Posthypnotic Amnesia

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Posthypnotic Amnesia

Following an appropriate suggestion and the termination of hypnosis, some people cannot remember the things they did or experienced while they were hypnotized. Along with eye closure and the generally relaxed appearance of the typical subject, this posthypnotic amnesia (PHA) helped give hypnosis its name, by analogy to the amnesia we all experience for the events that transpire during a night's sleep. The analogy is imperfect, however. PHA does not occur spontaneously, and it can be canceled by the administration of a pre-arranged reversibility cue. Along with hypnotic analgesia, PHA is perhaps the most thoroughly studied of all hypnotic phenomena (for earlier reviews, see (Coe, 1989; Cooper, 1979; Huesmann, Gruder, & Dorst, 1987; Kihlstrom, 1985; Kihlstrom & Evans, 1979).[1]

PHA most closely resembles the "functional" amnesias, occurring in the absence of palpable brain insult, injury, or disease. Historically associated with "hysteria" (Kihlstrom, 1994), these syndromes now go under the general rubric of the dissociative disorders (Kihlstrom, 1992a, 2005a; Kihlstrom & Schacter, 2000). In dissociative amnesia, formerly known as psychogenic amnesia, the patient cannot consciously remember events from some period in his or her past. In dissociative fugue, patients lose the entirety of their autobiographical memories, and lose or change their identity as well. In dissociative identity disorder, formerly known as multiple personality disorder, the patient embodies two or more identities, which alternate in control of conscious

[1] PHA frequently (but not necessarily) accompanies response to posthypnotic suggestions – so that, in the classic case, the subjects involved do not know what they are doing, or why (A.J. Barnier & McConkey, 1998; Edwards, 1956, 1965; Gandolfo, 1971; Sheehan & Orne, 1968).

experience, thought and action; each “alter ego” comes with its own fund of autobiographical memories; the amnesia which separates the different identities may be symmetrical or asymmetrical. Genuine instances of these functional disorders of memory are rare and often evanescent – Thigpen and Cleckley (1954), who famously described *The Three Faces of Eve*, never saw another convincing case of multiple personality disorder (1984). Still, dissociative amnesia has been a source of fascination since the time of William James (James, 1890/1980, 1902/1985; Taylor, 1983), and PHA has served as a sort of laboratory model for understanding its underlying processes (Barnier, 2002; Kihlstrom, 1979; Kihlstrom & McGlynn, 1991; Oakley, 1999).

Spontaneous and Suggested Posthypnotic Amnesia

The roots of modern hypnosis lie in the practices of Franz Anton Mesmer (1734-1815), a German physician who employed a technique he called “animal magnetism” to treat various illnesses. In 1784, Mesmer’s theory was discredited by two investigations commissioned by King Louis XVI of France – one of which, consisting of members of the Royal Academy of Science and the Faculty of Medicine of the University of Paris, and chaired by Benjamin Franklin, conducted what may have been the first controlled psychological experiments (a*vant la lettre*, as psychology was not considered to be a science at the time), and concluded that the effects of mesmerism were due to “imagination” rather than any physical force (Kihlstrom, 2002b). But Mesmer’s cures were not discredited, and so “mesmerism” and “animal magnetism” continued to be practiced in Europe, Britain, and America (Crabtree, 1993; Pattie, 1994; Tinterow, 1970;

Winter, 1998). The Franklin Commission took no note of amnesia, which was first described by the Marquis de Puysegur, a disciple of Mesmer's, later that same year (Laurence & Perry, 1988). But the second commission, composed of representatives of the Royal Academy of Medicine, did: A minority report concluded that some of the effects of mesmerism, including amnesia for events occurring during the mesmeric trance, could not be attributed to imagination (Yeates, 2018b).

James Braid, the British physician who coined the term "hypnosis" (Kihlstrom, 1992b; Yeates, 2018a, 2018b), observed amnesia, along with eyelid catalepsy and insensitivity to external stimuli, during a demonstration of animal magnetism by Charles LaFontaine (1803-1892), an itinerant mesmerist, in 1841. Charles Richet (1850-1935), the Nobel-Prizewinning physician who is credited with initiating modern interest in hypnosis, claimed that amnesia was characteristic of the state of *somnambulism provoke*, in which the subject is highly responsive to suggestion; and Jean-Martin Charcot (1825-1893), the great French neurologist, asserted that amnesia was characteristic of somnambulism, the third and deepest stage of *grand hypnotism* (Gauld, 1992).

In each of these instances, PHA appeared to occur spontaneously, without any specific suggestion being made by the hypnotist. Even Hippolyte Bernheim (1840-1919), a French physician who opposed Charcot's physiological ideas, and argued that most hypnotic phenomena were the product of suggestion, nevertheless believed that amnesia was an exception (Gauld, 1992). Similarly, some modern authorities likewise argue that PHA is "state-bound" (Erickson & Rossi, 1974). Still, Joseph Delboeuf (1831-1896) and J. Milne Bramwell (1852-1925), two prominent turn-of-the-century authorities, both argued that “spontaneous” amnesia usually occurred as a result of indirect or subtle suggestion – including what we would now call the “demand characteristics” (Orne, 1962) of the hypnotic situation. Their view has come to prevail. In his pioneering experimental work, Young (1926) performed a direct comparison, finding that PHA was denser following direct suggestion. Reviewing the then-nascent experimental literature on hypnosis, he concluded that PHA was a product of suggestion, including autosuggestion (Young, 1927, 1928, 1931) a position endorsed by Hull (1933).

