's views, described the sensory threshold, or *limen*, as a battleground where various perceptions competed for representation in consciousness. The stronger percepts pushed

the weaker ones below the limen; but the repressed percepts continued to strive for expression, chiefly by associating themselves with other ideas. Even Marx and Engels get into the act: by means of mystification people hide, even from themselves, the true reasons for what they do; and by means of consciousness-raising, people become aware of the true nature of their current situation. This line of development reached its apex in von Hartmann's *Philosophy of the Unconscious*.<sup>29</sup> For Hartmann, the universe is ruled by the unconscious, a highly intelligent dynamic force composed of three layers: the absolute unconscious, accounting for the mechanics of the physical universe; the physiological unconscious, underlying the origin, development, and evolution of life; and the relative unconscious, which he considered to be the origin of conscious mental life.

If we now institute a comparison between the Conscious and Unconscious, it is first of all obvious that there is a sphere which is always reserved to the Unconscious, because it remains for ever inaccessible to consciousness. Secondly, we find a sphere which in certain being only belongs to the Unconscious, but in others is also accessible to consciousness. Both the scale of organisms as well as the course of the world's history may teach us that all progress consists in magnifying and deepening the sphere open to consciousness; that therefore in a *certain* sense consciousness must be the higher of the two. Furthermore, if in man we consider the sphere belonging both to the Unconscious and also to consciousness, this much is certain, that everything which any consciousness has the power to accomplish can be executed equally well by the Unconscious, and that too always far more strikingly, and therewith far more quickly and more conveniently for the individual, since the conscious performance must be striven for, whereas the Unconscious comes of itself and without effort. (Hartmann,<sup>29</sup> Vol. 2, p. 39)

Hartmann's speculative philosophy was extremely popular—the three volumes, running to more than a thousand pages, went through a total of 12 editions. In the end it proved too speculative for the first generation of scientific psychologists—both Ebbinghaus<sup>17</sup> and James,<sup>43</sup> for example, roundly criticized it, not least because of the global, uncritical way in which it was applied:

Hartmann fairly boxes the compass of the universe with the principle of unconscious thought. For him there is no nameable thing that does not exemplify it. But his logic is so lax and his failure to consider the most obvious alternatives so complete that it would, on the whole, be a waste of time to look at his arguments in any detail. (James,<sup>43</sup> p. 171)

Nevertheless, we owe to Hartmann the very concept of the psychological unconscious, as well as the Romantic notion, which is still with us today, that the unconscious is in some sense superior to consciousness. As Hartmann put it: "the Unconscious can really outdo all the performances of conscious reason" (Hartmann,<sup>29</sup> Vol. 2, pp. 39–40).

Similarly, in the *Treatise on Physiological Optics*,<sup>30</sup> Helmholtz argued that our conscious perceptions are determined by unconscious inferences (*umbewusster Schluss*, literally "unconscious conclusion"), mental computations (as we would call them today) of which we can never be aware, and over which we have no control:

The psychic activities that lead us to infer that there in front of us at a certain place there is a certain object of a certain character, are generally not conscious activities, but unconscious ones. In their result they are the equivalent to *conclusion*, to the extent that the observed action on our senses enables us to form an idea as to the possible cause of this action. . . . But what seems to differentiate them from a conclusion, in the ordinary sense of that word, is that a conclusion is an act of conscious thought. . . . Still it may be permissible to speak of the psychic acts of ordinary perception as *unconscious conclusions*. . . (Helmholtz,<sup>31</sup> p. 174)

In later work, Helmholtz backed away from the label of unconscious conclusions, because of its association with the Romantic unconscious of Schopenhauer and Hartmann,<sup>32</sup> but he never abandoned the basic insight:

I find even now that this name is admissible within certain limits since these associations of perceptions in the memory actually take place in such a manner, that at the time of their origin one is not aware of it. . . (Helmholtz,<sup>33</sup> p. 255)

All of this laid the foundation for what Ellenberger<sup>19</sup> called *The Discovery of the Unconscious* in psychiatry and psychology—a discovery that came in two stages. What Ellenberger has called "the first dynamic psychiatry" covers the period roughly between 1775 and 1900, beginning with the animal magnetism of Mesmer and the hypnotism of Braid,<sup>55</sup> and culminating in the systematic study of hysteria and multiple personality by Charcot<sup>12</sup> and Janet<sup>45</sup> in France, and Prince<sup>74</sup> and Sidis<sup>81</sup> in America.

