CHAPTER 17

Consciousness in Hypnosis

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Abstract

In hypnosis, subjects respond to suggestions for imaginative experiences that can involve alterations in conscious perception, memory, and action. However, these phenomena occur most profoundly in those subjects who are highly hypnotizable. The chapter reviews a number of these phenomena, including posthypnotic amnesia; hypnotic analgesia; hypnotic deafness, blindness, and agnosia; and emotional numbing, with an eye toward uncovering dissociations between explicit and implicit memory, perception, and emotion. These dissociative phenomena of hypnosis bear a phenotypic similarity to the "hysterical" symptoms characteristic of the dissociative and conversion disorders. The experience of involuntariness in hypnotic response is considered in light of the concept of automatic processing. Hypnosis may be described as an altered state of consciousness based on the convergence of four variables: induction procedure, subjective experience, overt behavior, and psychophysiological indices – including neural correlates of hypnotic suggestion revealed by brain imaging.

Consciousness in Hypnosis

Hypnosis is a process in which one person (commonly designated the subject) responds to suggestions given by another person (designated the hypnotist) for imaginative experiences involving alterations in perception, memory, and the voluntary control of action. Hypnotized subjects can be oblivious to pain; they hear voices that aren't there and fail to see objects that are clearly in their field of vision; they are unable to remember the things that happened to them while they were hypnotized; and they carry out suggestions after hypnosis has been terminated, without being aware of what they are doing or why. In the classic case, these experiences are associated with a degree of subjective conviction bordering on delusion and an experience of involuntariness bordering on compulsion.

The Importance of Individual Differences

The phenomena of hypnosis can be quite dramatic, but they do not occur in everyone. Individual differences in hypnotizability are measured by standardized psychological tests, such as the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A) or the Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C). These psychometric instruments are essentially work samples of hypnotic performance, consisting of a standardized induction of hypnosis accompanied by a set of 12 representative hypnotic suggestions. For example, on both HGSHS:A and SHSS:C, subjects are asked to hold out their left arm and hand, and then it is suggested that there is a heavy object in the hand, growing heavier and heavier, and pushing the hand and arm down. The subject's response to each suggestion is scored according to objective behavioral criteria (for example, if the hand and arm lower at least 6 inches over a specified interval of time), yielding a single score representing his or her hypnotizability, or responsiveness to hypnotic suggestions. Hypnotizability, so measured, yields a quasi-normal distribution of scores in which most people are at least moderately responsive to hypnotic suggestions, relatively few people are refractory to hypnosis, and relatively few fall within the highest level of responsiveness (Hilgard, 1965).

Although most people can experience hypnosis to at least some degree, the most dramatic phenomena of hypnosis – the ones that really count as reflecting alterations in consciousness – are generally observed in those "hypnotic virtuosos" who comprise the upper 10 to 15% of the distribution of hypnotizability. Accordingly, a great deal of hypnosis research involves a priori selection of highly hypnotizable subjects, to the exclusion of those of low and moderate hypnotizability. An alternative is a mixed design in which subjects stratified for hypnotizability are all exposed to the same experimental manipulations, and the responses of hypnotizable subjects are compared to those who are insusceptible to hypnosis. In any case, measurement of hypnotizability is crucial to hypnosis research: There is no point in studying hypnosis in individuals who cannot experience it.

Some clinical practitioners believe that virtually everyone can be hypnotized, if only the hypnotist takes the right approach, but there is little evidence favoring this point of view. Similarly, some researchers believe that hypnotizability can be enhanced by developing positive attitudes, motivations, and expectancies concerning hypnosis (Gorassini & Spanos, 1987), but there is also evidence that such interventions are heavily laced with compliance (Bates & Kraft, 1991). As with any other skilled performance, hypnotic response is probably a matter of both aptitude and attitude: Negative attitudes, motivations, and expectancies can interfere with performance, but positive ones are not by themselves sufficient to create hypnotic virtuosity.

Hypnotizability is not substantially correlated with most other individual differences in ability or personality, such as intelligence or adjustment (Hilgard, 1965). However, in the early 1960s, Ronald Shor (Shor, Orne, & O'Connell, 1962), Arvid As (As, 1962), and others found that hypnotizability was correlated with subjects' tendency to have hypnosis-like experiences outside of formal hypnotic settings, and an extensive interview study by Josephine Hilgard (1970) showed that hypnotizable subjects displayed a high level of imaginative involvement in such domains as reading and drama. In 1974, Tellegen and Atkinson developed a scale of *absorption* to measure the disposition to have subjective experiences characterized by the full engagement of attention (narrowed or expanded), and blurred boundaries between self and object (Tellegen & Atkinson, 1974). Episodes of absorption and related phenomena such as "flow" (Csikszentmihalyi, 1990; Csikszentmihalyi & Csikszentmihalyi, 1988) are properly regarded as altered states of consciousness in their own right, but they are not the same as hypnosis and so are not considered further in this chapter.

Conventional personality inventories, such as the Minnesota Multiphasic Personality Inventory and California Psychological Inventory, do not contain items related to absorption, which may explain their failure to correlate with hypnotizability (Hilgard, 1965). However, absorption is not wholly unrelated to other individual differences in personality. Recent multivariate research has revealed five major dimensions – the "Big Five" – which provide a convenient summary of personality structure: neuroticism (emotional stability), extraversion, agreeableness, conscientiousness, and openness to experience (John, 1990; Wiggins & Trapnell, 1997). Absorption and hypnotizability are correlated with those aspects of openness that relate to richness of fantasy life, aesthetic sensitivity, and awareness of inner feelings, but not those that relate to intellectance or sociopolitical liberalism (Glisky & Kihlstrom, 1993; Glisky, Tataryn, Tobias, & Kihlstrom, 1991).

Absorption is the most reliable correlate of hypnotizability; by contrast, vividness of mental imagery is essentially uncorrelated with hypnosis (Glisky, Tataryn, & Kihlstrom, 1995). However, the statistical relations between hypnotizability and either absorption or openness are simply too weak to permit confident prediction of an individual's actual response to hypnotic suggestion (Roche & McConkey, 1990). So far as the measurement of hypnotizability is concerned, there is no substitute for performance-based measures such as the Stanford and Harvard scales.

The Controversy over State

Consciousness has two principal aspects: *monitoring* ourselves and our environment, so that objects and events are accurately represented in phenomenal awareness, and *controlling* ourselves and the environment through the voluntary initiation and termination of thought and action (Kihlstrom, 1984). From this point of view, the phenomena that mark the domain of hypnosis (Hilgard, 1973a) seem to reflect alterations in consciousness. The sensory alterations exemplified by hypnotic analgesia or deafness, as well as posthypnotic amnesia, are disruptions in conscious awareness: The subject seems to be unaware of percepts and memories that ought to be accessible to phenomenal awareness. Similarly, posthypnotic suggestion, as well as the experience of involuntariness that frequently accompanies suggested hypnotic experiences, reflects a loss of control over cognition and behavior.

Despite these considerations, the status of hypnosis as an altered state of consciousness has been controversial (e.g., Gauld, 1992; Hilgard, 1971; Kallio & Revensuo, 2003; Kirsch & Lynn, 1995; Shor, 1979a).[1] For example, psychoanalytically inclined theorists classified hypnosis as an instance of adaptive regression, or regression in the service of the ego (Fromm, 1979; Gill & Brenman, 1959). Orne believed that the essence of hypnosis was to be found in "trance logic" (Orne, 1959), whereas Hilgard argued that the phenomena of hypnosis were essentially dissociative in nature (Hilgard, 1973b, 1977). By contrast, Sarbin and Coe described hypnosis as a form of role-enactment (Sarbin & Coe, 1972); Barber asserted that the phenomena of hypnosis could be produced by anyone who held appropriate attitudes, motivations, and expectancies (Barber, 1969).

More recently, both Woody and Bowers (Woody & Bowers, 1994; Woody & Sadler, 1998) and Kihlstrom (Kihlstrom, 1984, 1992a, 1998) embraced some version of Hilgard's neodissociation theory of divided consciousness. By contrast, the "sociocognitive" approach offered by Spanos (1986a, 1991) emphasized the motivated subject's attempt to display behavior regarded as characteristic of a hypnotized person and the features of the social context that shaped these displays. Kirsch and Lynn (Kirsch, 2001a,b; Kirsch & Lynn, 1998a,b) offered a "social cognitive" theory of hypnosis that attributed hypnotic phenomena to the automatic effect of subjects' response expectancies. Following Kuhn (1962), the "state" and "nonstate" views of hypnosis have sometimes been construed as competing paradigms (e.g., Spanos & Chaves, 1970, 1991).

Consciousness and Social Influence

Part of the problem is the multifaceted nature of hypnosis itself. Hypnosis entails changes in conscious perception, memory, and behavior, to be sure, but these changes also occur following specific suggestions made by the hypnotist to the subject. As White (1941) noted at the dawn of the modern era of hypnosis research, hypnosis is a state of altered consciousness that takes place in a particular motivational context – the motivation being to behave like a hypnotized subject. Orne (1959), who was White's protege as both an undergraduate and a graduate student at Harvard, famously tried to distinguish between artifact and essence of hypnosis, but a careful reading of his work makes it clear that the demand characteristics that *surround* hypnosis are as important as any "trance logic" that arises *in* hypnosis.