On the standardized scales now used to measure hypnotizability, PHA is much more likely to occur as the result of suggestion (Hilgard & Cooper, 1965). When it does appear to occur spontaneously, this is likely due to the subject’s misunderstanding of instructions; pre-existing beliefs about hypnosis (including the analogy to sleep), and the resulting expectation that amnesia will occur (Cooper, 1979; Fourie, 1981; Kunzendorf & Benoit, 1985-1986; Simon & Salzberg, 1985; Young & Cooper, 1972). Alternatively, the subject may inadvertently have fallen asleep during the hypnotic session -- especially in group hypnosis, with its necessarily limited monitoring by the hypnotist. Patients with chronic schizophrenia appear to respond positively to suggestions for PHA, but their initial forgetting does not reverse, and is more likely a result of distractibility or some other attentional impairment (Lavoie, Sabourin, & Langlois, 1973; Lieberman, Lavoie, & Brisson, 1978; see also Frischholz et al., 1992). Such instances are properly classified as “pseudoamnesia”, and should not be confused with the real thing.

The fact that PHA occurs as a result of suggestion does not impeach the memory failure as counterfeit. Hypnotic analgesia also occurs only as a result of suggestion, but very few investigators doubt that it is genuine (Hilgard & Hilgard, 1975; Jensen & Patterson, 2014; Patterson, 2004). The fact is that all of the phenomena in the domain of hypnosis occur as a result of suggestion (Hilgard, 1973; Kihlstrom, 2008), which is why hypnosis is grist for the mills of both cognitive and social psychologists (Kihlstrom, 1978, 1986, 2003).

Posthypnotic Amnesia and Hypnotizability

Even those 19th-century authorities who believed that amnesia occurred spontaneously acknowledged that it was characteristic only of the "deepest" level of hypnosis. In the mid-20th century, the metaphor of "hypnotic depth" (Friedlander & Sarbin, 1938) was replaced by "hypnotizability" (Hilgard, 1965). The introduction of standardized scales for the assessment of hypnotizability enabled different laboratories to compare their results directly with each other, and helped put the study of hypnosis on a firm empirical foundation. The most commonly used instruments for this purpose are the individually administered Stanford Hypnotic Susceptibility Scales, Forms A, B, and C (SHSS:A, B, C), and the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A), a modification of SHSS:A for group administration. All of these scales begin with a formal induction of hypnosis, usually including suggestions for eye fixation, relaxation, and eye closure, followed by a series of suggestions for various hypnotic phenomena. Response to each of these suggestions is scored according to objective behavioral criteria. Prior to the termination of hypnosis, the subjects receive a suggestion that they will be unable to remember what they did or experienced during hypnosis, until the experimenter gives a reversibility cue, such as “Now you can remember everything”. After the termination of hypnosis, subjects are asked to recall the various test suggestions twice: once while the amnesia suggestion is in effect, and again after the amnesia has been canceled. According to the standardized objective scoring criterion, subjects pass PHA if they report three or fewer items (out of nine on SHSS:A/B or HGSHS:A; out of 11 on SHSS:C) on the initial amnesia test. Taking account of performance on the reversibility test, of course, helps distinguish suggested PHA from mere forgetfulness and other forms of pseudoamnesia (Kihlstrom & Register, 1984).

PHA, so measured, is highly correlated with hypnotizability (Barnier & McConkey, 1998; Hilgard, 1965; Kihlstrom & Register, 1984; Nadon, D'Eon, McConkey, Laurence, & Perry, 1988). As depicted in Figure 1, subjects who are classified as high in hypnotizability recall fewer items during PHA than those who score in the low range. The correlation between hypnotizability and initial recall falls to zero in the absence of an amnesia suggestion (Hilgard & Cooper, 1965; Kunzendorf & Benoit, 1985-1986) – clear evidence that spontaneous amnesia does not belong in the domain of hypnosis, and likely reflects little more than ordinary forgetting. Even when hypnotizable subjects recall enough items to fail the standard criterion for amnesia, their memories often have a vague, fragmentary, generic quality to them (e.g., “Something about my hands”), lacking particular details of the event in question (Evans, Kihlstrom, & Orne, 1973; Kihlstrom & Evans, 1978).

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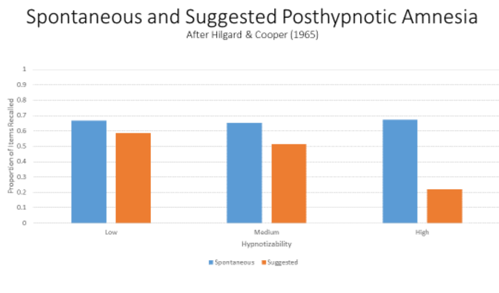

PHA is induced by suggestion, and it is also canceled by suggestion, in the form of the pre-arranged reversibility cue (Kihlstrom & Evans, 1976; Nace, Orne, & Hammer, 1974). Figure 2 shows that, on a subsequent reversibility test, hypnotizable subjects recover more new memories than insusceptible ones do. This is not simply due to suppressed performance on the initial amnesia test, a kind of regression artifact. This is because lows who manage to pass the criterion for initial amnesia (for whatever reason) show less recovery than highs do. In addition, subjects who showed generic recall during amnesia, are now able to remember their experiences in more detail (Kihlstrom & Evans, 1978).

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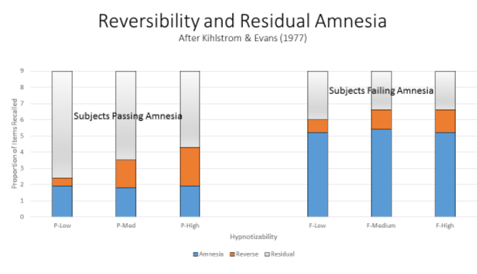

Despite reversibility, there sometimes remains a residual amnesia, which is also more prominent in hypnotizable than insusceptible subjects (Kihlstrom & Evans, 1977). As Figure 2 also shows, even after reversibility hypnotizable subjects who passed the test for initial amnesia recall fewer hypnotic experiences than those who did not. It is unlikely that this difference reflects ordinary forgetfulness, because response to amnesia suggestions is uncorrelated with performance on a battery of standard tests of short- and long-term memory (Kihlstrom & Twersky, 1978). If anything, hypnotizable, amnesic subjects show superior performance on long-term memory, compared to their nonamnesic counterparts.