What Ellenberger<sup>19</sup> calls "the new dynamic psychiatry" was essentially the creation of Freud, beginning with his collaborative *Studies on Hysteria*, published with Breuer.<sup>7</sup> Based on their clinical observations, Breuer and Freud concluded that the symptoms of hysteria were produced by unconscious memories of traumatic events—"hysterics suffer mainly from reminiscences" (Breuer & Freud,<sup>7</sup> p. 7). These events had been lost to conscious awareness, but nevertheless continued to influence experience, thought, and action outside of awareness:

We may reverse the dictum '*cessante causa cessat effectus*' [when the cause ceases the effect ceases] and conclude from these observations that the determining process continues to operate in some way or other for years—not indirectly, through a chain of intermediate causal links, but as a *directly* releasing cause—just as a psychological pain that is remembered in waking consciousness still provokes a lachrymal secretion long after the event. *Hysterics suffer mainly from reminiscences.* (Breuer and Freud,<sup>7</sup> p. 7)

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Our observations have shown. . . that the memories which have become the determinants of hysterical phenomena persist for a long time with astonishing freshness and with the whole of their affective colouring. We must, however, mention another remarkable fact. . . that these memories, unlike other memories of their past lives, are not at the patients' disposal. On the contrary, *these experiences are completely absent from the patients' memory when they are in a normal psychological state, or are only present in highly summary form.* Not until they have been questioned under hypnosis do these memories emerge with the undiminished vividness of a recent event. (Breuer and Freud,<sup>7</sup> p. 9)

Interestingly, in light of his critique of Hartmann,<sup>29</sup> James<sup>43,86</sup> himself was an active participant in the discovery of the unconscious. Although he disliked the notion of unconscious mental processes—for him, as for Searle,<sup>79</sup> consciousness and the mental were synonymous—James was persuaded by clinical observations of hysteria and hypnosis that even very complex mental processes could take place outside the scope of phenomenal awareness—a set of phenomena which he labeled *co-conscious* mental states.

Unfortunately, just when the concept of the psychological unconscious was getting up steam, the behaviorist revolution hit—and the psychological unconscious went the way of consciousness itself. It was bad enough to explain behavior in terms of mental states that could not be publicly observed; and so it was doubly bad to explain behavior in terms of mental states that could not even be *privately* observed! Interestingly, the rejection of unconscious mental processes was aided and abetted by James' critical remarks on Hartman's and other Romantic conceptions of the unconscious mind, as expressed in his view that the unconscious "is the sovereign means for believing what one likes in psychology, and of turning what might become a science into a tumbling-ground for whimsies" (James,<sup>43</sup> Vol. 1, p. 66).

Again, as with consciousness, some psychologists maintained an interest in the psychological unconscious. Unfortunately, by and large these individuals were psychoanalysts who isolated themselves from academic psychology, treating patients in their private offices and hospitals, training students in analytic institutes—a self-isolation that was reinforced by the prejudices of academic psychologists themselves.

There were exceptions: Rapaport<sup>75</sup> and others within the tradition of psychoanalytic ego psychology tried to maintain contact, and in the process conserved quite a bit of cognitive psychology against the behaviorists' hegemony; and the "New Look" of Bruner<sup>9,10,11</sup> and others tried to accomplish the same goal from the other side. Still, revival of academic interest in the psychological unconscious had to wait until the cognitive revolution was well consolidated. We are now at a point, however, where interest in the psychological unconscious runs wide and deep. This happy state of affairs is the end product of at least four quite independent strands of investigation, which together converge on our modern conception of the psychological unconscious.

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### 3. AUTOMATIC AND STRATEGIC PROCESSING

One research tradition contributing to the modern interest in the psychological unconscious is the distinction commonly drawn between "automatic" and "strategic" cognitive processes. The concept is related to Helmholtz's notion of unconscious inference. Consider the *moon illusion*<sup>48</sup>: the moon on the horizon looks much larger than the moon at zenith. The explanation is that there is an inverse relationship between the retinal size of an object and its distance from the viewer. Because the background horizon appears to be farther away than the open sky, while the retinal image cast by the moon has not changed at all, the visual system calculates that the moon at horizon *must be* larger than the moon at zenith. This calculation is entirely unconscious, of course; and what is equally interesting, knowledge of the illusion does not diminish it at all. Another example of automaticity is found in the Stroop<sup>85</sup> *color-word effect*: a list of color names is printed in different colors: if the ink color matches the color name (e.g., the word *yellow* printed in yellow ink), naming the color of the ink is easy; but if the word and color do not match (e.g., *yellow* printed in green ink), it is very hard. Automatic decoding of the word interferes with naming of the color.