Similarly, at the dawn of what might be called the "golden age" of hypnosis research, Sutcliffe published a pair of seminal papers that contrasted a credulous view of hypnosis, which holds that the mental states instigated by suggestion are identical to those that would be produced by the actual stimulus state of affairs implied in the suggestions, with a skeptical view that holds that the hypnotic subject is acting *as if* the world were as suggested (Sutcliffe, 1960, 1961). This is, of course, a version of the familiar state-nonstate dichotomy, but Sutcliffe also offered a third view: that hypnosis involves a quasi-delusional alteration in self-awareness – an altered state of consciousness that is constructed out of the interaction between the hypnotist's suggestions and the subject's interpretation of those suggestions.

Thus, hypnosis is simultaneously a state of (sometimes) profound cognitive change, involving basic mechanisms of perception, memory, and thought, and a social interaction, in which hypnotist and subject come together for a specific purpose within a wider sociocultural context. A truly adequate, comprehensive theory of hypnosis will seek understanding in both cognitive and interpersonal terms. We do not yet have such a theory, but even if we did individual investigators would naturally emphasize one aspect, whether altered consciousness or social context, over the other in their work. The interindividual competition that is part and parcel of science as a social enterprise often leads investigators to write as if alterations in consciousness and social influence were mutually exclusive processes – which they simply are not.

Taken together with the null-hypothesis statistical tests that remain part and parcel of the experimental method, and a propensity for making strong rather than weak inferences from experimental data, investigators will often present evidence for one process as evidence against the other. But if there is one reason why hypnosis has fascinated successive generations of investigators, since the very dawn of psychology as a science, it is that hypnosis exemplifies the marvelous complexity of human experience, thought, and action. In hypnosis and elsewhere, comprehensive understanding will require a creative synthesis in the spirit of discovery, rather than the spirit of proof – a creative synthesis of *both-and*, as opposed to a stance of *either-or*.

Defining an Altered State

Part of the problem as well are the difficulties of defining precisely what we mean by an altered state of consciousness (Ludwig, 1966). Some theorists have argued that every altered state should be associated with a unique physiological signature, much as dreaming is associated with the absence of alpha activity in the EEG and the occurrence of rapid eye movements (REM). The lack of a physiological indicator for hypnosis, then, is taken as evidence that hypnosis is not a special state of consciousness after all. But of course, this puts the cart before the horse. Physiological indices are validated against self-reports: Aserinsky and Kleitman (1953) had to wake their subjects up during periods of REM and ask them if they were dreaming. As such, physiological correlates have no privileged status over introspective self-reports: Aserinsky and Kleitman were in no position to contradict subjects who said "no." It is nice when our altered states have distinct physiological correlates, but our present knowledge of mind-body relations is simply not sufficient to make such correlates a necessary part of the definition. After all, cognitive neuroscience has made very little progress in the search for the neural correlates of ordinary waking consciousness (Metzinger, 2000). How far in the future do the neural correlates of altered states of consciousness, like hypnosis, await?

In the final analysis, it may be best to treat hypnosis and other altered states of consciousness as *natural concepts*, represented by a prototype or one or more exemplars, each consisting of features that are only probabilistically associated with category membership, with no clear boundaries between one altered state and another, or between altered and normal consciousness (Kihlstrom, 1984). And because we cannot have direct knowledge of other minds, altered states of consciousness must also remain *hypothetical constructs*, inferred from a network of relations among variables that are directly observable (Campbell & Fiske, 1959; Garner, Hake, & Eriksen, 1956; Stoyva & Kamiya, 1968), much in the manner of a psychiatric diagnosis. From this point of view the diagnosis of an altered state of consciousness can be made with confidence to the extent that there is convergence among four kinds of variables:

1. *Induction Procedure*: Operationally, a special state of consciousness can be defined, in part, by the means employed to induce it – or, alternatively, as the output resulting from a particular input. Barber (1969) employed such an input-output definition as the sole index of hypnosis, largely ignoring individual differences in hypnotizability. At the very least, hypnosis would seem to require *both* a hypnotic induction *and* a hypnotizable individual to receive it. But in the case of very highly hypnotizable subjects, even the induction procedure may be unnecessary.
2. *Subjective Experience*: Introspective self-reports of changes in subjective experience would seem to be central to any altered state of consciousness. As noted earlier, the domain of hypnosis is defined by changes in perception, memory, and the voluntary control of behavior – analgesia, amnesia, the experience of involuntariness, and the like. If the hypnotist gives a suggestion – for example, that there is an object in the subject's outstretched hand, getting heavier and heavier – and the subject experiences nothing of the sort, it is hard to say that he or she has been hypnotized.
3. *Overt Behavior*: Of course, a reliance on self-reports has always made psychologists nervous, so another residue of radical behaviorism (the first was the reliance on operational definitions) is a focus on overt behavior. If a subject hallucinates an object in his outstretched hand, and feels it grow heavier and heavier, eventually his arm ought to drop down to his side. As noted earlier, individual differences in hypnotizability are measured in terms of the subject's publicly observable, overt, behavioral response to suggestions. But in this instance, the overt behavior is, to borrow a phrase from the *Book of Common Prayer*, an outward and visible sign of an inward and spiritual grace: It is a consequence of the subject's altered subjective experience. Behavioral response is of no interest in the absence of corresponding subjective experience. For this reason, requests for "honesty reports" (Bowers, 1967; Spanos & Barber, 1968) or other appropriate postexperimental interviews (Orne, 1971; Sheehan & McConkey, 1982) can help clarify subjects' overt behavior and serve as correctives for simple behavioral compliance.
4. *Psychophysiological Indices*: Because both self-reports and overt behaviors are under voluntary control, and thus subject to distortion by social-influence processes, hypnosis researchers have been interested in

psychophysiological indices of response – including, of course, various brain imaging techniques. Over the years, a number of such indices have been offered, including skin conductance and alpha activity, but these have usually proved to be artifacts of relaxation and not intrinsic to hypnosis. In retrospect, it was probably a mistake to expect that there would be any physiological correlates of hypnosis in general, following an induction procedure but in the absence of any specific suggestions (Maquet et al., 1999), because subjects can have a wide variety of experiences while they were hypnotized. Progress on this issue is more likely to occur when investigators focus on the physiological correlates of specific hypnotic suggestions – as in brain imaging work that shows specific changes in brain activity corresponding to hypnotic visual hallucinations (Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000) or analgesia (Rainville, Hofbauer, Bushnell, Duncan, & Price, 2002).

Hypnosis and Hysteria

At least since the late 19th century, interest in hypnosis has had its roots in the medical and psychiatric phenomenon known as *hysteria* (for historical overviews and detailed references, see Kihlstrom, 1994a; Veith, 1965). This term originated some 4,000 years ago in ancient Egyptian (and later Greek) medicine to refer to a variety of diseases thought to be caused by the migration of the uterus to various parts of the body. In the 17th century, the English physician Thomas Sydenham reformulated the diagnosis so that hysteria referred to physical symptoms produced by non-organic factors. In the 19th century, the concept of hysteria was refined still further, by Briquet, a French neurologist, to include patients with multiple, chronic physical complaints with no obvious organic basis (Briquet, 1859). Sometime later, Charcot noticed that the symptoms of hysteria mimicked those of certain neurological illnesses, especially those affecting tactile sensitivity, "special senses" such as vision and audition, and motor function. Charcot held that these symptoms, in turn, were the products of "functional" lesions in the nervous system produced by emotional arousal and suggestion.

Charcot's interest in hysteria passed to his protégé Pierre Janet, who held that the fundamental difficulty in hysteria was a restriction in awareness – such that, for example, hysterically deaf patients were not aware of their ability to hear and hysterically paralyzed patients were not aware of their ability to move (Janet, 1907). Like Charcot, Janet was particularly impressed by the apparently paradoxical behavior of hysterical patients, as exemplified by ostensibly blind individuals who nevertheless displayed visually guided behavior. Janet argued that these behaviors were mediated by mental structures called *psychological automatisms*. In his view, these complex responses to environmental events were normally accessible to conscious awareness and control, but had been "split off" from the normal stream of conscious mental activity by traumatic stress – a situation that Janet called *desaggregation*, or, in English translation, "dissociation."

Although the hegemony of Freudian psychoanalysis in psychiatry during the first half of the 20th century led to a decline of interest in the classical syndromes of hysteria, the syndrome as such was listed in the early (1952 and 1968) editions of the *Diagnostic and Statistical Manual for Mental Disorders* (*DSM*) published by the American Psychiatric Association. Beginning in 1980, more recent versions of *DSM* dropped the category "hysteria" in favor of separate listings of *dissociative disorders* – including psychogenic amnesia and multiple personality disorder – and *conversion disorder*, listed under the broader rubric of the somatoform disorders (Kihlstrom, 1992b, 1994a). As the official psychiatric nosology is currently constituted, only the functional disorders of memory (Kihlstrom & Schacter, 2000; Schacter & Kihlstrom, 1989) are explicitly labeled as dissociative in nature. However, it is clear that the conversion disorders also involve disruptions in conscious awareness and control (Kihlstrom, 1992b, 1994a; 2001a; Kihlstrom & Schacter, 2000; Kihlstrom, Tataryn, & Hoyt, 1993; Schacter & Kihlstrom, 1989). Renewed interest in the syndromes of hysteria, reconstrued in terms of dissociations affecting conscious awareness, was foreshadowed by Hilgard's "neodissociative" theory of divided consciousness, which re-established the link between hypnosis and hysteria (Hilgard, 1973b, 1977; see also Kihlstrom, 1979, 1992a; Kihlstrom & McGlynn, 1991).