While amnesia is routinely assessed in the context of the standardized hypnotizability scales of hypnotizability, it is also possible to employ standard verbal-learning paradigms in which subjects study a list of words while hypnotized. This strategy loses some of the ecological validity that may attend memories for actual hypnotic experiences, but it avoids other potential problems. For example, memory for hypnotic suggestions may be affected by whether subjects are surprised, pleased, or disappointed by their responses to particular suggestions, resulting in Zeigarnik or von Restorff effects (Clemens, 1964; Coe, Baugher, Krimm, & Smith, 1976; Hilgard & Hommel, 1961; Pettinati, Evans, Orne, & Orne, 1981; Stam, Radtke-Bodorik, & Spanos, 1980). Nevertheless, suggestions for PHA are as effective with wordlists as they are with actual hypnotic experiences – provided that the subjects are highly hypnotizable. This allows investigators to apply standard paradigms from the literature on human learning and memory to the study of PHA.

Figure 3 shows the results of an experiment in which subjects memorized a list of 15 familiar words to a strict criterion of learning, and then received a suggestion for PHA (Kihlstrom, 1980). An initial free recall test revealed a dense PHA on the part of the more hypnotizable subjects, and little memory impairment in subjects of low or medium hypnotizability; after the amnesia suggestion was canceled, full memory was restored to the hypnotizable subjects. In this experiment, and many others using verbal-learning paradigms (e.g., Williamsen, Johnson, & Eriksen, 1965), there was no residual amnesia, possibly owing to the strict criterion of learning imposed during the study phase.

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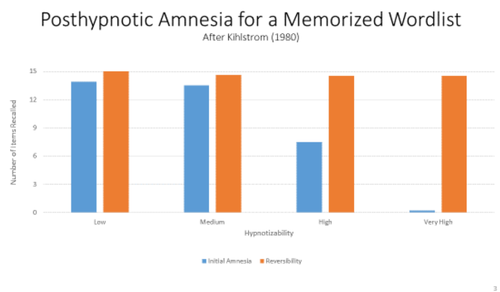

Aside from administering the pre-arranged reversibility cue, is there anything that can be done to gain access to the memories forgotten during PHA? To some extent, PHA may dissipate over time: If a second test is inserted after the initial amnesia test, but before administration of the reversibility cue, some new memories are often recovered – though still more are recovered after the reversibility cue (Kihlstrom, Easton, & Shor, 1983; Kihlstrom, Evans, Orne, & Orne, 1980). However, this gain in memory may not be time-dependent (Bertrand, Spanos, & Parkinson, 1983; Dubreuil, Spanos, & Bertrand, 1982-1983; Spanos, Tkachyk, Bertrand, & Weekes, 1984). Rather, it may be a variant on the testing effect (Roediger & Karpicke, 2006), by which an initial test of memory improves performance on later tests.

Exhortations to recall more items, and instructions for honesty in reporting memories, have no more effect than a simple uninstructed retest (Kihlstrom et al., 1980). Some breaching of amnesia does occur in subjects who expect that such attempts will be successful (Silva & Kirsch, 1987; Spanos, Radtke, & Bertrand, 1984). Breaching also occurs in subjects who rate themselves as voluntarily controlling recall (Coe & Sluis, 1989; Coe & Yashinski, 1985; Howard & Coe, 1980; Schuyler & Coe, 1981, 1989), but such individuals are a minority among highly hypnotizable subjects (Bowers, 1981; Bowers, 1982; Bowers, Laurence, & Hart, 1988). Like other hypnotic phenomena, PHA is usually experienced as an involuntary “happening”, rather than a voluntary “doing” (Sarbin, 2002), so that subjects are often surprised when it occurs (Shor, Pistole, Easton, & Kihlstrom, 1984). Honesty demands have little effect on response to hypnotic suggestions in general, though they can have profound effects on other conditions to which hypnosis is often compared (e.g., Bates, 1992; Bowers, 1967; Ruch, Morgan, & Hilgard, 1974).

Characterization of hypnosis as an altered state of consciousness (Gruzelier, 2005; Kallio & Revonsuo, 2003; Kihlstrom, 2005b, 2018) has sometimes prompted the suggestion that PHA is a form of state-dependent memory (SDM; Eich, 1980, 1988; Overton, 1977; Smith & Vela, 2001; Swanson & Kinsbourne, 1979). Consistent with the encoding specificity principle in memory (Tulving & Thomson, 1973), there is some evidence that suggestions for PHA are more effective for material learned before, rather than during, hypnosis (Smith, Morton, & Oakley, 1998). However, the reversibility cue does not re-induce hypnosis, and subjects do not show enhanced suggestibility or other signs of hypnosis while executing other posthypnotic suggestions (Reyher & Smyth, 1971). Some researchers have studied *hypnotic* rather than *posthypnotic* amnesia, giving suggestions for amnesia that are tested while subjects are still hypnotized (e.g., Spanos & Bodorik, 1977; Spanos et al., 1983). And it is also possible to give suggestions of amnesia for events that occurred before hypnosis was induced (e.g., Barnier, 2002; Barnier, Bryant, & Briscoe, 2001). These procedural variants produce effects that are equivalent to traditional PHA for events occurring during hypnosis: taken together, they suggest that PHA is not an instance of SDM. Empirically, the re-induction of hypnosis has no effect on memory in amnesic subjects, over and above a simple retest conducted posthypnotically (Kihlstrom, Brenneman, Pistole, & Shor, 1985).

