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Hypnosis and Cognition

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This article summarizes the contributions of hypnosis to our understanding of cognition. These contributions have been especially salient in the study of memory, and include source amnesia and the distinction between episodic and semantic memory; the occurrence of semantic priming in implicit (unconscious) memory; and paramnesia (false memory). Posthypnotic amnesia shows that explicit and implicit memory can be dissociated even under optimal encoding conditions. The hypnotic alterations of perception may expand the scope of central executive control over "low-level" sensory and perceptual processes, and offer a new perspective on perceptual couplings. Implicit (unconscious) perception in hypnosis is not subject to the same analytic limitations encountered in masked priming. In the study of "high-level" thought processes, hypnosis has played an important role in understanding the formation of delusional beliefs, and of intuitions in problem-solving. Studies of hypnosis suggest that automatic processes can be "de-automatized," as in the reversal of Stroop interference by suggestions for hypnotic agnosia. In social cognition, Orne's analysis of demand characteristics laid the foundations for the cognitive revolution in social psychology, by underscoring the status of subjects—and people outside the laboratory—as active, sentient, problem-solving agents. The search for correlates of hypnotizability led to the incorporation of openness to experience as a major cognitive dimension in the structure of personality. One topic for future research is the relationship between hypnotizability in children and their development of a theory of mind. Studies of hypnosis in children may shed new light on the development of the imagination.

Keywords: hypnosis, implicit memory, implicit perception, intuition, automaticity

Throughout the history of psychology, researchers of many different theoretical stripes have found hypnosis to be intrinsically interesting. This interest only seems natural. In response to the suggestions of the hypnotist, hypnotizable subjects appear to lose control over voluntary motor activities; they do not feel pain or touch, they go deaf or blind; they hear voices speaking to them that no one else hears; they fail to see things that are right in front of them; they feel like children again; they fail to recognize objects that are objectively familiar to them; they emerge from hypnosis unable to remember what they did while they were hypnotized; and when the hypnotist gives a prearranged cue, they carry out some activity that had been suggested to them earlier, without knowing what they are doing or why. Hypnosis is one of the few things you can do in a laboratory that both experimenter and subject find enjoyable.

Early in its history, hypnosis was little more than a phenomenon to be studied with the laboratory methods of the then-new science of psychology, the primary goal being to determine the limits of hypnotic suggestions—as in the pioneering research of Young (1927). This was also, in large part, the view of Hull (1933), who simply assumed that hypnosis was a "habit phenomenon" that improved with practice. In much the same way, the "Golden Age" of modern hypnosis research, which ran from the late 1950s into the 1990s, was primarily concerned with applying established paradigms and theories to the understanding of hypnotic phenomena. To be sure, the Golden Age investigators had theories about hypnosis; but for the most

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part they had methods to match their curiosity about an intrinsically interesting phenomenon.

At the same time, the project of understanding hypnosis in terms of what was already known coexisted with another project, which was to study hypnosis for the unique light it might shed on mind and behavior. This second project has an even longer history, reaching back to the clinical work of Charcot and Janet, where hypnosis served as a laboratory model for understanding the mysteries of hysteria (Kihlstrom, 1979; for additional coverage of hypnosis and psychopathology, see the article by Barnier, Cox, and McConkey in this issue, Barnier, Cox, & McConkey, 2014). Similarly, William James devoted an entire chapter of the *Principles of Psychology* (James, 1890/1980) to hypnosis, precisely because he thought that the new scientific psychology could benefit from the insights it provided (Kihlstrom & McConkey, 1990). James's interest in hypnosis had its origins in his interest in the will, and he thought that hypnosis could shed unique light on how ideas, in the form of suggestions, generated action, in the form of hypnotic behaviors. Additionally, of course, James was interested in consciousness. He thought that consciousness and thinking were identical, and that unconscious thought was a kind of oxymoron. Still, he was persuaded by Janet's observations, and his own, that in hypnosis things could be unconsciously felt but not consciously perceived, and that mental activity could be divided into multiple streams, only one of which was accessible to phenomenal awareness at any given time.

In the years since James, Young, and Hull, hypnosis has offered much to psychological theory, and particularly to our understanding of consciousness (Kihlstrom, 2007). In this article, I focus on the contributions of hypnosis to our understanding of various aspects of cognition, broadly construed to include social cognition and cognitive development. For coverage of hypnosis and cognitive neuroscience, see Kihlstrom (2013a) and the article in this issue by Halligan and Oakley (2014).