Viewed from a theoretical perspective centered on consciousness, the dissociative disorders include a number of different syndromes all involving disruptions in the monitoring and/or controlling functions of consciousness that are not attributable to brain insult, injury, or disease (Kihlstrom, 1994a, 2001a). These syndromes are reversible, in the sense that it is possible for the patient to recover the lost functions. But even during the symptomatic phase of the illness, the patient will show evidence of intact functioning in the affected system, outside awareness. Thus, patients with psychogenic (dissociative) amnesia, fugue, and multiple personality disorder may show impaired explicit memory but spared implicit memory (Kihlstrom, 2001a; Schacter & Kihlstrom, 1989). In the same way, patients with conversion disorders affecting vision and hearing may show impaired explicit perception but spared implicit perception (Kihlstrom, 1992b; Kihlstrom, Barnhardt, & Tataryn, 1992). In light of these considerations, a more accurate taxonomy of dissociative disorders (Kihlstrom, 1994a) would include three subcategories of syndromes:

1. those affecting memory and identity (e.g., functional amnesia, fugue, and multiple personality disorder);
2. those affecting sensation and perception (e.g., functional blindness and deafness, analgesia, and tactile anesthesia);
3. those affecting voluntary action (e.g., functional weakness or paralysis of the limbs, aphonia, and difficulty swallowing).

Dissociative Phenomena in Hypnosis

As intriguing and historically important as the syndromes of hysteria and dissociation are, it is also true that they are very rare and for that reason (among others) have rarely been subject to controlled experimental investigation. However, beginning with Charcot's observation that hysterical patients are highly suggestible, a number of theorists have been impressed by the phenotypic similarities between the symptoms of hysteria and the phenomena of hypnosis. Accordingly, it has been suggested that hypnosis might serve as a laboratory model for hysteria (Kihlstrom, 1979; Kihlstrom & McGlynn, 1991; see also Oakley, 1999). In this way, study of alterations in consciousness in hypnosis might not just help us understand hypnosis, but also hysteria and the dissociative and conversion disorders as well. In this regard, it is interesting to note that hypnotically suggested limb paralysis seems to share neural correlates, as well as surface features, with conversion hysteria (Halligan, Athwal, Oakley, & Frackowiak, 2000; Halligan, Oakley, Athwal, & Frackowiak, 2000; Terao & Collinson, 2000).

Implicit Memory in Posthypnotic Amnesia

Perhaps the most salient alteration in consciousness observed in hypnosis is the one that gave hypnosis its name: posthypnotic amnesia. Upon termination of hypnosis, some subjects find themselves unable to remember the events and experiences that transpired while they were hypnotized – an amnesia that is roughly analogous to that experienced after awakening from sleeping. Posthypnotic amnesia does not occur in the absence of direct or implied suggestions (Hilgard & Cooper, 1965), and the forgotten memories are not restored when hypnosis is reinduced (Kihlstrom, Brenneman, Pistole, & Shor, 1985). Posthypnotic amnesia is so named because the subject's memory is tested in hypnosis, but hypnotic amnesia, in which both the suggestion and the test occur while the subject is hypnotized, has the same properties. Although posthypnotic amnesia typically covers events and experiences that transpired during hypnosis, it is also possible to suggest amnesia for events that occurred while the subject was not hypnotized (Barnier, 1997; Bryant, Barnier, Mallard, & Tibbits, 1999). Both features further distinguish posthypnotic amnesia from state-dependent memory (Eich, 1988).

In contrast to the amnesic syndrome associated with hippocampal damage, posthypnotic amnesia is temporary: On administration of a prearranged cue, the amnesia is reversed and the formerly amnesic subject is now able to remember the previously forgotten events (Kihlstrom & Evans, 1976; Nace, Orne, & Hammer, 1974) – although there is some evidence that a small residual amnesia may persist even after the reversibility cue has been given (Kihlstrom & Evans, 1977). Reversibility marks posthypnotic amnesia as a disruption of memory retrieval, as opposed to encoding or storage, somewhat like the temporary retrograde amnesias observed in individuals who have suffered concussive blows to the head (Kihlstrom, 1985; Kihlstrom & Evans, 1979). The difference, of course, is that posthypnotic amnesia is a functional amnesia – an abnormal amount of forgetting that is attributable to psychological factors, rather than to brain insult, injury, or disease (Kihlstrom & Schacter, 2000). In fact, as noted earlier, posthypnotic amnesia has long been considered to be a laboratory model of the functional amnesias associated with hysteria and dissociation (Barnier, 2002; Kihlstrom, 1979; Kihlstrom & McGlynn, 1991).

Probably the most interesting psychological research concerning posthypnotic amnesia concerns dissociations between explicit and implicit memory (Schacter, 1987), and posthypnotic amnesia is no exception. Following Schacter (1987), we can identify explicit memory with conscious recollection, as exemplified by performance on traditional tests of recall and recognition. By contrast, implicit memory refers to the influence of some past event on current experience, thought, and action in the absence of (or independent of) conscious recollection. Implicit memory, as exemplified by various sorts of priming effects observed in amnesic patients, is for all intents and purposes unconscious memory.

Early evidence that posthypnotic amnesia impaired explicit memory but spared implicit memory came from a pair of experiments by Kihlstrom (1980), which were in turn inspired by an earlier investigation by Williamsen and his colleagues (see also Barber & Calverley, 1966; Williamsen, Johnson, & Eriksen, 1965). Kihlstrom found that hypnotizable subjects, given an amnesia suggestion, were unable to recall the items in a word list that they had memorized during hypnosis. However, they remained able to use these same items as responses on free-association and category instance-generation tasks. Kihlstrom originally interpreted this as reflecting a dissociation between episodic and semantic memory – as did Tulving (1983), who cited the experiment as one of four convincing demonstrations of the episodic-semantic distinction. However, Kihlstrom also noted a priming effect on the production of list items as free associations and category instances, compared to control items that had not been learned; furthermore, the level of priming observed was the same as that shown by insusceptible subjects who were not amnesic for the word list.[2]

Spared priming during posthypnotic amnesia was subsequently confirmed by Spanos and his associates (Bertrand, Spanos, & Radtke, 1990; Spanos, Radtke, & Dubreuil, 1982), although they preferred to interpret the results in terms of the demands conveyed by test instructions rather than dissociations between explicit and implicit memory. Later, Dorfman and Kihlstrom (1994) bolstered the case for spared priming by correcting a methodological oversight in the earlier studies: The comparison of priming with free recall confounded explicit and implicit memory with the cue environment of the memory test. The dissociation between explicit and implicit memory was confirmed when a free-association test of priming was compared to a cued-recall test of explicit memory. Similarly, Barnier and her colleagues extended the dissociation to explicit and implicit memory for material learned outside as well as within hypnosis (Barnier, Bryant, & Briscoe, 2001).

Whereas most studies of implicit memory in the amnesic syndrome employ tests of repetition priming, such as stem and fragment completion, the studies just described employed tests of semantic priming, which cannot be mediated by a perceptual representation of the stimulus materials. However, David and his colleagues (David, Brown, Pojoga, & David, 2000) found that posthypnotic amnesia spared repetition priming on a stem-completion task. Similar results were obtained by Barnier et al. (2001). In an especially important twist, David et al. employed Jacoby's process dissociation paradigm (Jacoby, 1991) to confirm that the priming spared in posthypnotic amnesia is a reflection of involuntary unconscious memory, rather than either involuntary or voluntary conscious memory.[3] That is to say, the spared priming is a genuine reflection of implicit, or unconscious, memory.

With the benefit of hindsight, we can trace studies of implicit memory in posthypnotic amnesia at least as far as the classic work of Hull (Hull, 1933; Kihlstrom, 2004a), who demonstrated that posthypnotic amnesia impaired recall but had no effect on practice effects, savings in relearning, or retroactive interference (see further discussion below). Hull concluded merely that the forgetting observed in posthypnotic amnesia was "by no means complete" (p. 138) – much as Gregg (1979, 1982) later interpreted the evidence as reflecting the distinction dissociation between optional and obligatory aspects of memory performance. But we can now interpret the same evidence as illustrating a strong dissociation between explicit and implicit memory.

In addition to priming, the dissociation between explicit and implicit memory is revealed by the phenomenon of *source amnesia*, in which the subject retains knowledge acquired through some learning experience while forgetting the learning experience itself (Schacter, Harbluk, & McClachlan, 1984; Shimamura & Squire, 1987). Interestingly, source amnesia was first identified in the context of hypnosis (Cooper, 1966; Evans, 1979a,b, 1988; Evans & Thorne, 1966). Evans and Thorne (1966) found that some amnesic subjects retained world-knowledge that had been taught to them during hypnosis, (e.g., the color an amethyst turns when exposed to heat or the difference between the antennae of moths and butterflies), although they did not remember the circumstances in which they acquired this information. In a later study, Evans (1979a) showed that source amnesia did not occur in insusceptible subjects who simulated hypnosis and posthypnotic amnesia. Although the methodology of Evans' study has been criticized (Coe, 1978; Spanos, Gwynn, Della Malva, & Bertrand, 1988), most of these criticisms pertain to the real-simulating comparison and do not undermine the phenomenon itself. Along with the notion of demand characteristics (Kihlstrom, 2002a; Orne, 1962, 1973), source amnesia is one of the most salient examples of a concept developed in hypnosis research that has become part of the common parlance of psychological theory.[4]

Source amnesia might be interpreted as a form of implicit learning (Berry & Dienes, 1993; Reber, 1967, 1993; Seger, 1994). In line with the traditional definition of learning, as a relatively permanent change in behavior that occurs as a result of experience, we may define implicit learning as the acquisition of new knowledge in the absence *either* of conscious awareness of the learning experience *or* conscious awareness of what has been learned, *or* both. Although evidence for implicit learning can be construed as evidence for implicit memory as well (Schacter, 1987), we may distinguish between the two phenomena with respect to the sort of knowledge affected. In implicit memory, the memories in question are *episodic* in nature, representing more or less discrete episodes in the life of the learner. Memories are acquired in implicit learning as well, of course, but in this case we are concerned with new *semantic* and *procedural* knowledge acquired by the subject. When implicit and explicit learning are dissociated, subjects have no conscious access to the knowledge – in which case implicit learning counts as a failure of metacognition (Flavell, 1979; Metcalfe & Shimamura, 1994; Nelson, 1992,1996; Nelson & Narens, 1990; Reder, 1996; Yzerbyt, Lories, & Dardenne, 1998). Because the subjects in Evans' experiments were aware of what they had learned, though they were amnesic for the learning experience, source amnesia is better construed as an example of implicit memory.