Ordinarily, an experimenter would not let a subject leave the laboratory until all hypnotic and posthypnotic suggestions had been canceled. Nevertheless, the question of the persistence of posthypnotic suggestions endures in the literature (Edwards, 1963). PHA has been reported to last for as long as one year (Wells, 1940). However, the duration of the effect, as with all hypnotic and posthypnotic suggestions, will depend the hypnotizability of the subject, the precise wording of the suggestion, the subject's understanding of the experimenter's intent, the cognitive load imposed by the suggestion, and other considerations (Damaser, Whitehouse, Orne, Orne, & Dinges, 2010).

Comparison to Directed Forgetting and Thought Suppression

There is a long history of comparing hypnosis with a "task-motivation" condition in which unhypnotized subjects are exhorted to think and imagine with the themes of the suggestions they are given, and to try their best to do what is asked of them (Barber, 1969). This body of research includes some studies of PHA (e.g.,) (Barber & Calverley, 1966; Spanos, De Groh, & De Groot, 1987; Spanos, Stam, D'Eon, Pawlak, & Radtke-Bodorik, 1980; Thorne, 1969; Thorne & Hall, 1974), but task-motivation instructions and similar procedures are known to be heavily laced with behavioral compliance (Bates, 1992; Bates, Miller, Cross, & Brigham, 1988; Bowers, 1967; Bowers & Gilmore, 1969; Spanos & Barber, 1968), and will not be considered further here.

In some respects, PHA resembles the “directed”, “instructed”, or “positive” forgetting (DF) observed in the normal waking state (Bjork, 1970, 1972, 1978; Epstein, 1972; Golding & MacLeod, 1998; Sahakyan, Delaney, Foster, & Abushanab, 2013; see also Groome & Eysenck, this volume). A number of studies have compared PHA and DF, but various procedural differences between PHA and the various forms of DF make direct comparison difficult (Coe et al., 1989; Geiselman, Bjork, & Fishman, 1983; Geiselman, MacKinnon, et al., 1983; Kihlstrom, 1983; Kihlstrom & Barnhardt, 1993). The DF paradigm most closely resembling PHA involves post-input cuing by item sets, which appears to involve some sort of retrieval inhibition (Anderson & Green, 2001; Anderson & Levy, 2009; Anderson et al., 2004). In a head-to-head comparison of PHA, depicted in Figure 4, Basden and her colleagues found that PHA produced more forgetting than DF; forgetting in PHA, but not in DF, was correlated with hypnotizability; and after PHA was canceled, hypnotizable subjects produced more new target memories than their counterparts did after the DF instruction was canceled (Basden, Basden, Coe, Decker, & Crutcher, 1994). David and colleagues also found that PHA was correlated with hypnotizability, but DF was not (David, Brown, Pojoga, & David, 2000).

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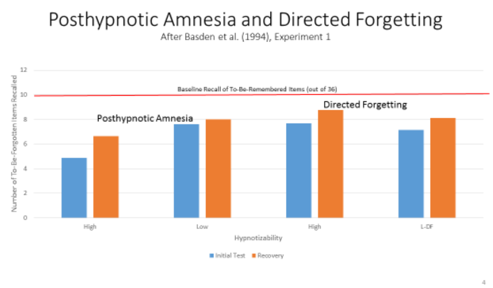

A related phenomenon is thought suppression (TS), except that what is being suppressed is an idea rather than an episodic memory. In a series of provocative experiments, Wegner and his colleagues found that asking subjects to suppress a thought – for example, not to think about a white bear – lead to a paradoxical enhancement of thoughts of the proscribed topic such thoughts, and a further increase after the injunction was lifted – a phenomenon called “ironic rebound” (Wegner, 1989; Wegner, 1992; Wegner & Erber, 1992; Wegner & Schneider, 1989; Wegner, Schneider, Carter, & White, 1987; for reviews, see Abramowitz, Tolin, & Street, 2001; Forster & Liberman, 2014). However, in another comparative study, Bowers and Woody (1996) found that subjects given hypnotic suggestions for thought suppression displayed neither paradoxical enhancement nor ironic rebound (see Figure 5). In contrast to the hypnotic condition, nonhypnotic thought suppression was not correlated with hypnotizability. Whereas subjects in the thought suppression condition reported that they experienced considerable difficulty in keeping the unwanted thoughts out of mind, the hypnotic subjects had little trouble doing so. Taken together, these findings indicate that PHA, DF, and TS are very different phenomena, with different underlying mechanisms.

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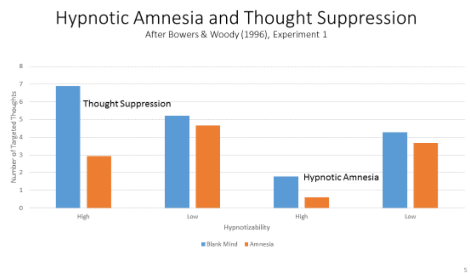

Interestingly, PHA enhances performance on an attention-demanding random-number-generation task. When asked to generate random numbers, subjects tend to make some consistent errors, such as not repeating digits frequently enough – a phenomenon known as repetition avoidance (Brugger, 1997). Even in the absence of PHA, hypnotizability is correlated with the ability to generate random number sequences (Graham & Evans, 1977). However, Terhune and Brugger (2011) found that a posthypnotic suggestion to forget previously generated digits improves performance for a subset of highly hypnotizable subjects who also report a strong tendency to have dissociative experiences – mostly by reducing repetition avoidance. Repetition avoidance was observed in the absence of the amnesia suggestion, and it returned when the suggestion was canceled. It is not known whether either DF or TS would provide the same advantage.