Memory

Posthypnotic amnesia gave hypnosis its name (Kihlstrom, 1992b), and so it is proper that a discussion of the contributions of hypnosis to our understanding of cognition begin with memory (Kihlstrom, 1997a). In this respect, pride of place goes to *source amnesia*; a phenomenon of considerable interest to cognitive psychologists and cognitive neuroscientists, which was initially discovered, and named, in the context of hypnosis (Evans, 1979; Evans & Thorne, 1966). Under the guise of a test of general information, Evans and Thorne (1966) taught subjects obscure facts, followed by a standard suggestion for posthypnotic amnesia. When the subjects came out of hypnosis, they had little memory for the things they had done while hypnotized, including the general-information test. However, when asked about the topics tested earlier, a substantial portion of these otherwise amnesic subjects nonetheless answered correctly. Further, when asked where they had acquired the information, they either said that they did not know, or they confabulated the source of their knowledge—hence the label.

Evans's observations were inspired, in turn, by even earlier observations on hypnotically induced paramnesia by Banister and Zangwill (1941a, 1941b). In these experiments, amnesic subjects recognized items that had previously been presented to them during hypnosis, but confabulated the context in which they had encountered them. Evans's observation was somewhat controversial within some hypnosis circles (Spanos, Gwynn, Della Malva, & Bertrand, 1988; Wagstaff, 1981), but later similar observations were made on neurological patients with amnesia (Schacter, Harbluk, & McClachlan, 1984; Shimamura & Squire, 1987, 1991) and normal aging memory (Glisky, Rubin, & Davidson, 2001). Source amnesia is now firmly established as a phenomenon of memory—an example of what might be called *the irony of self-reports*, which is that too many psychologists take self-reports seriously only when they are made by people who are brain-damaged.

Source amnesia is commonly interpreted as revealing a dissociation between two different forms of memory, episodic and semantic. Aside from discriminating between short-term and long-term memory, the earliest cognitive theories considered memory to be a unitary storage system (Atkinson & Shiffrin, 1968). Later theoretical developments, however, drew further distinctions between declarative (fact-based) and procedural (rule-based) memory, and then

between two forms of declarative memory, episodic and semantic. Much of the evidence for these structural distinctions in long-term memory was derived from studies of amnesia, including posthypnotic amnesia. For example, Tulving (1983) cited a study of posthypnotic amnesia (Kihlstrom, 1980) as one of four experiments demonstrating the distinction between episodic and semantic memory. In this experiment, subjects memorized a list of words during hypnosis, and then received a suggestion for posthypnotic amnesia. "Virtuoso" hypnotic subjects showed a dense amnesia for the studied wordlist, but they were still able to use list items as responses in word-association and category-generation tasks. Thus, posthypnotic amnesia affected episodic memory for the memorized wordlist, but spared semantic memory for the words themselves. If truth be told, this particular dissociation had been observed before (Barber & Calverley, 1966; Williamsen, Johnson, & Eriksen, 1965), but in the context of earlier "unistore" theories of memory, its relevance to broader questions of cognitive architecture went unnoticed.

More important, however, the subjects in this experiment were *more* likely to respond with list items to word-association or category-generation stimuli, compared with control items that they had never studied at all; and this was true even for the subjects who were amnesic for the list. This "priming" effect had not been noted in the earlier experiments, but it has since been replicated and extended (Barnier, Bryant, & Briscoe, 2001; David, Brown, Pojoga, & David, 2000). Priming effects were already familiar in the study of semantic memory, and had served as a basis for various theories of spreading activation, but the significance of priming in various forms of amnesia was not yet fully appreciated. Only later did we come to understand that spared priming in amnesia could be an instance of what would come to be called *implicit memory* (Schacter, 1987; Schacter et al., 1984)—that is, as an expression of unconscious memory.