Preserved priming on free-association and category-generation tasks, in the face of impaired recall, is a form of dissociation between explicit and implicit memory. Preserved learning, in the face of amnesia for the learning experience, is also a form of dissociation between explicit and implicit memory. But the case of posthypnotic amnesia is different, in at least three respects, from other amnesias in which these dissociations are observed. First, in contrast to the typical explicit-implicit dissociation, the items in question have been deeply processed at the time of encoding. In the priming studies, for example, the critical targets were not just presented for a single trial, but rather were deliberately memorized over the course of several study-test cycles to a strict criterion of learning (Dorfman & Kihlstrom, 1994; Kihlstrom, 1980). Second, the priming that is preserved is *semantic* priming, which relies on the formation during encoding and preservation at retrieval of a semantic link between cue and target. This priming reflects deep, semantic processing of a sort that cannot be mediated by a perceptual representation system. Third, the impairment in explicit memory is reversible: Posthypnotic amnesia is the only case I know where implicit memories can be restored to explicit recollection.

Taken together, then, these priming results reflect the unconscious influence of semantic representations formed as a result of extensive attentional activity at the time of encoding. The priming itself may be an automatic influence, but again it is not the sort that is produced by automatic processes mediated by a perceptual representation system.

Implicit Perception in Hypnotic Analgesia

In addition to their effects on memory, hypnotic suggestions can have very dramatic effects on the experience of pain (Hilgard & Hilgard, 1975; Montgomery, DuHamel, & Redd, 2000). Although hypnotic analgesia was supplanted by more reliable chemical analgesia almost as soon as its efficacy was documented in the mid-19th century, modern psychophysical studies confirm that hypnotizable subjects given suggestions for analgesia can experience considerable relief from laboratory pain (Faymonville et al., 2000; Hilgard, 1969; Knox, Morgan, & Hilgard, 1974). In fact, a comparative study found that, among hypnotizable subjects, hypnotic analgesia was superior not just to placebo but also to morphine, diazepam, aspirin, acupuncture, and biofeedback (Stern, Brown, Ulett, & Sletten, 1977). Although hypnosis can serve as the sole analgesic agent in surgery, it is probably used more appropriately as an adjunct to chemical analgesics, where it has been shown to be both effective and cost effective in reducing actual clinical pain (Lang, Benotsch et al., 2000; Lang, Joyce, Spiegel, Hamilton, & Lee, 1996).[5]

Hypnotic analgesia is not mediated by relaxation, and the fact that it is not reversed by narcotic antagonists would seem to rule out a role for endogenous opiates (Barber & Mayer, 1977; Goldstein & Hilgard, 1975; Moret et al., 1991; Spiegel & Albert, 1983). There is a placebo component to all active analgesic agents, and hypnosis is no exception; however, hypnotizable subjects receive benefits from hypnotic suggestion that outweigh what they or their insusceptible counterparts achieve from plausible placebos (McGlashan, Evans, & Orne, 1969; Stern et al., 1977). It has also been argued that hypnotized subjects employ such techniques as self-distraction, stress inoculation, cognitive reinterpretation, and tension management to reduce pain (Nolan & Spanos, 1987; Spanos, 1986b). Although there is no doubt that cognitive strategies can reduce pain, their success, unlike the success of hypnotic suggestions, is not correlated with hypnotizability and thus is unlikely to be responsible for the effects observed in hypnotizable subjects (Hargadon, Bowers, & Woody, 1995; Miller & Bowers, 1986, 1993).

Rather, Hilgard suggested that hypnotic analgesia entails a division of consciousness that prevents the perception of pain from being represented in conscious awareness (Hilgard, 1973b, 1977). In other words, verbal reports of pain and suffering reflect the conscious perception of pain, whereas physiological responses reflect the processing of pain processed outside of conscious awareness. Hilgard's "hidden observer" is both a metaphor for the subconscious perception of pain and a label for a method by which this subconscious pain can be accessed (Hilgard, Morgan, & Macdonald, 1975; Knox et al., 1974). Although it has been suggested that hidden observer reports are artifacts of experimental demands (Spanos, 1983; Spanos, Gwynn, & Stam, 1983; Spanos & Hewitt, 1980), Hilgard showed that both the overt and covert pain reports of hypnotized subjects differed from those given by subjects who are simulating hypnosis (Hilgard, Hilgard, Macdonald, Morgan, & Johnson, 1978; Hilgard, Macdonald, Morgan, & Johnson, 1978; see also Laurence, Perry, & Kihlstrom, 1983).

The division in consciousness in hypnotic analgesia, as proposed by Hilgard, would help explain one of the paradoxes of hypnotic analgesia, which is that it alters subjects' self-reports of pain but has little or no effect on reflexive, physiological responses to the pain stimulus (e.g., Hilgard & Morgan, 1975; Hilgard et al., 1974). One interpretation of this difference is that hypnotized subjects consciously feel the pain after all. However, we know on independent grounds that physiological measures are relatively unsatisfactory indices of the subjective experience of pain (Hilgard, 1969). From the perspective of neodissociation theory, the diminished self-ratings are accurate reflections of the subjects' conscious experience of pain, whereas the physiological measures show that the pain stimulus has been registered and processed outside of awareness – a registration that can be tapped by the hidden observer method.

The paradox of hypnotic analgesia can also be viewed through an extension of the explicit-implicit distinction from learning and memory to perception (Kihlstrom, 1996; Kihlstrom et al., 1992). Explicit perception refers to the conscious perception of a stimulus event, whereas implicit perception refers to the effect of such an event on the subject's ongoing experience, thought, and action in the absence of, or independent of, conscious awareness. Just as explicit and implicit memory can be dissociated in the amnesic syndrome and in posthypnotic amnesia, so explicit and implicit perception can be dissociated in "subliminal" perception (Marcel, 1983) or prosopagnosia (Bauer, 1984). In the case of hypnotic analgesia, explicit perception of the pain stimulus is reflected in subjects' self-reports of pain, whereas implicit perception is reflected in their physiological responses to the pain stimulus.

Implicit Perception in Hypnotic Deafness

Dissociations between explicit and implicit perception can also be observed in two other classes of hypnotic phenomena. In hypnotic *esthesia*, the subject experiences a marked reduction in sensory acuity: Examples include hypnotic deafness, blindness, and tactile anesthesia. In *hypnotic negative hallucinations*, the subject fails to perceive a particular object (or class of objects) in the environment, but otherwise retains normal levels of sensory function (hypnotized subjects can experience positive hallucinations as well, perceiving objects that are not actually present in their sensory fields). Although the hypnotic esthesias mimic sensory disorders, the content-specificity of the negative hallucinations marks them as more perceptual in nature.

Careful psychophysical studies, employing both magnitude-estimation (Crawford, Macdonald, & Hilgard, 1979) and signal-detection (Graham & Schwarz, 1973) paradigms, have documented the loss of auditory acuity in hypnotic deafness.

Nevertheless, as is the case in posthypnotic amnesia and hypnotic analgesia, subjects experiencing these phenomena show through their behavior that stimuli in the targeted modality continue to be processed, if outside of awareness. For example, Hilgard's hidden observer has also been observed in hypnotic deafness (Crawford et al., 1979). Hypnotically deaf subjects continue to manifest speech dysfluencies when subjected to delayed auditory feedback (Scheibe, Gray, & Keim, 1968; Sutcliffe, 1961) and in the case of unilateral deafness show substantial numbers of intrusions from material presented to their deaf ear (Spanos, Jones, & Malfara, 1982). Nor does hypnotic deafness abolish the "beats" produced by dissonant tones (Pattie, 1937) or cardiovascular responses to an auditory conditioned stimulus (Sabourin, Brisson, & Deschamb, 1980).

Spanos and Jones (Spanos et al., 1982) preferred to interpret their findings as revealing that hypnotically deaf subjects heard perfectly well, but Sutcliffe (1960, 1961) offered a more subtle interpretation. In his view, the persisting effects of delayed auditory feedback certainly contradicted the "credulous" view that hypnotic deafness was identical to the actual stimulus state of affairs that might arise from damage to the auditory nerve or lesions in the auditory projection area – or, for that matter, the simple absence of an auditory stimulus (Erickson, 1938a,b). But instead of drawing the "skeptical" conclusion that hypnotized subjects were engaged in mere role-playing activity, Sutcliffe suggested that they were deluded about their experiences – that is, that they believed that they heard nothing, when in fact they did. Sutcliffe's emphasis on delusion can be viewed as an anticipation of Hilgard's (1977) neodissociation theory of divided consciousness, where the subjects' delusional beliefs reflect their actual phenomenal experience, and the evidence of preserved hearing reflects something like implicit perception.