Retrieval Disruption in Posthypnotic Amnesia

Residual amnesia notwithstanding, reversibility marks PHA as a disruption of memory retrieval, opposed to encoding or storage – a problem of accessibility, not availability (Evans & Kihlstrom, 1973; Orne, 1966). To understand the mechanisms underlying PHA, a number of researchers turned to information-processing theories of memory. Both traditional two-stage theories of retrieval (e.g., Anderson & Bower, 1972; Atkinson & Juola, 1973; Bahrick, 1970; Kintsch, 1970; Watkins & Gardiner, 1979) and level-of-processing theory (Craik & Lockhart, 1972; Lockhart, Craik, & Jacoby, 1976), motivate a comparison of recall and recognition testing. According to the two-stage theory, successful recall requires both the generation and recognition processes, while recognition testing obviates the generation process. For level of processing theory, the more cues presented at the time of retrieval, the higher the probability of finding overlap with those features processed at the time of encoding. According to Tulving's theory of "episodic ecphory" (Tulving, 1974, 1976; Tulving & Thomson, 1973), recall and recognition differ only quantitatively, in terms of the informational value of the retrieval cues presented to the subject.

In any event, research is unanimous that PHA is densest when assessed with free recall as opposed to cued recall or recognition tests (Allen, Law, & Laravuso, 1996; Barber & Calverley, 1966; Kihlstrom & Shor, 1978; Radtke, Thompson, & Egger, 1987; St. Jean & Coe, 1981; Williamsen et al., 1965). Remarkably, however, some hypnotizable subjects remain amnesic even after viewing a videotape of themselves responding to a series of hypnotic suggestions – what must be the most informative retrieval cues imaginable (McConkey & Sheehan, 1981; McConkey, Sheehan, & Cross, 1980).

Figure 6 shows the results of an experiment in which subjects memorized a list of 16 words consisting of four items from each of four categories, followed by tests of free recall, cued recall, and recognition conducted during PHA, and a final test of free recall following administration of the reversibility cue (Kihlstrom, 2019b). A control group who learned the material, and were tested, in the normal waking state scored perfectly on each test. The initial recall test revealed a dense amnesia. Memory during amnesia progressively improved with the provision of additional retrieval cues, but was fully restored to free recall only following the reversibility cue – a variant, perhaps, on the recognition failure of recallable words .

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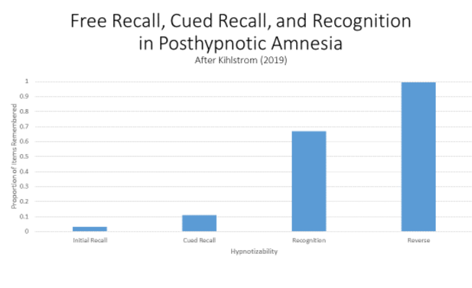

Interestingly, subjects who have been instructed to simulate hypnosis perform worse on recognition tests than real hypnotic subjects do – even scoring below chance levels (Barber & Calverley, 1966; Spanos, James, & De Groot, 1990; Williamsen et al., 1965). The demand characteristics (Orne, 1962) of the hypnotic situation are clear: subjects are not supposed to remember what they did during hypnosis, and it should not matter how their memory is tested. That recognition is superior to recall during PHA reassures us on two points: first, that hypnotic subjects are doing something other than responding to the demand characteristics of the experimental situation; and second, that even PHA does not violate the basic principles of memory.

Organization of Memory in Posthypnotic Amnesia

The discovery of organization in recall, whether by associative or categorical clustering (Bousfield, 1953; Jenkins & Russell, 1952), or some other inter-item relationship (Tulving, 1962b), was one of the signal events in the cognitive revolution in the study of human learning and memory. According to at least some versions of generate-recognize theory, recall succeeds to the extent that it is organized, (Bower, 1970). However, testing the hypothesis that retrieval is disorganized in PHA entails a sort of paradox: when amnesia is complete, the subjects do not recall enough material to test for organization. Accordingly, this line of research has focused on subjects who recall at least some of the to-be-remembered material – but who, by virtue of their relatively high hypnotizability, can be assumed to be experiencing at least the partial effects of the amnesia suggestion.

Initial studies of disorganized retrieval focused on temporal organization – that is, the tendency of subjects to recall events in the order in which they occurred (Mandler & Dean, 1969). This organizational rubric seems natural for a sequence of events, such as the items of the standardized scales of hypnotizability. In recounting their experiences while hypnotized, after all, subjects are essentially constructing a narrative – a story with a beginning, a middle, and an end (Mandler & Johnson, 1977; Mandler & Murphy, 1983). Moreover, the wording of the amnesia test on the standardized scales ("[P]lease tell me everything that happened since you began looking at the target") implies that subjects should begin at the beginning and proceed through to the end. As Figure 7 shows, hypnotizable subjects are less likely, compared to subjects of low or moderate hypnotizability, to recall the test suggestions in the order in which they occurred (Evans & Kihlstrom, 1973; Kihlstrom & Evans, 1979). If the amnesia suggestion has been omitted from the scale, there is no difference between the groups in temporal organization if the amnesia suggestion (Kihlstrom & Evans, 1979).

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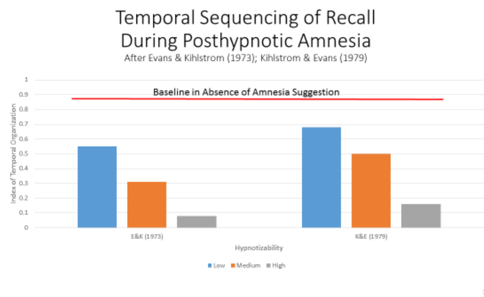
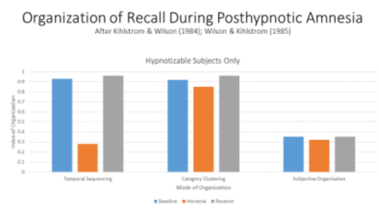


Embedding standard verbal-learning procedures in a hypnotic context permits examination of the fate of other forms of organization in PHA. Figure 8 compares serial organization (Mandler & Dean, 1969) with category clustering (Bousfield, 1953) and subjective organization (Tulving, 1962b). Consistent with the findings from the standardized scales, subjects who organized the list sequentially during the memorization phase showed a disruption in temporal sequencing during PHA, which was restored after the amnesia suggestion was canceled (Kihlstrom & Wilson, 1984). However, the same pattern was not observed with category clustering or subjective organization (Wilson & Kihlstrom, 1986).