Although posthypnotic amnesia did not play a prominent role in the discovery of implicit memory, it nonetheless sheds unique light on the nature of the phenomenon. Almost all studies of implicit memory, whether in brain-damaged patients or neurologically intact subjects, have used a *repetition* priming paradigm in which the cue presented on the priming test is wholly or partly a recapitulation of the physical stimulus presented for initial study. For example, a subject might study the word *ashcan* and then be asked to complete the stem *ash*___ with a legal English word. Repetition priming is observed when the subject completes the stem with *ashcan* as opposed to some other possibility, such as *ashtray*. Spared repetition priming supported a number of competing hypotheses about implicit memory: for example, that it was mediated by a perceptual representation system (Schacter, 1990); by perceptually driven processing (Roediger, Weldon, & Challis, 1989); or by spared automatic processing (Jacoby, 1991). The problem for these approaches is that the spared priming observed in posthypnotic amnesia includes not only repetition priming but also semantic priming. In the original experiment, for example, subjects who memorized a word like *girl* during the study phase were presented with a word like *boy* as a cue for free association; or they studied a word like *foot*, and were cued to generate instances of the category *human body part*. Such priming effects are not based on physical similarity between cue and target; rather, they are based on semantic relatedness (McNamara, 2005).

Semantic priming cannot be mediated by a perceptual representation system that does no more than create a representation of the physical attributes of a stimulus, and it cannot be mediated by perceptually driven processing; nor, for that matter, can it be a product of automatic processing, so long as automatic processing is confined to low-level "perceptual" analyses of physical appearance. Therefore, to the extent that semantic priming occurs in the absence of conscious recollection (whether by virtue of brain damage or something else), theories of implicit memory that focus on perceptual representations, perceptually driven processing, and the like must be incomplete. Unfortunately, those investigators who study implicit memory have hardly ever used semantic priming paradigms. There are exceptions (Blaxton, 1989; Gardner, Boller, Moreines, & Butters, 1973), including some (but not all) studies of source amnesia, but these are very few in number.

Posthypnotic amnesia also underscores other features of priming that would be of considerable relevance to theories of implicit memory. For example, most demonstrations of implicit

memory, whether in amnesic patients or normal subjects, have used rather impoverished encoding conditions—either by virtue of brain damage (as in the case of the amnesic syndrome, electroconvulsive shock, or dementia), normal aging, or "shallow" processing by college students. However, in the hypnotic case the amnesia affecting explicit memory is not a result of impoverished encoding. In the first place, posthypnotic amnesia is reversible, marking it as a product of retrieval factors, rather than encoding or storage. In the second place, posthypnotic amnesia can be suggested for materials that have been deeply processed by subjects during the course of deliberate memorization—invoking the elaborative and organizational activity that forces subjects to go beyond perceptually driven processing and perceptual representations. Memories can be rendered unconscious by processes that operate after deep encoding, affecting the accessibility of stored traces. This is an instance where attention to the findings from the hypnosis laboratory might well have led implicit memory researchers to overcome the kind of methodological tunnel vision that led them to focus almost exclusively on shallow processing and repetition priming, to the detriment of a comprehensive theory of unconscious memory.

Enhanced memory, or hypermnesia, has also been claimed for hypnosis. In contrast to posthypnotic amnesia, however, empirical evidence for hypnotic hypermnesia has never been particularly convincing. There is no evidence that hypnotic suggestions enhance memory, over and above the hypermnesia that occurs naturally in the normal waking state (Register & Kihlstrom, 1987, 1988); and there are good reasons to be concerned that hypnotic suggestions can enhance retrieval biases that induce false recollections (Kihlstrom, 1994). False recollection, along with other sins of commission (Schacter, 1999), illustrates the reconstructive nature of memory (Bartlett, 1932).

False memory was not discovered in hypnosis (Loftus, 1974; Roediger, 1996), but many psychotherapists resorted to hypnosis to stimulate the recovery of ostensibly "repressed," "dissociated," or otherwise forgotten memories of sexual abuse and other childhood traumas, causing considerable difficulty when these memories proved to be unverifiable, unreliable, or outright wrong. There is some irony here, because the articulation of "neodissociation" theories of hypnosis (Hilgard, 1977; Kihlstrom, 1992a), inadvertently lent credence to the idea that traumatic memories could be blocked from consciousness, but still affect a person's experience, thought, and action in the form of "body memories" and the like (Kihlstrom, 1996b, 1997b). However, careful research has undercut this aspect of clinical lore: if anything, traumatic memories are likely to be *better* remembered than ordinary ones (Kihlstrom, 2006; McNally, 2003). In this respect, the contribution of hypnosis was to vividly underscore the problems, in psychotherapy and the courtroom, created by the reconstructive nature of memory (for fuller coverage, see the article in this issue by Mazzoni, Laurence, & Heap [2014]).