Only one study has used priming to examine implicit perception in hypnotic deafness. Nash and his colleagues found that hypnotic deafness reduced the likelihood that subjects would select, from a visually presented array, words that were phonetically (but not semantically) similar to words that had been spoken to them (Nash, Lynn, Stanley, & Carlson, 1987). Because the hypnotic subjects selected *fewer* such words compared to baseline control subjects, this counts as an instance of negative phonological priming, and thus of implicit perception as well.

Implicit Perception in Hypnotic Blindness

Similar paradoxes are observed in the visual domain. Inspired by an earlier experimental case study of hypnotic blindness (Brady, 1966; Brady & Lind, 1961; see also Bryant & McConkey, 1989d; Grosz & Zimmerman, 1965), Sackeim and his colleagues (Sackeim, Nordlie, & Gur, 1979) asked a hypnotically blind subject to solve a puzzle in which the correct response was indicated by the illumination of a lamp. Performance was significantly *below* chance. Bryant and McConkey (1989a,b) conducted a similar experiment, with a larger group of subjects, generally finding *above*-chance performance. The difference in outcomes may reflect a number of factors, including the subjects' motivation for the experiment and individual differences in cognitive style (Bryant & McConkey, 1990a,b,c), but either outcome shows that the visual stimulus was processed by the hypnotically blind subjects.

Dissociations between explicit and implicit perception are also suggested by a series of studies by Leibowitz and his colleagues, who found that ablation of the background did not affect perception of the Ponzo illusion (Miller, Hennessy, & Leibowitz, 1973) and that suggestions for tubular (tunnel) vision had no effect on the size-distance relation (Leibowitz, Lundy, & Guez, 1980) or on illusory feelings of egomotion (roll vection) induced by viewing a rotating object (Leibowitz, Post, Rodemer, Wadlington, & Lundy, 1980). These experiments are particularly interesting because they make use of a class of perceptual phenomena known as *perceptual couplings*, which are apparently inviolable links between one perceptual organization and another (Epstein, 1982; Hochberg, 1974; Hochberg & Peterson, 1987; Peterson & Hochberg, 1983). If an observer sees two lines converging in a distance, he or she must see two identical horizontal bars arranged vertically along these lines as differing in length. In the Miller et al. study, ablation of the converging lines is a failure of explicit perception, but the persistence of the perceptually coupled Ponzo illusion indicates that they have been perceived implicitly.

Perceptual couplings also seem to be involved in the finding of Blum and his colleagues that hypnotic ablation of surrounding stimuli did not alter either the magnitude of the Titchener-Ebbinghaus illusion (Blum, Nash, Jansen, & Barbour, 1981) or the perception of slant in a target line (Jansen, Blum, & Loomis, 1982). They are also implicated in the observation that hypnotic anesthesia of the forearm does not affect perceptual adaptation of the pointing response to displacing prisms (Spanos, Dubreuil, Saad, & Gorassini, 1983; Spanos, Gorassini, & Petrusic, 1981; Spanos & Saad, 1984). The subjects may not feel their arms moving during the pointing trials, but the fact that adaptation occurs indicates that the kinesthetic information has been processed anyway.[6]

Although the evidence from perceptual couplings is consistent with the notion of spared implicit perception, only two studies have used priming methodologies to seek evidence of unconscious vision in hypnotic blindness. Bryant and McConkey (1989a) showed subjects pairs of words consisting of a homophone and a disambiguating context word (e.g., *window-pane*), half under conditions of ordinary vision and half during hypnotically suggested blindness. On a later memory test, the subjects generally failed to recall words they had been shown while blind. On a subsequent test, however, when the words were presented auditorially, they tended to spell them in line with their earlier visual presentation (e.g., *pane* rather than *pain*). A subsequent study found a similar priming effect on word-fragment completion (Bryant & McConkey, 1994). In both cases, priming was diminished somewhat by hypnotic blindness compared to trials where the subjects saw the primes clearly, but any evidence of priming counts as evidence of implicit perception – and the magnitude of priming in both studies was substantial by any standards.

Color, Meaning, and the Stroop Effect

In addition to total (binocular or uniocular) or tubular blindness, hypnotic subjects can also be given suggestions for color blindness. Although some early research indicated that hypnotic colorblindness affected performance on the Ishihara test and other laboratory-based tests of color perception (Erickson, 1939), the claim has long been controversial (Grether, 1940; Harriman, 1942a,b), and the most rigorous study of this type found no effects (Cunningham & Blum, 1982). Certainly, hypnotically colorblind subjects do not show patterns of test performance that mimic those of the congenitally colorblind. Nor do hypnotic suggestions for colorblindness abolish Stroop interference effects (Harvey & Sipprelle, 1978; Mallard & Bryant, 2001). All of these results are consistent with the hypothesis that color is processed implicitly in hypnotically induced colorblindness, even if it is not represented in the subjects' phenomenal awareness.

However, hypnotic suggestions of a different sort may indeed abolish Stroop interference. Instead of suggesting that subjects were colorblind, Raz and his colleagues suggested that the color words were "meaningless symbols... like characters of a foreign language that you do not know... gibberish" (Raz, Shapiro, Fan, & Posner, 2002, p. 1157). The focus on meaning, rather than color, makes this suggestion more akin to the hypnotic agnosia (or, perhaps, alexia) studied by Spanos and his colleagues in relation to hypnotic amnesia (Spanos, Radtke et al., 1982). In contrast to the effects of suggested colorblindness, suggested agnosia completely abolished the Stroop interference effect. Subsequent research, employing a drug to induce cycloplegia and thus eliminate accommodation effects, ruled out peripheral mechanisms, such as visual blurring or looking away from the stimulus (Raz et al., 2003). However, preliminary fMRI research suggests that the reduced Stroop interference reflects a nonspecific dampening of visual information processing (Raz, Fan, Shapiro, & Posner, 2002) – a generalized effect of visual information processing, rather than an effect mediated at linguistic or semantic levels. This generalized effect on visual information processing may explain why Stroop interference did not persist as an implicit expression of semantic processing, despite the conscious experience of agnosia.

Implicit Emotion

Hypnotic suggestions can alter conscious emotion as well as perception and memory. In fact, the suggested alteration of emotion has been a technique for psychotherapy at least since the time of Janet (Ellenberger, 1970), and has played a role in hypnotic studies of psychodynamic processes (Blum, 1961, 1967, 1979; Reyher, 1967). Aside from its inclusion in an advanced scale of hypnotic susceptibility (Hilgard, 1965), the phenomenon and its underlying mechanisms have not been subject to much empirical study. However, more recent studies leave little doubt that hypnotic suggestions can alter subjects' conscious feeling states, just as they can alter their conscious percepts and memories (Bryant & McConkey, 1989c; Weiss, Blum, & Gleberman, 1987).

As with perception and memory, however, special interest attaches to the question of whether the "blocked" emotional responses can nevertheless influence the person's ongoing experience, thought, and action outside of conscious awareness. Until recently, the idea of unconscious emotion has generally been seen as a holdover from an earlier, more psychodynamically oriented period in the history of psychology. However, in an era where dissociations between explicit and implicit perception and memory are widely accepted as evidence of unconscious cognitive processing, there seems little reason to reject out of hand the prospect of dissociations between explicit and implicit emotion (Kihlstrom, Mulvaney, Tobias, & Tobis, 2000).[7] Kihlstrom et al. have proposed that, in the absence of self-reported emotion, behavioral and physiological indices of emotional response, such as facial expressions and heart rate changes, might serve as evidence of implicit, unconscious emotional responding. In fact, a study by Bryant and Kourch found that hypnotic suggestions for emotional numbing diminished self-reported emotional responses, but had no effect on facial expressions of emotion (Bryant & Kourch, 2001). Although this finding is suggestive of a dissociation between explicit and implicit expressions of emotion, two other studies found that emotional numbing diminished both subjective reports and facial expressions (Bryant & Mallard, 2002; Weiss et al., 1987). With respect to the dissociation between explicit and implicit emotion, then, the effects of hypnotically induced emotional numbing are currently uncertain.

Anomalies of Dissociation in Hypnosis

Most of the classic phenomena of hypnosis – amnesia, analgesia, and the like – appear to be dissociative in two related but different senses. In the first place, hypnotized subjects lack awareness of percepts and memories that would ordinarily be accessible to consciousness. This disruption in conscious awareness is the hallmark of the dissociative disorders encountered clinically, including "functional" amnesia and "hysterical" deafness. In the second place, these percepts and memories continue to influence the subject's ongoing experience, thought, and action outside awareness – creating dissociations between explicit and implicit memory, or explicit and implicit perception, similar to those that have now become quite familiar in the laboratory or neurological clinic. As Hilgard (1977) noted, it is as if consciousness has been divided, with one stream of mental life (e.g., a failure of conscious recollection) proceeding in phenomenal awareness while another stream (e.g., the implicit expression of memory encoding, storage, and retrieval) proceeds outside of awareness.