Taken as a whole, these results suggest that there may be something special about temporal organization and its disruption in PHA. At the same time, it should be noted that some controversies remain with regard to the organization of recall in PHA. Some studies have failed to find the disorganization effect on seriation (e.g., Radtke & Bertrand, 1990), while another study found a decrement in subjective organization, once overlearning enabled subjects to achieve higher levels of organization prior to the amnesia suggestion (Tkachyk, Spanos, & Bertrand, 1985). Other studies have found disorganized clustering (e.g., Perlini, Bertrand, & Spanos, 1988); another set of experiments found that suggestions to forget only one category of items had no effect on recall, or clustering, of the remaining items, suggesting that categorical organization remained intact (Davidson & Bowers, 1991). At present, methodological differences among the studies preclude firm conclusions about the fate of organization during PHA (Kihlstrom & Wilson, 1988; Spanos, Bertrand, & Perlini, 1988).

In its original formulation, the disorganization hypothesis did not distinguish between seriation and other forms of organization, such as clustering. Given the availability of large amounts of data from the standardized scales, and the item-by-item structure of the typical experience of hypnosis, temporal sequencing was simply a convenient – not to mention ecologically valid -- place to begin understanding the mechanisms underlying genuine retrieval failure. An alternative “social-cognitive” view construes hypnosis as a special case of strategic role-enactment: subjects respond positively to amnesia suggestions by failing to attend to appropriate retrieval cues, failing to employ appropriate retrieval strategies, or simply failing to report items that they remember perfectly well – all in the service of presenting themselves as “good” hypnotic subjects (e.g., Spanos, 1986; Wagstaff, 1977a, 1977b). The social-cognitive account of PHA would seem to be indifferent to the particular form of organization being studied. On the other hand, the failure of Wilson and Kihlstrom (Wilson & Kihlstrom, 1986) to find a disruption in either category clustering or subjective organization, despite the use of procedures identical to those that yielded a substantial effect on seriation

(Kihlstrom & Wilson, 1984), suggests that temporal disorganization may play a special role in PHA. Even subjective organization can sometimes involve temporal organization: linking unrelated items into a story or image is a familiar mnemonic device (Worthen & Hunt, 2011): both strategies have an underlying temporal structure; and alphabetization, another popular form of subjective organization, counts as a special form of seriation (Tulving, 1962a). Perhaps subjective organization is disrupted when it is essentially serial in nature, but not otherwise. This hypothesis remains to be tested.

Implicit Memory in Posthypnotic Amnesia

It is one thing to forget something and then remember it again at a later time. It is quite another for the forgotten material to continue to dynamically influence experience, thought, and action even in the absence of conscious recollection. It turns out that PHA impairs conscious recollection, but spares what has come to be known as implicit memory (Kihlstrom, Dorfman, & Park, 2017; Schacter, 1987; Schacter, Chiu, & Ochsner, 1993).

Hints of a dissociation between explicit and implicit memory appeared even in the earliest research on PHA, which employed savings in relearning as an objective measure of memory. Savings, as has been recognized since its invention by Ebbinghaus (1885/1964), is sensitive to memories available in storage that are not consciously accessible (Nelson, 1978, 1985). In the first study of the type, Young (1926) noted that hypnotic subjects typically showed substantial savings in relearning material which they could not remember learning during hypnosis. Strickler (1929; see also Hull, 1933) confirmed Young's findings in a more extensive and thoroughly documented study conducted in Hull's laboratory. While hypnotized, subjects mastered a list of paired-associate nonsense material presented on the memory drum Hull himself invented (Kihlstrom, 2004). On a "reinstatement-recall" test, in which subjects were presented with the stimulus term and asked to recall the response term (thus a form of cued recall), the subjects gave the correct response to only about 3% of items, on average, compared to about 84% correct for a control series studied and tested in the normal waking state. Nevertheless, these densely amnesic subjects showed approximately 48% savings in relearning, versus 98% for the waking control series: individual subjects' savings scores during amnesia ranged from 31-61%.

Other experiments from Hull's laboratory yielded much the same results (for a comprehensive overview, see Hull, 1933). Coors (1928) obtained about 38% savings in relearning of a stylus maze compared with 83% in control subjects. Along similar lines, Patten (1932) found that a period of practice in hypnosis, covered by PHA, did not interfere with cumulative practice effects in mental addition, while Life, in an experiment summarized by Hull (1933), obtained similar findings for rehearsal effects on memory for nonsense syllables. Mitchell (1932) found that PHA did not abolish retroactive interference effects, as measured by savings in relearning. Also working in Hull's laboratory, Scott (1930) found no effect of PHA on conditioned responses acquired during hypnosis. The amplitude of the conditioned response was somewhat reduced, but this was likely confounded with extinction during repeated testing of response to the conditioned stimulus.[2]

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[2]Stern, Edmonston, and their colleagues found that PHA abolished habituation to a tone stimulus, as measured by the electrodermal orienting response (Stern, Edmonston, Ulett, & Levitsky, 1963). Although thus would seem to contradict Scott's findings, it appears that most of Stern et al.'s subjects were not

Interpretation of all these experiments is complicated by the fact that during these experiments amnesia was not specifically suggested to the subjects. But only a little: As Hull himself notes (p. 133, fn. 2) all of these subjects were highly selected for hypnotizability. All had demonstrated suggested PHA in previous laboratory sessions, so it can be assumed that the subjects expected to be amnesic during the experiments in question, and Hull makes clear that all of the subjects in his group's experiments showed complete PHA as tested by recall.