Returning to the positive side of the ledger, a series of experiments by Bower and his colleagues revealed the role of emotion in memory, such as mood-congruent encoding and retrieval (Bower, Monteiro, & Gilligan, 1978; Bower, Gilligan, & Monteiro, 1981). These studies helped return emotion to the attention of cognitive psychologists, and helped set the stage for what has become an "affective revolution" (or, perhaps, a counterrevolution) in psychology.

Sensation and Perception

Hypnotic suggestion can also dramatically alter sensation and perception, although these effects have not drawn as much attention from experimental psychologists as the effects on memory have. The salient exception is hypnotic analgesia, which has been well-studied in both the laboratory (Hilgard, 1969) and the clinic (Hilgard & Hilgard, 1975), and has enjoyed considerable practical application (Jensen & Patterson, 2014). Hilgard's studies of hypnotic analgesia also gave rise to the idea that consciousness could be divided without resort to commissurotomy—a major milestone in the "consciousness revolution" that occurred in cognitive psychology beginning in the late 1970s (Hilgard, 1977).

As with hypnotic hypermnesia, some authorities have long asserted that hypnotic suggestion could improve sensory acuity, especially in vision or audition. Early studies along these lines suffered from a number of methodological problems (Raz, Marinoff, Zephrani, Schweizer, & Posner, 2004). However, a later study by

Graham and Leibowtiz (Graham & Leibowitz, 1972) took considerable care to rule out peripheral changes, and a further study by Sheehan et al. confirmed these findings using signal-detection methods (Sheehan, Smith, & Forrest, 1982; Smith, Forrest, & Sheehan, 1983). Even though these changes occur only subjects who are myopic in the first place, if confirmed they would illustrate the role of central, "top-down" processes on even low-level sensory functions.

The hypnotic alterations in perception, including both positive and negative hallucinations, are also relevant to the problem of perceptual couplings. These are apparently inviolable links between one perceptual organization and another (Epstein, 1982; Hochberg, 1981; Kihlstrom, Barnhardt, & Tataryn, 1992). In the Ponzo (railroad tracks) illusion, for example, seeing lines converging in the distance forces the observer to see horizontal bars that cross the converging lines to be unequal in length. Perceptual couplings illustrate the role of unconscious inferences in perception, and thus, are highly relevant to the debate between "constructivist" and "ecological" views of perception. A number of studies indicate that one coupled element is not abolished when the other is covered by a suggested negative hallucination (Jansen, Blum, & Loomis, 1982; Miller, Hennessy, & Leibowitz, 1973). This does not always happen, though (Blum, Nash, Jansen, & Barbour, 1981), so the fate of perceptual couplings needs to be straightened out. The result might well indicate whether the inferences (or computations) that generate the coupled element must be performed on a conscious percept.

Negative alterations of perception, including the sensory anesthesias as well as negative hallucination, also bear on the nature of implicit, or unconscious, perception (Kihlstrom, 1996a; Kihlstrom et al., 1992). In both cases, the subject is not consciously aware of some object in the perceptual field. The object itself is in no sense subliminal, as it is presented as supraliminal intensity and duration; nor is it presented in an unattended portion of the sensory field; nor is there any interference by a forward or backward mask. The fact that subjects can fail to perceive stimuli that are presented under conditions that are optimal for conscious perception would seem to have implications for theories of consciousness in general. That is, any theory of perceptual consciousness is going to have to account for failures to perceive objects that, given the state of both the stimulus and the perceiver, are clearly perceptible (Kihlstrom, 2007).

In particular, hypnotic blindness speaks to a long-running debate concerning the analytic limits of unconscious perception. Although it is generally agreed that unconscious perception can include the analysis of the physical properties of a stimulus, the famous experiments by Marcel (1983)—demonstrating, for example, that masked presentation of word such as *doctor* could prime lexical decisions concerning semantically related words such as *nurse*—stimulated a vigorous debate over whether masked could be processed for meaning as well. A long debate over this issue was definitively resolved by a series of experiments by Greenwald and his colleagues, who conclusively demonstrated masked affective priming—that is, priming that required analysis of the connotative if not denotative meaning of the words (Draine & Greenwald, 1998). At the same time, Greenwald's systematic research revealed analytic limitations on semantic priming. That is, affective priming occurred for single-word stimuli such as *enemy* or *loses*, which are each negatively valenced, but not for two-word phrases such as *enemy loses*, which is positively valenced (Greenwald, 1992). Moreover, as Marcel and others had shown, masked priming of even single words does not last very long, with optimal stimulus-onset asynchronies (SOAs) between prime, mask, and target on the order of only a few seconds at most.