Co-Consciousness and Trance Logic

Sometimes, however, the suggested and actual state of affairs are both represented in conscious awareness, leading to a set of inconsistencies and paradoxes that Orne, in a classic paper, labeled "trance logic" (Orne, 1959). Orne defined trance logic as the "apparently simultaneous perception and response to both hallucinations and reality without any apparent attempts to satisfy a need for logical consistency" (p. 295) – or, as he often put it in informal conversation, "the peaceful coexistence of illusion and reality." For example, in the double hallucination, it is suggested that the subject will see and interact with a confederate sitting in a chair that is actually empty. When the subject's attention is drawn to the real confederate, who has been quietly sitting outside his or her field of vision, Orne reported that hypnotized subjects typically maintained both the perception of the real confederate and the hallucinations, exhibiting confusion as to which was the real confederate. Similarly, many subjects reported that they could see through the hallucinated confederate to the back of the armchair. Thus, the subjects were simultaneously aware of two mutually contradictory states of affairs, apparently without feeling the need to resolve the contradictions inherent in the experience.

Orne's initial report of trance logic was somewhat impressionistic in nature, but later investigators have attempted to study the phenomenon more quantitatively – with somewhat mixed results (Hilgard, 1972; R.F.Q. Johnson, 1972; Johnson, Maher, & Barber, 1972; McConkey, Bryant, Bibb, Kihlstrom, & Tataryn, 1990; McConkey & Sheehan, 1980; Obstoj & Sheehan, 1977; Sheehan, Obstoj, & McConkey, 1976). On the other hand, everyone who has ever worked with hypnotized subjects has seen the phenomenon. Although Orne (Orne, 1959) held the view that trance logic was a defining characteristic of hypnosis, this does not seem to be the case – not least because similar inconsistencies and anomalies of response can occur in ordinary imagination as well as in hypnosis (McConkey, Bryant, Bibb, & Kihlstrom, 1991). Spanos (Spanos, DeGroot, & Gwynn, 1987) suggested that the occurrence of trance logic was an artifact of incomplete response to the suggestion on the part of the subject, but this proposal seems to be based on the assumption that a "complete" image or hallucination would be tantamount to "the real thing" – the actual perceptual state of affairs produced by an adequate environmental stimulus. On the other hand, it may well be that the hallucination is quite complete, in the sense of being subjectively compelling to the person who experiences it – but the accompanying division of consciousness might be incomplete. In this case, trance logic reflects a kind of co-consciousness in which two different and mutually contradictory streams of mental activity – one perceptual, one imaginary – are represented simultaneously in phenomenal awareness.

Making the Unconscious Conscious

In the case of posthypnotic amnesia and hypnotic analgesia, as well as the hypnotic esthesias and negative hallucinations, it seems that hypnotized subjects are able to become unaware of percepts and memories that would ordinarily be represented in phenomenal awareness. In contrast, it has sometimes been suggested that hypnosis also has the opposite capacity – to enable subjects to become aware of percepts and memories that would not ordinarily be accessible to conscious introspection. For example, in *hypnotic hypermnesia* subjects receive suggestions that they will be able to remember events that they have forgotten. In *hypnotic age regression*, it is suggested that they will relive a previous period in their lives – an experience that is often accompanied by the apparent recovery of long-forgotten childhood memories.

Hypermnesia suggestions are sometimes employed in forensic situations, with forgetful witnesses and victims, or in therapeutic situations, to help patients remember traumatic personal experiences. Although field studies have sometimes claimed that hypnosis can powerfully enhance memory, these reports are mostly anecdotal in nature and generally fail to seek independent corroboration of the memories produced during hypnosis. Moreover, they have not been supported by studies run under laboratory conditions. A report by the Committee on Techniques for the Enhancement of Human Performance, a unit of the U.S. National Research Council, concluded that gains in recall produced by hypnotic suggestion were rarely dramatic and were matched by gains observed when subjects are not hypnotized (Kihlstrom & Eich, 1994; Nogrady, McConkey, & Perry, 1985). In fact, there is some evidence from the laboratory that hypnotic suggestion can interfere with normal hypermnesic processes (Register & Kihlstrom, 1987). To make things worse, any increases obtained in valid recollection can be met or exceeded by increases in false recollections (Dywan & Bowers, 1983). Moreover, hypnotized subjects (especially those who are highly hypnotizable) may be vulnerable to distortions in memory produced by leading questions and other subtle, suggestive influences (Sheehan, 1988).

Similar conclusions apply to hypnotic age regression (Nash, 1987). Although age-regressed subjects may experience themselves as children and may behave in a childlike manner, there is no evidence that they actually undergo either abolition of characteristically adult modes of mental functioning or reinstatement of childlike modes of mental functioning. Nor do age-regressed subjects experience the revivification of forgotten memories of childhood. Hypnotic age regression can be a subjectively compelling experience for subjects, but it is first and foremost an imaginative experience. As with hypnotic hypermnesia, any memories recovered during hypnotic age regression cannot be accepted at face value, in the absence of independent corroboration.

Some clinical practitioners have objected to these conclusions, on the ground that laboratory studies of memory generally lack ecological validity (Brown, Scheflin, & Hammond, 1998). In fact, one diary-based study did find some evidence that hypnosis enhanced the recovery of valid memory of actual personal experiences (Hofling, Heyl, & Wright, 1971). This study has not been replicated, however, and another study, also employing lifelike stimulus materials – a gangland assassination staged before an audience of law enforcement officers – found no advantage for hypnosis whatsoever (Timm, 1981). Perhaps not surprisingly, many legal jurisdictions severely limit the introduction of memories recovered through hypnosis, out of a concern that such memories may be unreliable and tainted by suggestion and inappropriately high levels of confidence. An abundance of caution seems to be appropriate in this instance, but in the present context it seems that hypnotic suggestion is better at making percepts and memories inaccessible to consciousness than it is at making unconscious percepts and memories accessible to phenomenal awareness.

Automaticity in Hypnosis

Even before the discovery of implicit memory and the rediscovery of "subliminal" perception, psychology's renewed interest in unconscious mental life was signalled by the general acceptance of a distinction between *automatic* and *controlled* mental processes. As a first approximation, automatic processes are executed unconsciously in a reflex-like fashion, whereas controlled processes are executed consciously and deliberately (Kihlstrom, 1987, 1994b). A popular example of automaticity is the Stroop color-word effect, in which subjects have difficulty naming the colors in which words are printed when the words themselves name a different color (MacLeod, 1991, 1992; Stroop, 1935). Despite the subjects' conscious intention to name the ink colors and to ignore the words, they automatically process the words anyway, and this processing activity interferes with the naming task.

According to traditional formulations (LaBerge & Samuels, 1974; Posner & Snyder, 1975; Schneider & Shiffrin, 1977; Shiffrin &

Schneider, 1977, 1984), automatic processes share five properties in common:

1. **Inevitable Evocation**: Automatic processes are necessarily engaged by the appearance of specific cues in the stimulus environment, independent of the person's conscious intentions.
2. **Incorrigible Execution**: Once invoked, automatic processes proceed unalterably to their conclusion and cannot be modified by conscious activity.
3. **Effortlessness**: The execution of an automatic process consumes little or no attentional resources and therefore does not interfere with other ongoing mental processes.
4. **Speed**: Automatic processes are executed rapidly, on the order of seconds or even fractions of a second – too quickly to be vulnerable to conscious control.
5. **Unavailability**: Perhaps because they consume no attentional resources, perhaps because they are fast, or perhaps because they are represented as procedural rather than declarative knowledge (Anderson, 1992), automatic processes are unconscious in the strict sense of being unavailable to conscious introspection *in principle*, and they can be known only by inference from performance data.

The Experience of Involuntariness in Hypnosis

As indicated at the outset of this chapter, there is much about hypnosis that appears to be automatic. Indeed, the experience of involuntariness – sometimes called the classic suggestion effect (Weitzenhoffer, 1974) – is part and parcel of the experience of hypnosis. Hypnotic subjects don't simply imagine heavy objects in their hands and allow their arms to lower accordingly. They outstretch their hands voluntarily, as an act of ordinary compliance with the hypnotist's instruction or request to do so, but when he or she starts giving the suggestion they *feel* the heaviness in their hands, their arms drop, as involuntary *happenings* rather than as voluntary *doings* (Sarbin & Coe, 1972). Not all responses to hypnotic suggestion are experienced as completely involuntary, but the experience is strongest among those who are most highly hypnotizable (Bowers, 1982; Bowers, Laurence, & Hart, 1988).

Automaticity lies at the heart of the "social cognitive" theory of hypnosis proposed by Kirsch and Lynn (Kirsch, 2000; Kirsch & Lynn, 1997, 1998b), which asserts that hypnotic behaviors are generated automatically by subjects' expectancies that they will occur – much in the manner of a self-fulfilling prophecy (Rosenthal & Rubin, 1978; Snyder & Swann, 1978). This view, in turn, is rooted in James's (1890) theory of ideomotor action (see also Arnold, 1946), which held that motor behavior was generated automatically by the person's idea of it. Conscious control over behavior, then, is accomplished by exerting conscious control over one's cognitive and other mental states; but once a subject attends to a particular idea, the resulting behavior occurs naturally.

Kirsch and Lynn's social cognitive, ideomotor theory of hypnosis is distinct from Spanos's "sociocognitive" approach (Spanos, 1986b), which holds either that subjects fabricate reports of involuntariness to convince the hypnotist that they are, in fact, deeply hypnotized (Spanos, Cobb, & Gorassini, 1985) or that certain features of the hypnotic context lead subjects to misattribute their responses to the hypnotist's suggestions, instead of to their own voluntary actions (Spanos, 1986a). Spanos's latter view, that the hypnotic experience of involuntariness is illusory, was also embraced by Wegner (2002; but see Kihlstrom, 2004b). Working from a neuropsychological perspective, Woody and Bowers have suggested that the experience of involuntariness is a genuine reflection of the effects of hypnosis on frontal-lobe structures involved in executive functioning (Woody & Bowers, 1994; Woody & Sadler, 1998).