Some automatic processes seem to be innate, while others are automatized after extensive practice. Within broad limits,<sup>4,64</sup> both types of automatic processes appear to be inevitably engaged by the presentation of specific stimulus inputs; they are independent of any intentionality on the part of the subject; and they cannot be controlled or terminated before they have run their course. What interests me most, however, are the implications for consciousness. First, as Helmholtz noted, we have no conscious awareness of their operation. Second, we have little or no awareness of the information processed automatically.

Consider a study by Spelke, Hirst, and Neisser,<sup>84</sup> in which subjects were asked to read unfamiliar prose and take dictation at the same time. On initial trials, performance on both these attention-demanding tasks was seriously impaired: each required too much attention to be done at the same time as the other. After six

weeks of practice, however, the subjects were able to take accurate dictation at the same time as they could read a prose passage (with 80% comprehension). Nevertheless, the subjects were generally unable to recall any of the words they had transcribed, and had little or no appreciation of how the lists had been structured. The dictation task, once automatized, no longer interfered with reading for comprehension; but neither did it yield memorable encodings of the dictated words.

In the world outside the laboratory, the flavor of this experience is captured beautifully in the following found poem, written by the American athlete and broadcast journalist Phil Rizzuto<sup>72</sup> (p. 7):

### My Secret

When I'm driving  
To Yankee Stadium and back,  
I do it so often.

I don't remember passing lights.  
I don't remember paying tolls  
Coming over the bridge.

Going back over the bridge,  
I remember . . .

Here we have someone, whose mind is focused elsewhere, performing a task he has accomplished hundreds and thousands of times in the past, apparently without any awareness of what he is doing.

While Hartmann thought that the progress of civilization consisted in expanding the range of consciousness, Alfred North Whitehead apparently argued the opposite<sup>5</sup>:

It is a profoundly erroneous truism . . . that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle—they are strictly limited in number, they require fresh horses, and must only be made at decisive moments.

That quite complicated activities can be routinized, and performed without any concurrent awareness, is indicated by reports of three patients suffering from *petit mal* epilepsy:

One patient, whom I shall call A., was a serious student of piano . . . as apt to make a slight interruption in his practicing, which his mother recognized as the beginning of an "absence." Then he would continue to play for a time with considerable dexterity. . . . Sometimes the attack would come on [Patient B] while walking home from work. He would continue to walk and to thread his way through the busy streets on his way home. He might



realize later that he had had an attack because there was a blank in his memory for a part of the journey... If Patient C was driving a car, he would continue to drive, although he might discover later that he had driven through one or more red lights. (Pennfield,<sup>71</sup> p. 39)

Demonstrations of automaticity indicate that a great deal of complex cognitive activity can go on outside of conscious awareness—provided that the skills, rules, and strategies required by the task have been automatized. Previously, as in the Atkinson and Shiffrin<sup>2</sup> paradigm, unconscious preattentive processes were limited to elementary perceptual analyses of the physical features of environmental stimuli. Now it is clear that there are circumstances under which the meanings and implications of events can be unconsciously analyzed as well; moreover, adaptive behaviors can be organized in response to these events, all without these behaviors being represented in conscious awareness.

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#### 4. THE IMPACT OF COGNITIVE NEUROPSYCHOLOGY

About 20 years ago, as cognitive psychology turned into cognitive *neuropsychology*, researchers began to see evidence of the psychological unconscious in the behavior of brain-damaged patients. Pride of place, of course, goes to studies of the amnesic syndrome resulting from bilateral damage to the hippocampus and related structures in the medial temporal lobe, or, alternatively, the diencephalon and mammillary bodies. Such patients show a dense anterograde amnesia: after only a few moments of distraction, they cannot remember events that have just occurred. But as we all know, these patients also show the influence of the unremembered past on their current experience, thought, and action. For example, a patient who has recently seen the word *ASSASSIN* will be unable to recall or recognize the word shortly thereafter. But when asked to complete a fragment with a legal English word, they will be more successful with *A\_A\_I* than with *T\_P\_R*. This effect, known generically as priming, shows that something about the past event has been retained in memory, and actively influences current task performance.