At least some of these rules were apparently broken in a pair of studies by Bryant and McConkey (Bryant & McConkey, 1989, 1995). Inspired by Eich's (1984) study of unconscious perception in dichotic listening, they showed subjects pairs of words consisting of a homophone such as *window* and a disambiguating context word such as *pane*. Half the trials were conducted under conditions of ordinary vision, and half following a suggestion for hypnotic blindness. On a later memory test, the subjects generally failed to recall the items that they had been presented while they were blind (as predicted, given that the items were not consciously seen in the first place); nevertheless, they showed significant priming effects on both a homophone-spelling test and a word-fragment completion test. These count as semantic prim-

ing effects, and they occurred long after the SOAs that are typical in studies of masked priming; and they occurred even though the stimuli were not degraded in any way.

In the past, studies of unconscious perception have been based on three major paradigms: neuropsychological, as in the case of blindsight, prosopagnosia, and hemispatial neglect; "subliminal" perception, including masked priming; and attentional manipulation, as in parafoveal presentation, dichotic listening, and both attentional and inattentional blindness (including the attentional blink, repetition blindness, and change blindness). Hypnosis adds a fourth arrow to this quiver. Although Bryant and McConkey did not use Greenwald's two-word phrases, the message from these studies is clear. At least under some conditions, implicit perception supports even complex semantic analyses—complex enough to decode the relationship between *window* and *pane*. Furthermore, the priming effect created by an unperceived visual stimulus can last for an appreciable period of time. Apparently, the analytic limits on implicit perception depend on how the percept is rendered unconscious.

Thinking

For the most part, the phenomena of hypnosis involve alterations in conscious perception and memory, but subjects also think about these anomalous experiences. In a classic article, Orne (1959) drew attention to a peculiar form of thinking observed in hypnosis, which he called "trance logic," and which he often informally (alas, however, never in print) characterized as "the peaceful coexistence between illusion and reality." In the double hallucination, for example, a subject will interact with a hallucinated confederate; when their attention is drawn to the real confederate sitting elsewhere, they may maintain both the hallucination and the perception and show confusion about which is which. Although trance logic is not unique to hypnosis (McConkey, Bryant, Bibb, & Kihlstrom, 1991), anyone who has worked with highly hypnotizable subjects has observed it in one form or another. Trance logic would be an interesting medium for studying how subjects resolve cognitive dissonance generally.

One way they do this, apparently, is by constructing delusions. Long ago, Sutcliffe concluded that the hypnotized subject was, essentially, deluded about the actual stimulus state of affairs—in other words, that the world around them is the same as suggested by the hypnotist (Sutcliffe, 1960, 1961). However, subjects can also generate delusions by constructing explanations for their anomalous experiences. This appears to be a general process, not limited to hypnosis. In an early textbook of psychopathology, Jaspers distinguished between primary delusions, which reflect an individual's anomalous subjective experiences, and secondary delusions, which represent his attempt to interpret and explain his primary delusions (Jaspers, 1923/1962; see also Reed, 1972). Similarly, Maher (1974) argued that schizophrenic delusions did not reflect a thought disorder, but rather the patient's more-or-less rational attempt to explain an experiential disorder. As such, hypnosis offers a means for inducing disorders of perception, memory, and the voluntary control of action, and thus, a window on the formation of delusions in real time (Kihlstrom & Hoyt, 1988). For example, when Zimbardo and his colleagues surreptitiously induced partial deafness in normal hypnotic subjects by means of a posthypnotic suggestion (itself covered by amnesia), the subjects showed increasing levels of paranoia, including delusions of secrecy and conspiracy (Zimbardo, Andersen, & Kabat, 1981).