On the other hand, it is possible that the hypnotic experience of involuntariness is illusory after all – though not for the reasons suggested by Spanos and Wegner. After all, as Shor noted, "A hypnotized subject is not a will-less automaton. The hypnotist does not crawl inside a subject's body and take control of his brain and muscles" (Shor, 1979b, p. 127). From the framework of Hilgard's neodissociation theory of divided consciousness (Hilgard, 1977; see also Kihlstrom, 1992a), the experience of involuntariness reflects an amnesia-like barrier that impairs subjects' conscious awareness of their own role in producing hypnotic responses. In this view, the hypnotic subject actively imagines a heavy object in his outstretched hand, and actively lowers his hand and arm as if it were heavy, but is not aware of doing so. Thus, the subject's behavior is technically voluntary in nature, but is experienced as involuntary – as occurring automatically – because the subject is unaware of his or her own role as the agent of the behavior. In other words, the apparent disruption of conscious control actually occurs by virtue of a disruption of conscious awareness – a proposal that (perhaps) gains credence from the dissociations between explicit and implicit memory and perception discussed earlier.

Automaticity in Posthypnotic Suggestion

Perhaps the most dramatic demonstration of apparent automaticity in hypnosis is posthypnotic suggestion, in which the subject responds after the termination of hypnosis to a suggestion administered while he or she was still hypnotized. On the group-administered HGSHS:A, for example, it is suggested that when the subjects hear two taps, they will reach down and touch their left ankles, but forget that they were instructed to do so. After the termination of hypnosis, many highly hypnotizable subjects will respond quickly to such a prearranged cue – without knowing why they are doing so or confabulating a reason, such as that they feel an itch. They may even be unaware that they are doing anything unusual at all.

Any suggested experience that can occur during hypnosis can also occur posthypnotically, provided that the subject is sufficiently hypnotizable. For this reason, posthypnotic suggestion has always been problematic for some views of hypnosis as an altered state of consciousness, because the phenomenon occurs after the hypnotic state has been ostensibly terminated. So far as we can tell, subjects do not re-enter hypnosis while they are responding to the posthypnotic suggestion. At least, they are not particularly responsive to other hypnotic suggestions during this time (Reyher & Smyth, 1971). We cannot say that hypnosis caused the behavior to occur, because the subjects are not hypnotized when they make their response. Nevertheless, some alteration of consciousness has occurred, because at the very least they are not aware of what they are doing or why (Sheehan & Orne, 1968).

In the present context, posthypnotic suggestion is of interest because it seems to occur automatically in response to the prearranged cue (Erickson & Erickson, 1941). Certainly posthypnotic suggestion differs from ordinary behavioral compliance. Damaser (Damaser, 1964; see also Orne, 1969) gave subjects a posthypnotic suggestion to mail the experimenter one postcard per day, a control group received an ordinary social request to perform the same behavior, and a third group received both the posthypnotic suggestion and the social request. Surprisingly, the subjects who received the social request mailed more postcards than did those who received only the posthypnotic suggestion (see also Barnier & McConkey, 1999b). Apparently, those who agreed to the social request felt that they were under some obligation to carry it out, but those who received the posthypnotic suggestion carried it out only so long as they felt the urge to do so. This urge can be powerful: Subjects who fail to respond to a posthypnotic suggestion on an initial test appear to show a persisting tendency to perform the suggested behavior at a later time (Nace & Orne, 1970). Posthypnotic behavior can persist for long periods of time (Edwards, 1963), even after the posthypnotic suggestion has been formally canceled (Bowers, 1975).

Nevertheless, close examination shows that posthypnotic behavior does not meet the technical definition of automaticity, as it has evolved within cognitive psychology (Barnier, 1999). In the first place, posthypnotic suggestion fails the test of *inevitable evocation*. Except under special circumstances (Orne, Sheehan, & Evans, 1968), response to a posthypnotic suggestion declines markedly outside the experimental context in which the suggestion is originally given (Barnier & McConkey, 1998; Fisher, 1954; Spanos, Menary, Brett, Cross, & Ahmed, 1987). Moreover, like all other aspects of hypnosis, posthypnotic behavior depends intimately on the both the subject's interpretation of the hypnotist's suggestion and the context in which the cue appears (Barnier & McConkey, 1999a, 2001). It is in no sense reflexive in nature. Moreover, posthypnotic suggestion is not *effortless*. Subjects respond to simple posthypnotic suggestions more frequently than to complex ones (Barnier & McConkey, 1999c), suggesting that the activity makes demands on the subject's information-processing capacity. Responding to a posthypnotic suggestion interferes with responding to a waking instruction, even when the response requirements of the two tasks do not conflict (Hoyt & Kihlstrom, 1986). Thus, responding to a posthypnotic suggestion seems to consume more information-processing capacity than would be expected of a truly automatic process.

Posthypnotic suggestion does not appear to be an instance of automaticity, but it does appear to be an instance of prospective memory (Einstein & McDaniel, 1990), in which subjects must remember to perform a specified activity at some time in the future. Awareness of the posthypnotic suggestion does not seem to interfere with posthypnotic behavior (Barnier & McConkey, 1999c; Edwards, 1956; Gandolfo, 1971). But when accompanied by posthypnotic amnesia, posthypnotic behavior takes on some of the qualities of implicit memory. Even though subjects may forget the suggestion, the fact that they carry out the suggestion on cue shows clearly that the prospective memory has been encoded and influences subsequent behavior in the absence of conscious recollection.

Hypnosis in Mind and Body

Researchers have long been interested in biological correlates of hypnosis. In the 19th century, Braid likened hypnosis to sleep, whereas Pavlov considered it to be a state of cortical inhibition (Gauld, 1992). In the mid-20th century revival of interest in consciousness, some theorists speculated that hypnosis entailed an increase in high-voltage, low-frequency alpha activity in the EEG, though this proved to be an artifact of relaxation and eye closure (Dumas, 1977; Evans, 1979b). The discovery of hemispheric specialization, with the left hemisphere geared to analytic and the right hemisphere to nonanalytic tasks, coupled with the notion that the right hemisphere is "silent" or unconscious," led to the speculation that hypnotic response is somehow mediated by right-hemisphere activity (Bakan, 1969). Studies employing both behavioral and electrophysiological paradigms (e.g., MacLeod-Morgan & Lack, 1982; Sackeim, 1982) have been interpreted as indicating increased activation of the right hemisphere among highly hypnotizable individuals, but positive results have proved difficult to replicate (e.g., Graffin, Ray, & Lundy, 1995; Otto-Salaj, Nadon, Hoyt, Register, & Kihlstrom, 1992), and interpretation of these findings remains controversial.

It should be understood that hypnosis is mediated by verbal suggestions, which must be interpreted by the subject in the course of responding. Thus, the role of the left hemisphere should not be minimized (Jasiukaitis, Nouriani, Hugdahl, & Spiegel, 1995; Rainville, Hofbauer, Paus, Bushnell, & Price, 1999). One interesting proposal is that hypnotizable individuals show greater flexibility in deploying the left and right hemispheres in a task-appropriate manner, especially when they are actually hypnotized (Crawford, 2001; Crawford & Gruzelier, 1992). Because involuntariness is so central to the experience of hypnosis, it has also been suggested that the frontal lobes (which organize intentional action) may play a special role in hypnosis, and especially in the experience of involuntariness (Woody & Bowers, 1994; Woody & Sadler, 1998). Along these lines, Farvolden and Woody have found that highly hypnotizable individuals perform relatively poorly on neuropsychological tasks that assess frontal-lobe functioning (Farvolden & Woody, 2004).

"Neutral" Hypnosis

Although most work on the neural correlates of hypnosis has employed psychophysiological measures such as the EEG and event-related potentials, it seems likely that a better understanding of the neural substrates of hypnosis may come from the application of brain imaging technologies (Barnier & McConkey, 2003; Killeen & Nash, 2003; Ray & Tucker, 2003; Woody & McConkey, 2003; Woody & Szechtman, 2003). One approach has been to scan subjects after they have received a hypnotic induction but before they have received any specific suggestions, on the assumption that such a procedure will reveal the neural correlates (if indeed any exist) of hypnosis as a generalized altered state of consciousness. For example, one PET study found that the induction of hypnosis generated widespread activation of occipital, parietal, precentral, premotor, and ventrolateral prefrontal cortex in the left hemisphere, and the occipital and anterior cingulate cortex of the right hemisphere – in other words, pretty much the entire brain (Maquet et al., 1999). At the same time, another PET study found that the induction of hypnosis was accompanied by increased activation of occipital cortex and decreases in the right inferior parietal lobule, left precuneus, and posterior cingulate (Rainville, Hofbauer et al., 1999). As is so often the case in brain imaging experiments, the difference in results may be due to differences in control conditions. Whereas Rainville et al. asked their hypnotized subjects simply to relax (Rainville, Hofbauer et al., 1999), Maquet et al. asked their subjects to review a pleasant life experience (Maquet et al., 1999).

Although the concept of "neutral" hypnosis has had its proponents (Kihlstrom & Edmonston, 1971), in subjective terms the state, such as it is, differs little from eyes-closed relaxation (Edmonston, 1977, 1981) and bears little resemblance to the dissociative and hallucinatory experiences associated with specific hypnotic suggestions. Moreover, it is unlikely that imaging subjects who are merely in neutral hypnosis and not responding to particular hypnotic suggestions will tell us much about the neural correlates of hypnosis, because the experiences of hypnotic subjects are so varied, depending on the suggestion to which they are responding. A more fruitful tack will likely involve imaging subjects while they are responding to particular hypnotic suggestions. Just as the neural correlates of NREM sleep differ from those of REM sleep (Hobson, Pace-Schott, & Stickgold, 2000), so the neural correlates of neutral hypnosis will differ from those of specific, suggested hypnotic phenomena.