Credit for this discovery goes to Warrington and Weiskrantz,<sup>89</sup> but the significance of their observation was not entirely clear until many years later. Based on effects such as these, Schacter<sup>77</sup> and others began to draw a distinction between two expressions of memory, explicit and implicit—or, alternatively, memory with and without awareness.<sup>18,42</sup> Explicit memory refers to one's conscious recollection of the past, as manifested on tasks like recall and recognition. Implicit memory refers to any change in experience, thought, and action that is attributable to a past event: priming effects, savings in relearning, and proactive and retroactive interference are good examples. We now know that explicit and implicit memory are dissociable in at least three different senses: (1) there are patients, such as amnesics, who show implicit memory in the absence of explicit memory; (2) there are some variables that

influence explicit but not implicit memory, and others that influence implicit but not explicit memory, and others that influence both explicit and implicit memory, but in opposite directions; and (3) explicit and implicit memory are stochastically independent, in that priming effects occur for items that cannot be recognized.

Implicit memory can also be expressed psychophysically. Consider the syndrome of prosopagnosia, observed in patients who have suffered bilateral damage in the inferior portions of the . These individuals lose the ability to recognize faces of people who are objectively familiar to them. They can describe these faces accurately, and they can recognize the people in question from other physical features, such as voice or gait, but they can no longer put names to faces (including their own). But prosopagnosic patients show differential physiological responses to familiar and unfamiliar faces, and to correct vs. incorrect names paired with familiar faces; when asked whether two faces match, they do better with familiar than with unfamiliar ones; and concurrent presentation of familiar faces can influence the processing of words that are associated with these faces.<sup>95</sup> Again, all of these effects show that memory for the face, and the connection between facial and verbal knowledge, has been preserved at some level, even if the patients cannot express this knowledge consciously. By now, lots of evidence has accumulated in favor of the distinction between explicit and implicit memory.

An analogous distinction can be made in the domain of perception. Consider Weiskrantz's<sup>91</sup> classic studies of blindsight in patients with damage to the striate cortex of the occipital lobe. Such patients report a lack of visual experience in some portion of the visual field: when a stimulus is presented to their scotoma, they say they see nothing at all. Yet when forced to make guesses about the properties of a stimulus, their conjectures about presence, location, form, movement, velocity, orientation, and size prove to be more accurate than would be expected by chance alone. Something similar occurs in visual neglect arising from lesions in the temporoparietal region of one hemisphere (usually the right) that do not affect primary sensory or motor cortices. These patients appear to neglect that portion of the contralateral sensory field (usually the left). Thus, a patient asked to bisect a set of horizontal lines may ignore the ones on the left side of the page; and for the remainder, the pencil strokes tend to be located about one-quarter of the way in from the right. It is as if the left half of the page, and the left half of each line, is not seen at all. But it is, at least sometimes: thus Marshall and Halligan<sup>66</sup> showed a left-hemineglect patient two pictures of houses, one above the other. The pictures were identical in every respect, except that one had flames coming out of a window on the left side. The patient did not detect the difference, because after all the pictures had identical right sides; but when asked which she would prefer to live in, she consistently chose the one without the flames.

We may take studies such as these as evidence for implicit perception.<sup>58</sup> Whereas implicit memory refers to performance effects attributable to past events, implicit perception is concerned with the analogous effects of an event in the current environment, or the very immediate past. Of course, one could take all this just as evidence for implicit memory: after all, all introspection is retrospection, as someone

(William James, I think) once said. But there is an important difference between the two phenomena: in implicit memory, the events in question were consciously perceived at the time they occurred, and subsequently were lost to conscious recollection. In implicit perception the event was never consciously perceived at all: it is the perception that is implicit in task performance, not just the memory. In general, I prefer to reserve implicit memory for cases where the event in question was consciously perceived, but not consciously remembered.