In fact, the results of hypnosis research actually led to the revision of the most prominent contemporary theory of delusions. Based on observations of delusions in schizophrenia and other disorders, Coltheart and his colleagues have proposed a two-factor theory of their origins: first, anomalous experiences seed the formation of delusions; and then, these aberrant beliefs persist in the face of logic and evidence (e.g., Coltheart, Langdon, & McKay, 2011). The theory is consistent with the earlier views of Jaspers and Maher (among others), but it resists formal experimental test in pre-post designs that observe subjects both before and after the anomalous experiences occur. In a large-scale program of research, Barnier and her colleagues have used hypnotic suggestion to just this end, using hypnotic suggestions for mirrored self-misidentification, alien control, and the like (Connors, Barnier, Coltheart, Cox, & Langdon, 2012; Connors et al., 2013). An interesting finding was that the results of this

research have already forced a revision of the theory. Although the prior anomalous experience is indeed critical, it is also important that the subject is ignorant of the true source of the experience (this was also critical in Zimbardo's study of suggested deafness).

Further use of hypnosis as a laboratory model of clinical delusions may also shed light on the second factor, by which the delusion is maintained, which raises the question of precisely *how* the delusion is maintained in the face of contrary logic and evidence. It seems likely that the persistence of delusions can be explained by exaggerations of ordinary errors in reasoning. This possibility, too, can be studied with hypnosis—either by tracking the formation of secondary delusions as they naturally occur, or by making additional suggestions aimed at exacerbating these sorts of errors and biases. In the present context, though, the really important fact is that the evidence of hypnosis was not rejected out of hand, simply because it was evidence from hypnosis. To the contrary, it was actively embraced, and the theory modified accordingly.

A somewhat more indirect influence of hypnosis occurred in the study of intuition. The literature on problem-solving abounds with anecdotal accounts of the role of intuition in problem-solving—where the problem-solver feels that a problem is actually solvable, or that he is on the verge of a solution. In one of the earliest models of problem-solving, Wallas posited a stage of "intimation" (intuition), occurring toward the end of the incubation stage, and immediately before the "illumination" of full-fledged insight (Wallas, 1926). Such intuitions were incorporated into the General Problem Solver model as "feelings of warmth" (Newell & Simon, 1973), and into memory as the "feeling of knowing" (Hart, 1965) or "tip-of-the-tongue" state (Brown & McNeill, 1966). However, later theorists argued that intuitions could be misleading (Metcalfe, 1986)—and, indeed, a whole tradition has cognitive and social psychology arose based on the alleged shortcomings of intuitive judgments (e.g., Chabris & Simons, 2010; Ross, 1977).

Nevertheless, intuition has recently experienced a reversal of fortune—and in a good way, toward a more balanced view which acknowledges the validity of intuitions under a wide range of circumstances (Dorfman, Shames, & Kihlstrom, 1996; Kihlstrom, Shames, & Dorfman, 1996; Myers, 2002). Indeed, intuitions are commonly held to reveal the role of unconscious processes in reasoning, problem-solving, judgment, and decision-making (Gladwell, 2005; Wilson, 2002). This more favorable view of intuitions has its origins in research by Bowers and his colleagues using a variant of the Remote Associates Test (RAT), in which subjects must generate the word that three stimulus words have as a common associate (Bowers, Regehr, Balthazard, & Parker, 1990). These investigators found that subjects could distinguish between coherent RAT triads (that actually have a remote associate in common) and incoherent ones (that do not), even though they could not identify the remote associate itself.

Bowers' research, in turn, had its origins in early research on the effects of posthypnotic suggestion on attitudes (Bowers, 1975, 1984). On a series of trials, the subjects were asked to state their preference between two pictures, one a portrait and the other a landscape. All subjects were reinforced for picking a picking whichever picture was paired with a serial number that had a "7" in it, following standard verbal-conditioning procedures. However, half the subjects had previously received a posthypnotic suggestion to this effect, covered by posthypnotic amnesia. When the verbal reinforcement was discontinued, the subjects' preferences reverted to baseline—except for those subjects who had received the posthypnotic suggestion, who continued to prefer paintings paired with a 7. Apparently, the subjects in the posthypnotic condition made internal rather than external attributions concerning their preferences—although, by virtue of posthypnotic amnesia, they did not know why they had those preferences.