Subsequent research employing explicit suggestions for PHA has generally confirmed the findings of the earlier experiments. In a study of retroactive inhibition, Graham and Patton (1968) had subjects learn a list of adjectives in the normal waking state. Two groups then learned a second list while hypnotized, followed by suggestions either for complete amnesia or complete recall; a third group learned the interpolated list in the normal waking state, with no suggestion. Compared to control subjects who had no exposure to the second list, all three experimental groups showed a significant diminution of savings in relearning the original list; the amount of loss did not differ significantly among them (Figure 9) . Coe and his colleagues (Coe, Basden, Basden, & Graham, 1976) also observed substantial levels of retroactive interference during PHA.

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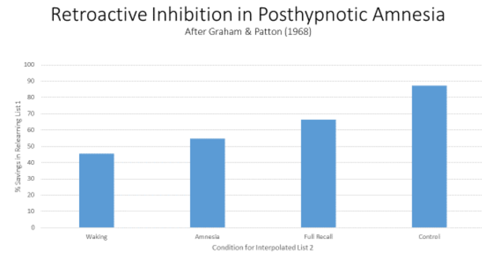
actually amnesic. Instead, they either distorted their memory of the habituation stimulus, or their perception of the test stimulus -- for example, by transforming the tone into a buzzer.



Source amnesia, another expression of implicit memory, was initially discovered and named in the context of research on PHA. Evans and Thorn (1966) found that some amnesic subjects retained world-knowledge which they had learned incidentally 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. It is possible to suggest source amnesia (Cooper, 1966), but in the initial study by Evans and Thorn, the phenomenon occurred spontaneously in subjects who had been given the usual suggestion for PHA. In a later study, Evans (1979) showed that source amnesia did not occur in insusceptible subjects who simulated hypnosis and PHA. Although the methodology of Evans' study has been criticized (Coe, 1978; Spanos, Gwynn, Della Malva, & Bertrand, 1988; Wagstaff, 1981), 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 emerging from hypnosis research that has become part of the common parlance of psychological theory.[3]

[3] Source amnesia had been famously observed in an amnesic patient by Claparede (Claparede, 1911/1951; see also) (Kihlstrom, 1995), but not named as such. Evans and Thorn (1966) also noted that their findings had been anticipated by Banister and Zangwill (Banister & Zangwill, 1941a, 1941b) 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. Even earlier, Young

Source amnesia might be implicated in research by Huesmann et al. (1987) on PHA. In their first experiment, hypnotized subjects solved a series of problems adapted from the Luchins (1942) ”water jar” paradigm, followed by a suggestion for PHA. Despite recalling very little of the learning experience, they displayed a clear problem-solving set on test items, employing an algorithm learned during hypnosis, even though a simpler algorithm would have sufficed. In another experiment, subjects listened to a story about either baseball or a cave; following a suggestion for PHA, they were asked to free-associate to homographs such as *bat*. Examination of their responses indicated that their interpretation of the homographs was biased by the story they had heard, even though they could not remember the story itself.

Research employing psychophysiological measures of memory also indicates that implicit memory is spared during PHA. Bitterman and Marcuse (1945), working with only a single subject over multiple trials in a lie-detector situation, suggested PHA for single words presented during hypnosis. Experienced polygraphers were able to identify the target words on a majority of trials – on all trials, in fact, allowing for second guesses. This outcome does not necessarily mean that the subject was being deceptive; indeed, as the authors noted, the results might indicate a “dissociation” (p. 251) between conscious recognition and autonomic indices of memory that operate outside conscious awareness. This possibility is strengthened by a study by Kinnunen and colleagues, who examined skin conductance responses during a posthypnotic interview (Kinnunen, Zamansky, & Block, 1994) . They concluded that hypnotic

(1926, p. 352) had noted that one of the subjects in his experiment on savings in relearning “retained all the associations but did not remember when he had learned them”. Another subject, remarking on his ability to produce the correct associations, that “they just come”.

subjects were being truthful when discussing their responses to hypnotic suggestions, including PHA, while subjects simulating hypnosis typically showed physiological signs of deception.[4]

In the most extensive psychophysiological investigation of PHA to date, Allen and his colleagues recorded event-related potentials (ERPs) during PHA (Allen, Iacono, Laravuso, & Dunn, 1995; Schnyer & Allen, 1995). Examining five peak amplitudes -- P1, N1, P2, N400, and LPC (including P300), they found a pattern of response that distinguished highly hypnotizable, amnesic subjects from both insusceptible, nonamnesic subjects and simulators; the latter two groups did not differ significantly. The differences between amnesic and nonamnesic subjects disappeared after the amnesia suggestion was canceled. Similarly, LaBerge and Zimbardo (1999) found that the P300 component of the ERP distinguished between test items that were covered by the amnesia suggestion and control items that were not. Taken together with differences in response latencies between amnesic subjects and simulators, Allen et al. suggested that their findings were indicative of "recognition without awareness" (p. 427), analogous to the psychophysiological findings common in studies of prosopagnosia (e.g., Bauer, 1984).

Savings in relearning, retroactive (and proactive) interference, source amnesia, classical conditioning, and physiological response all count as examples of implicit

[4]A series of studies by Coe and his associates employed a polygraph as a social-psychological manipulation in attempts to breach PHA by persuading subjects that they could be caught lying (Coe & Yashinski, 1985; Howard & Coe, 1980; Schuyler & Coe, 1981, 1989). As noted earlier, the gambit succeeded for a subset of subjects for subjects who indicated that they were, indeed, voluntarily withholding information on the amnesia test, but not for those who reported that their PHA occurred involuntarily. The subjects who breached amnesia did show autonomic signs of increased anxiety, but the researchers did not examine the polygraph records to determine whether they could identify material covered by the amnesia suggestion.

memory, because none of them require conscious access to the episodic memories which give rise to these effects. But as the concept of implicit memory has evolved, priming has emerged as the gold standard. Priming occurs when one task, such as studying a word (the prime), influences performance on another task, such as free association (the target). When the one task facilitates task performance, we speak of positive priming; negative priming occurs when the first task impairs performance on the second. Most research on implicit memory in general, and all of the research on implicit memory in PHA, has involved positive priming.