Still, sometimes the distinction can get blurry. In an experiment performed with my colleagues Randall Cork and Daniel Schacter,<sup>60</sup> a group of patients received elective surgery with a mixture of isoflurane and oxygen as the anesthetic agent. During the operation, they heard a tape presenting a list of 15 paired-associates of the form *BREAD-BUTTER*. In the recovery room, and again 48 hours later, they were presented with the cue terms; on one test they were asked to produce the associated response, while on another they were asked to report the first word that came to mind. Cued recall was at chance levels, but free association showed a significant priming effect. Other people have gotten this kind of effect, too, but not everybody has been successful. And we ourselves failed to confirm the effect when we switched from isoflurane and oxygen to sufentanil and nitrous oxide as the anesthetic agent<sup>15</sup>—an outcome which if confirmed may begin to tell us something about the biological substrates of consciousness. But for the moment, assuming that the patients were unaware of the tape at the time it was presented, in this case we have implicit memory providing evidence for implicit perception.

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## 5. SUBLIMINAL INFLUENCE

But you do not have to be brain-damaged to show perception and memory outside of conscious awareness. Consider a now-classic experiment by the philosopher-psychologist J. S. Pierce and his graduate student Joseph Jastrow<sup>73</sup>—Jastrow was the recipient of the first American Ph.D. in psychology,<sup>6</sup> and this study was probably the first psychological experiment performed in America. In a series of studies of weight and brightness discrimination, these experimenters reduced the difference between standard and comparison stimuli until they were at zero confidence in judging which was the heavier or brighter. Yet, when forced to guess, their choices were significantly more accurate than chance. Apparently, some stimulus information was registering somewhere in the perceptual system. Pierce and Jastrow thought their evidence disproved the very existence of a sensory threshold, or limen. That may be going too far, but more recent evidence confirms their essential point, that stimuli which cannot be consciously perceived can still have effects on conscious experience, thought, and action. Almost a century later, Marcel<sup>65</sup> revived the problem of subliminal perception—a special case of implicit perception<sup>58</sup> with his classic studies of priming in lexical decision. He found that prior presentation of words

like DOCTOR primed lexical decisions—judgments of whether an item is a legal word—of words like NURSE, even though an intervening mask prevented conscious perception of the prime.

Early studies of subliminal perception, most often performed by psychoanalytic ego-psychologists or proponents of the New Look, were severely criticized on a variety of technical grounds, most of them now known to be misguided.<sup>20,25,40</sup> For example, it has been argued that any discriminative response is an indication of supraliminal stimulation, thus ruling out the notion of subliminal perception by fiat. Certainly one motive for the critique was the association of subliminal stimulation with the unconscious of psychoanalytic theory. But another reason was the simple fact that the theories of the time tended to describe cognition in terms of a series of ever more complicated processes, and thus had no room in them for the possibility that the meanings of words could be analyzed before the forms of words.

Things are different now. A great advance in this area was made by Merikle and his colleagues,<sup>69</sup> who distinguished between the *subjective threshold* (the point at which a stimulus cannot be consciously perceived) and the *objective threshold* (the point at which all differential response to a stimulus disappears). There is now considerable evidence from studies of identity priming (where, for example, TILE primes TILE), form priming (where FILE primes TILE), and semantic priming (where FILE primes INDEX) that subliminal perception is possible. This is especially true if presentation conditions are closer to the subjective threshold than to the objective threshold. But semantic priming is possible even under conditions that are near objective threshold. So, for example, Greenwald and his colleagues<sup>28</sup> found masked evaluative priming (e.g., where the connotative meaning of a word like JOY facilitates an evaluative judgment of a word like PEACE), under presentation conditions that were so degraded that the subjects were unable to guess *where* in the field the item was presented, much less its identity.

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## 6. DISSOCIATIVE PHENOMENA IN HYPNOSIS

A final contribution in this area comes from research on hypnosis, a social interaction in which the subject acts on suggestions for experiences involving alterations in perception, memory, and the voluntary control of action. Many of these phenomena involve a division in consciousness, such that cognitive processing outside of phenomenal awareness influences ongoing experience, thought, and action.<sup>35,50</sup> In this case, however, the processes have not been routinized through repeated practice; and the percepts and memories in question are in no sense degraded.