Automatic and Controlled Processing

One of the landmarks of the cognitive revolution in psychology was the distinction between automatic and controlled processes (Moors & DeHouwer, 2006). In the classic case, automatic processes are like reflexes: inevitably evoked by particular stimuli, running incorrigibly to completion, consuming few or no cognitive resources, and causing no interference with other cognitive processes. They are unconscious in the strict sense of the term, because they operate outside of conscious awareness and independently of conscious control. Originally

postulated to resolve the debate between early- and late-selection theories of attention, the distinction between automatic and controlled processes forms the foundation for a large number of "dual-process" theories popular in personality, social, and clinical psychology as well (e.g., Chaiken & Trope, 1999). In fact, some theorists have gone so far as to argue that automaticity so dominates mind and behavior that there is little room left for conscious control (for a critique, see Kihlstrom, 2008).

Some automatic processes appear to be innate, part of our genetic and evolutionary endowment, while others have become automatized by virtue of practice and overlearning. However, whatever their source, one (usually unstated) implication has been that, once established, automatization is permanent—that automatized processes remain forever free of conscious control (their effects might be counteracted in a post hoc fashion, but that is not the same as control of their execution). Recently, however, the prospects for de-automatization have been improved by evidence from hypnosis. In a series of experiments, Raz and his colleagues have demonstrated that subjects given hypnotic suggestions for agnosia (or maybe alexia)—that the letter strings presented to them look like gibberish—show a reduction or elimination of Stroop interference (Raz et al., 2003). Although most of Raz's studies have focused on the Stroop effect (for a review, see Kihlstrom, 2011), he and his colleagues have recently extended his observations to the McGurk effect as well (Lifshitz, Bonn, Fischer, Kashem, & Raz, 2013). In both cases, hypnotic suggestion virtually eliminated the effect. Although de-automatization has been discussed and observed before, chiefly in the context of meditation (Deikman, 1966; Wenk-Sormaz, 2005), the dramatic effects of hypnotic suggestion reveal a hitherto unappreciated dimension of automaticity: that it is possible to regain conscious control of a process that has been automatized. Now that the concept of automaticity has been well-established, this fact will need to be incorporated into cognitive theory.

Attitudes and Social Cognition

The hypnotic manipulation of affect was also used in an early test of the balance theory of social attitudes. Whether they invoke dissonance or balance, a major prediction of these theories is that the cognitive and emotional components of an attitude should be consistent with each other. Rosenberg (1960) pretested subjects' attitudes on a variety of contemporary social issues, and then gave them posthypnotic suggestions for affect reversal regarding two of these issues—for example, that shifting from a mayoral to a city-manager form of government would fill the subject with "loathing and disgust." The affective component of the targeted attitudes changed radically, and so did the cognitive structure associated with these attitudes. This was true regardless of whether the attitude was of high or low importance to the subjects themselves. This was a major early test of balance theory, and Rosenberg did not hesitate to use hypnosis to construct it.

Wheatley and Haidt (2005) performed a similar experiment to demonstrate the role of intuitions in moral judgments. Inspired by earlier research in which hypnosis had been used to manipulate subjects emotional states (Bower et al., 1981)—though not, apparently, by the Rosenberg study—they gave subjects posthypnotic suggestions to feel disgust when they read a particular word. That cue later appeared in some vignettes (e.g., about incest with a cousin or bribery of a legislator), about which they were to make a moral judgment. Those vignettes which contained the critical cue word were rated as more disgusting and more morally wrong, compared with the same vignettes without the cue. Previous arguments for moral intuitionism had been based on observational studies using such tasks as the Trolley Problem, which ostensibly precluded rational judgment strategies (Greene & Haidt, 2002; but see Kihlstrom, 2013b). This study was the first to show that moral intuitions could be manipulated directly.

The most important contribution of hypnosis to the study of social cognition, however, was more conceptual than instrumental: Orne's analysis of the social psychology of the psychological experiment (Orne, 1962, 1969, 1970, 1973) see also (Kihlstrom, 2002). Orne's concepts of ecological validity (derived from Brunswik) and demand characteristics (derived from Lewin and Koffka) were central to his critique of experimental research in social psychology, particularly those studies involving deception. In his view, researchers all too often viewed subjects as passive responders to experimental manipulations. To the contrary, Orne argued that subjects did not leave their brains at the laboratory door. They were

better viewed as the sentient, curious beings they were, actively thinking about what is happening to them, evaluating the proceedings as they went on, figuring out what they were supposed to do, and planning their responses accordingly. Orne then proceeded to illustrate his points with a series of brilliant experiments on such topics as age-regression and antisocial behavior, often using the real-simulating design that he invented (Orne, 1979).