Hypnotic Analgesia

Perhaps because of the added interest value that comes with clinical application, most brain imaging studies of hypnotic suggestions have focused on analgesia. A pioneering study using the ^{133}Xe technique found bilateral increases in the activation of the orbitofrontal region, as well as in somatosensory cortex, during analgesia compared to resting baseline and a control condition in which subjects attended to the pain (Crawford, Gur, Skolnick, Gur, & Benson, 1993). They suggested that these changes reflected the increased mental effort needed to actively inhibit the processing of somatosensory information. A more recent PET study implicated quite different regions, particularly the anterior cingulate cortex (ACC). However, this later study also employed quite a different procedure, modulating pain perception through a pleasant autobiographical reverie instead of a specific suggestion for analgesia (Faymonville et al., 2000).

Because the specific wording of suggestions is so important in hypnosis, perhaps the most interesting brain imaging studies of analgesia compared suggestions targeting sensory pain, which relates to the location and physical intensity of the pain stimulus, with suggestions targeting suffering, or the meaning of the pain (Melzack, 1975). Standard hypnotic suggestions for analgesia affect both sensory pain and suffering (Hilgard & Hilgard, 1975), but these two dimensions can also be dissociated by altering the specific wording of the suggestion (Rainville, Carrier, Hofbauer, Bushnell, & Duncan, 1999). Using hypnotic suggestions, Rainville and his colleagues have found that suggestions that alter the unpleasantness of a pain stimulus, without altering its intensity, are associated with changes in ACC but not in somatosensory cortex (Rainville, Duncan, Price, Carrier, & Bushnell, 1997; Rainville et al., 2002).

Hallucinations and Imagery

Brain imaging studies also bear on the relation between hypnotic hallucinations and normal imagery. On the surface, at least, imagery would seem to be a cognitive skill relevant to hypnosis, and some theorists sometimes write as if hypnosis were only a special case of a larger domain of mental imagery (for reviews, see Bowers, 1992; Glisky et al., 1995; Kunzendorf, Spanos, & Wallace, 1996; Sheehan, 1982). On the contrary, Szechtman and his colleagues found that hypnotized subjects experiencing suggested auditory hallucinations showed activation of the right ACC; this area was also activated during normal hearing, but not during auditory imagery (Szechtman, Woody, Bowers, & Nahmias, 1998). Interestingly, a parallel study found that schizophrenic patients also showed right ACC activation during their auditory hallucinations (Cleghorn et al., 1992). They suggested that activation of this region might cause internally generated thoughts and images to be confused with those arising from the external stimulus environment (Woody & Szechtman, 2000a,b). Another interpretation, based on the role of ACC in emotion, is that the activity in this region reflects affective arousal to experiences, whether perceptual or hallucinatory, which surprise the subject; mental images, being deliberately constructed by the subject, would not have this surprise value.

In another study, Kosslyn and his colleagues studied the modulation of color perception through hypnotic suggestion (Kosslyn et al., 2000). After PET imaging identified a region (in the fusiform area) that was differentially activated by the presentation of chromatic and gray-scale stimuli, these investigators gave suggestions to highly hypnotizable subjects that they would perceive the colored stimulus in gray scale, and the gray-scale stimulus as colored. The result was that the fusiform region was activated in line with subjects' perceptions – actual and hallucinated color or actual and hallucinated gray scale, independent of the stimulus. In contrast to nonhypnotic color imagery, which appears to activate only the right fusiform region (Howard et al., 1998), hypnotically hallucinated color activated both the left and right hemispheres. Taken together with the Szechtman et al. study (1998), these results suggest that hypnotic hallucinations are in at least some sense distinct from mental images.

Brain States and States of Consciousness

The controversy over the very nature of hypnosis has often led investigators to seek evidence of neural and other biological changes to demonstrate that hypnosis is "real" – or, alternatively, to debunk the phenomenon as illusion and fakery. For example, the lack of reliable physiological correlates of hypnotic response has been interpreted by Sarbin as supporting his role-enactment interpretation of hypnosis (Sarbin, 1973; Sarbin & Slagle, 1979). On the other hand, Kosslyn and his colleagues argued that the activity of the fusiform color area in response to suggestions for altered color vision "support the claim that hypnosis is a psychological state with distinct neural correlates and is not just the result of adopting a role" (Kosslyn et al., 2000, p. 1279).

Neither position is quite correct. Physiological correlates are nice when they exist, and they may enable otherwise skeptical observers to accept the phenomena of hypnosis as real. But such correlates are neither necessary nor sufficient to define an altered state of consciousness. In the final analysis, consciousness is a psychological construct, not a biological one, and can only be defined at a psychological level of analysis. The phenomena of hypnosis – amnesia, analgesia, positive and negative hallucinations, and the like – obviously represent alterations in conscious perception and memory. The neural correlates of these phenomena are a matter of considerable interest, but they are another matter entirely.

At the same time, the phenomena of hypnosis seem to offer a unique vantage point from which consciousness and its neural correlates can be studied, because they remind us that consciousness is not just a matter of attention and alertness. Mental states are also a matter of *aboutness*: They have intentionality, in that they refer to objects that exist and events that occur in the world outside the mind. Hypnotized subjects are conscious, in the sense of being alert and attentive, but when certain suggestions are in effect they are not conscious *of some things* – of some event in the past or some object in their current environment. The fact that percepts and memories can be explicit or implicit means that mental states themselves can be conscious or unconscious.

The phenomena of hypnosis remind us that there is a difference between being aware of something explicitly and being unaware of something that nonetheless, implicitly influences our ongoing experience, thought, and action. Almost uniquely, hypnosis allows us to create, and reverse, dissociations between the explicit and the implicit – between the conscious and the unconscious – at will in the laboratory. The difference between implicit and explicit percepts and memories, then, is the difference that makes for consciousness. And the neural correlates of that difference are the neural correlates of consciousness.

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Notes

1. This was true even before hypnosis received its name (Braid, 1843; Gravitz & Gerton, 1984; Kihlstrom, 1992c) – and for that matter even before that, the status of hypnosis as an altered organismal state was controversial. In the 18th century, Mesmer thought his "crises" were induced by animal magnetism, but the Franklin Commission chalked them up to mere imagination (Kihlstrom, 2002b). In the 19th century, Charcot thought that hypnosis was closely related to hysteria and to neurological disease, whereas Liebeault and Bernheim attributed its effects to simple suggestion. Perhaps because he was writing in the heyday of functional behaviorism, Hull (1933) did not confront the "state-nonstate" issue: For him, hypnosis was an intrinsically interesting phenomenon that psychology ought to be able to explain (Kihlstrom, 2004a).
2. Lacking the explicit-implicit distinction subsequently introduced by Schacter (see also Graf & Schacter, 1985; Schacter, 1987; Schacter & Graf, 1986), Kihlstrom noted simply that the priming represented "a residual effect of the original learning episode on a subsequent task involving retrieval from 'semantic' memory" (p. 246), that it "took place outside of phenomenal awareness," and that it was "similar to one which occurs in patients diagnosed with the amnesic syndrome" (p. 246). A similar interpretation appeared in 1985 (Kihlstrom, 1985), in a paper that had been written in 1984, and the relevance of the explicit-implicit distinction was made explicit (sorry) in 1987 (Kihlstrom, 1987).
3. Interestingly, David et al. obtained a similar pattern of results for directed forgetting in the normal waking state. Posthypnotic amnesia and directed forgetting are both examples of retrieval inhibition (Anderson & Green,

2001; Anderson et al., 2004; Geiselman, Bjork, & Fishman, 1983; Levy & Anderson, 2002), but the two paradigms generally differ greatly in other respects (Kihlstrom, 1983); for example, the role of incidental or intentional learning, the amount of study devoted to the items, the temporal location of the cue to forget. the retention interval involved, and the means by which memory is measured – as well as the degree to which the to-be-forgotten items are actually inaccessible, whether the forgetting is reversible, and the extent of interference between to-be-forgotten and to-be-remembered items.

4. Source amnesia is a failure of source monitoring (Johnson, Hashtroudi, & Lindsay, 1993), a process that in turn is closely related to reality monitoring (Johnson & Raye, 1981). It probably lies at the heart of the experience of *déjà vu* (Brown, 2003). As noted by Evans and Thorne (1966), their work had been anticipated by Banister and Zangwill (1941a,b) who used hypnotic suggestion to produce visual and olfactory "paramnesias" in which subjects recognize a previously studied item but confabulate the context in which it has been studied.
5. A thorough discussion of experimental and clinical research on hypnotic analgesia is beyond the scope of this chapter. Interested readers may wish to consult Kihlstrom (2000, 2001b).
6. Note, however, Wallace and his colleagues have found that hypnotic anesthesia actually abolishes prism adaptation, so this finding remains in some dispute (Wallace, 1980; Wallace & Fisher, 1982, 1984a,b; Wallace & Garrett, 1973, 1975).
7. McClelland and his colleagues have made a distinction between explicit (conscious) and implicit (unconscious) motivation, as well (McClelland, Koestner, & Weinberger, 1989), but to date there have been no studies of hypnosis along these lines.

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