Consider, for example, posthypnotic suggestion—the phenomenon that, so our mythology tells us, gave Freud his first good insight into the psychological unconscious. It may be suggested that, after the termination of hypnosis, the hypnotist will tap a pencil on the desk, at which time the subject will get up and sit in

another, vacant chair; it may further be suggested that the subject will not remember receiving this suggestion, or anything else that has transpired while he or she was hypnotized. When the hypnotist taps a pencil, many subjects—especially those who are highly hypnotizable—will make the appropriate response, but deny knowing why they are doing so.<sup>80</sup> Even without the concomitant suggestion for amnesia, there is still something unconscious about the behavior: the subjects are aware of the significance of the cue, but they are not aware of any deliberate intention to move. Still, they move. When pressed, they will confabulate a reason, claiming that they wanted to stretch their legs, or that the upholstery was uncomfortable. This is a paradigm case of unconscious influence—the person does something without knowing why; but it is not an activity that has been practiced hundreds of times before; and there is nothing about the eliciting cue that is subliminal or otherwise degraded.

Posthypnotic response, especially when accompanied by posthypnotic amnesia,<sup>51</sup> involves a dissociation between explicit and implicit memory: the person's current behavior is influenced by a past event, in the absence of conscious awareness of that event. But other experiments illustrate the dissociation in more conventional terms. In one experiment,<sup>49</sup> hypnotized subjects memorized a list of words, and then received a suggestion for posthypnotic amnesia. After termination of hypnosis they received a recall test: Those subjects with the highest level of hypnotizability showed a very dense amnesia, compared to the performance of control subjects who were not deeply hypnotized. Later, all subjects were asked to give the first words that came to mind in response to various cues; some of these cues targeted the list items as free associates, others targeted control items, carefully matched to the list items, that had not been memorized. The nonamnesic subjects showed a substantial priming effect, producing more list than nonlist items as responses; but so did the amnesics, and in fact the magnitude of the priming effect was the same in the two groups. Interestingly, a second recall test continued to show a dense amnesia: apparently, production of list items as free associates did not remind the amnesic subjects of the items they had memorized. Finally, after the amnesia suggestion was canceled, everybody remembered the list almost perfectly.

This dissociation between explicit and implicit memory is quite different from the usual priming study, in a number of respects: good encoding was insured by requiring the subjects to meet a criterion of two perfect repetitions of the list before the amnesia suggestion was given; and adequate retention was demonstrated by the full recovery of memory after administration of the reversibility cue. Moreover, the priming observed here is semantic priming, not repetition priming: because the free-association cues were not presented as part of the study list, a semantic link between cue and target had to be formed by the subject at the time of encoding, and preserved in memory over the retention interval. Most explicit-implicit memory dissociations are a product of poor encoding; in this case, the reversibility of the amnesia indicates that it is a phenomenon of retrieval.

Hypnosis can give evidence of implicit perception, too, but again the details are different from the usual subliminal case.<sup>58</sup> Consider the familiar phenomenon

of hypnotic analgesia,<sup>36</sup> in which the subject receives suggestions that he or she is insensitive to pain. The effect can be so profound as to permit highly hypnotizable patients to undergo major surgical procedures without benefit of chemical analgesia or anesthesia. But the analgesic patient's unawareness of pain does not mean that the pain has not registered in the perceptual-cognitive system. So, for example, physiological indices such as heart rate still respond to the pain stimulus, even though the subject reports feeling little or no pain.<sup>37</sup> Similarly, mental representations of the pain stimulus may be accessed, after analgesia has been successfully established, when the hypnotist attempts to communicate with a "hidden part" of the person that may know more than the "hypnotized part."<sup>38</sup> Under these circumstances, many analgesic subjects give pain reports that are comparable to those collected under normal, nonhypnotic conditions. Hilgard's<sup>35</sup> "hidden observer" is a metaphor for these mental representations of current and past experience, and the means by which they may be accessed.<sup>54</sup> The success of the hidden observer technique reflects implicit perception: despite their failure to experience pain, the pain stimulus has been registered and thoroughly processed by the sensory-perceptual system.

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## 7. UNCONSCIOUS, PRECONSCIOUS, SUBCONSCIOUS

One of the major accomplishments of the cognitive revolution in psychology has been an increased appreciation of the role of unconscious processes in cognition, emotion, and motivation. It is now clear that even in the absence of conscious perception and memory, current and past events can influence the person's ongoing experience, thought, and action. The evidence for this conclusion provides the empirical basis for a provisional taxonomy of unconscious mental life.