However, the implications of Orne's research went farther than methodological niceties. The view of research subjects as passive stimulus-response machines echoed the view of people in general that prevailed at the time, as social psychology adopted the stance of stimulus-response behaviorism (Zimbardo, 1999), and transformed itself from the study of the individual in society to the study of social influence—that is to say, the control of experience, thought, and action by the presence and behavior of other people. Orne argued for the same view of people in the real world as he had for subjects inside the laboratory: that they were actively engaged in interpreting the situation, forming impressions of other people and managing other people's impressions of them, developing expectations and acting on them. In a very real sense, the cognitive revolution in social psychology begins with his work.

Personality and Cognition

The first fact about hypnosis is that there are wide individual differences in hypnotizability, and the kinds of effects described earlier in this article are confined to that relatively small portion of the population known as "hypnotic virtuosos" (for more on highly hypnotizable subjects, see Barnier, Cox, & McConkey, 2014). This, in turn, has stimulated a large body of research on the cognitive and personality correlates of hypnotizability—a search which proved fruitless until researchers began to develop scales measuring the occurrence of "hypnotic-like" experiences outside the hypnotic context that were not well represented in extant personality inventories such as the Minnesota Multiphasic Personality Inventory and the California Psychological Inventory (or, for that matter, in the lexicon of personality traits). The principal product of this line of research was Tellegen's "Absorption Scale" (Tellegen & Atkinson, 1974), which was directly inspired by Tellegen's reading of the hypnosis literature. Absorption, in turn, quickly came to be incorporated into a larger dimension of "openness to experience," which is now recognized as one of the "Big Five" dimensions of personality, along with extraversion, neuroticism, agreeableness, and conscientiousness. In contrast to the other dimensions of the Big Five, openness is a cognitive disposition (McCrae & Costa, 1990).

The story does not necessarily end there. Openness, as currently defined, includes not only hypnotic-like imaginative involvements, but also intellectance (or culturedness) and sociopolitical liberalism. The operating assumption appears to be that absorption, intellectance, and liberalism are three "facets" of a single broad trait of openness. On the other hand, some research indicates that hypnotizability is correlated with the absorption facet of openness, but not with liberalism or intellectance (Glisky & Kihlstrom, 1993). It may turn out that the intercorrelations among absorption, liberalism, and intellectance are weak enough to raise the question as to which of them is the true "fifth factor" in the Big Five structure of personality. However that research turns out, hypnosis will have played a role by adding an explicitly cognitive dimension to the structure of personality, and clarifying the nature of that dimension.

Cognitive Development

One area of cognition that has been left virtually untouched by hypnosis is cognitive development. Early attempts to use hypnotic age regression to reverse cognitive development, and thus, explore developmental processes without having to perform longitudinal studies (Reiff & Scheerer, 1959) suffered from a number of problems, and were misguided from the start (O'Connell, Shor, & Orne, 1970). Although hypnosis has been successfully used in the clinic with children (HIlgard & LeBaron, 1984), systematic research on hypnosis in children has been limited to assessments of hypnotizability in different age cohorts (Cooper & London, 1971, 1978; London & Cooper, 1969; Morgan & Hilgard, 1973)—and there has not even been very much of that.

The emergence of the "theory of Mind" opens up new and as yet unexplored possibilities for the study of hypnosis and cognitive development. As the child develops, he or she begins to appreciate mental states as such—among other things, that our mental states control our actions; that our

mental representations may differ from external reality; that our mental states may differ from those of other people—and, perhaps most critically, that fantasy is different from reality, and our imagination of something is different from our perception of it. Central to these developments is the appreciation of dreams for what they are, and the ability to disentangle imagination from reality (e.g., Lillard et al., 2013; Markman, Klein, & Suhr, 2008; Taylor, in press). Hypnosis is of obvious relevance here. Systematic study relating children's response to hypnosis to their achievement of a theory of mind may well throw unique light on cognitive development in general.

The Relation of Hypnosis to Other Things

That is for the future, are so many other issues, such as neuroscientific studies and the broadening the empirical support for hypnotic interventions in medicine and psychotherapy. In the period since Young and Hull, much has been learned about hypnosis—what it can do and what it cannot, who can experience it and who cannot, the roles of altered consciousness and social context. Furthermore, while shedding light on the nature of hypnosis, hypnosis research has also enhanced our understanding of mind and behavior in general, by shedding light on phenomena that might otherwise go unnoticed.

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