First, there are a variety of cognitive processes which may be classified as *unconscious*, in the strict sense that they are inaccessible to phenomenal awareness under any circumstances, and can be known only by inference. The individual has no access to the rules by which these processes operate, or even any awareness that they are operating at all. Unconscious processes play a major role in mental life. They are the means by which we detect features and recognize patterns of stimulation,<sup>2</sup> and by which we execute cognitive and motoric skills.<sup>1</sup> According to the modal thinking in this area,<sup>4,64,82</sup> unconscious processes, aside from operating outside the scope of phenomenal awareness, are automatic and effortless—that is, they are inevitably invoked by particular stimulus inputs, and their execution consumes little or no attentional resources.

According to Helmholtz<sup>30</sup> and his progeny, unconscious processes are the stuff of which conscious experience is made. But implicit in this assertion is the idea that the declarative knowledge which these procedures generate is accessible to consciousness, even if the procedures themselves are not. But that turns out not

to be the case. Conscious experience, thought, and action can be affected by representations, as well as processes, of which we are not aware. These mental contents might be called *preattentive*, but I prefer to honor Freud's legacy by labeling them *preconscious*. In contrast to unconscious mental processes, preconscious contents are available to phenomenal awareness, and accessible in principle, if not in fact. As a rule, preconscious processing—that is, the processing of preconscious declarative knowledge—reflects a degradation of stimulus input, trace information, or cognitive resources.

Preconscious processing often seems to be analytically limited. So, for example, the priming effects obtained in general anesthesia are of the repetition class, which can be mediated by a perceptual memory system that stores the results of structural, but not semantic, analyses. To take one example, it is difficult to show semantic (as opposed to repetition) priming effects in subliminal perception or amnesic patients. Such effects can be seen in other circumstances, however, such as hypnosis. The semantic priming observed in posthypnotic amnesia is quite different from what we observe in implicit memory associated with preconscious processing, because it seems to reflect the complex processing of events, including semantic analysis, and their retention over long periods of time; moreover, conscious access to these representations can be restored under appropriate conditions. We may follow Prince<sup>74</sup> in classifying these representations as subconscious, because they possess the attributes required to be fully conscious processes, but are nevertheless dissociated from the stream of phenomenal awareness.

What is the mechanism for this dissociation? Whatever it is, it does not appear to be quite the same as that involved in unconscious and preconscious processing. There is no extensive practice of a skill, leading to knowledge compilation or proceduralization. There is no degradation of perceptual representations, memory traces, or cognitive resources. The mental representations in question have been fully activated by perceptual inputs or acts of thought, well above any threshold that might be required for representation in working memory, and they are the products of complex analyses; yet they are still denied to introspective phenomenal awareness. Subconscious processing—that is, the processing of representations that should be conscious, but nevertheless are not—poses a difficult challenge for psychology.

My own view,<sup>57</sup> is that subconscious processes are mediated by multiple mental representations of the self,<sup>59</sup> each linked to a somewhat different set of experiences, thoughts, and actions, and that phenomenal awareness of percepts, memories, and thoughts depends on which self-representation resides in working memory at any particular time. Moreover, I think the connection to the self is also implicated in automatic and preconscious processing, so that it serves as a kind of final common pathway uniting all the various instances of unconscious mental life.

What really matters most, though, is that a century of scientific psychology, and a couple of decades of cognitive science, have moved us far beyond Hartmann's<sup>29</sup> speculative philosophy of the unconscious, and Freud's psychodynamic interpretations. We now know a great deal about the conditions under which mental processes may be automatized, and rendered unconscious. And we now know that we have

to take such concepts as unconscious perception, memory, and thought seriously. We also know that Hartmann was wrong in his Romantic assertion that the Unconscious has the same power as conscious mental life. Everything we know about the psychological unconscious indicates that, for all its capacities, still it suffers from serious analytic limitations.<sup>27,56</sup>

The most important accomplishment, however, is that we now have good evidence, from a wide variety of research paradigms, that our experience, thought, and action is influenced by mental structures and processes of which we are not aware. The unconscious is not, as William James feared it would be, merely a "tumbling-ground for whimsies"; rather, it is an empirical fact of mind, and can be studied by the conventional techniques of psychological science. Thus, while we continue to work on the problem of mind and body, we must also strive to understand the nature of unconscious mental life and its relationship to consciousness.

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This paper is dedicated to William E. Edmonston, Jr., on the occasion of his retirement from Colgate University.

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# The Mind, The Brain, and Complex Adaptive Systems

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