Priming as an aspect of implicit memory in PHA was first observed, though not labeled as such, in a pair of studies employing free-association and category-generation tasks (Kihlstrom, 1980; see also) (Kihlstrom, 2019a). Figure 10 depicts the major results. In the first experiment, hypnotized subjects memorized a list of words, like *girl*, that were strong associates of other words, like *boy*, followed by a suggestion for PHA. Highly hypnotizable subjects performed very poorly on a free-recall test administered while the amnesia suggestion was in effect, but continued to use the list items as responses on a word-association test. In a second experiment, in which subjects memorized lists consisting of highly salient category instances, such as *foot*, highly hypnotizable subjects were densely amnesic on the test of free recall, but still used the list items when asked to generate instances of categories such as *part of the human body*. More important, the amnesic subjects were *more likely* to generate list items as free associates and category instances, compared to carefully matched items that had not been learned.

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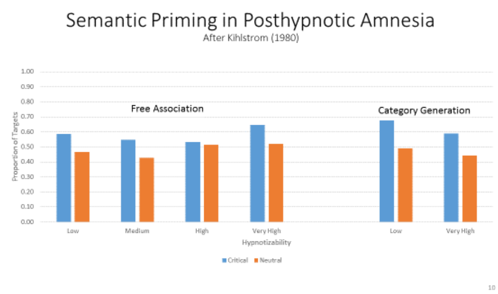

This study had been explicitly modeled on an earlier experiment by Williamsen et al. (1965), who observed, but did not comment on, similar priming effects in both free association and partial-word completion (Figure 11). Barber and Calverley (1966), in a replication and extension of Williamsen et al., likewise found, but did not comment on, spared priming in partial-word completion. Later studies by Spanos and his associates found preserved priming on a free-association test (Spanos, Radtke, & Dubreuil, 1982) and on a homophone-spelling test (Bertrand, Spanos, & Radtke, 1990), confirming the earlier results. They also showed that an alternative suggestion, that subjects would be “unable to bring these words to mind, unable to think of or remember them in any way” (p. 568), actually suppressed the production of target items, and increased the response latency for those that were produced. This effect on semantic, as opposed to episodic, memory is more properly termed *agnosia* rather than amnesia (Raz, Shapiro, Fan, & Posner, 2002; Ulrich, Kiefer, Bongartz, Grön, & Honig, 2015): hypnotic agnosia is an understudied phenomenon that warrants treatment in a different chapter, in a different book.

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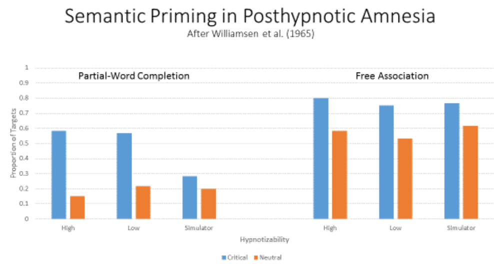

Priming comes in two general forms. Repetition priming is based on a perception-based representation of the prime, and is mediated by its physical resemblance to the target; semantic priming is based on a meaning-based representation, and is mediated by semantic similarity. While most research on implicit memory in the amnesic syndrome and other forms of "organic" amnesia focuses on repetition priming (e.g.,) , the studies of priming in free association and category-generation tasks entail semantic priming. Partial-word completion is often considered to be an instance of repetition priming, but in the Williamsen et al. and Barber-Calverley the situation is somewhat ambiguous. In both experiments, the items were presented for study aurally, but the completion test was visual. Given the cross-modal nature of the situation, the priming might better be construed as lexical in nature, based on abstract stored representations of the items in question.

Although these priming effects appear to demonstrate a dissociation between explicit (conscious) and implicit (unconscious) memory, they are not completely definitive. Comparing priming with free recall entails a confound: free recall tests involve very minimal retrieval cues which specify only the time and place the target event occurred; but free-association and category-generation tests provide additional cues, in the form of the free-association stimuli or category labels. The most convincing demonstration of explicit-implicit dissociations come from studies where the two tests are matched for the informational value of the cues provided to the subjects (Graf, Squire, & Mandler, 1984). Such closely matched tests of explicit and implicit memory were not built into the design of these early studies. The criticism is muted somewhat by the fact that many of these studies found that recognition, which involves highly informative "copy cues", was also impaired during PHA. Barnier and her colleagues examined both repetition and conceptual priming in a study that kept modality of presentation (visual) constant between encoding and retrieval, and employed matched cues for the tests of explicit and implicit memory (Barnier et al., 2001). As Figure 12 shows, the hypnotizable subjects showed a substantial deficit on a cued-recall test of explicit memory, but levels of priming on free-association and fragment-completion tests of implicit memory.

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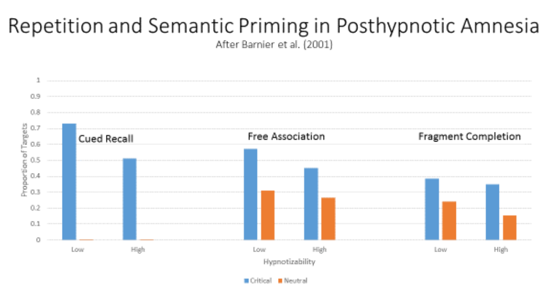

Even though priming is generally considered to reflect unintentional retrieval of stored information concerning a prior episode, conscious recollection may still contribute to performance on tasks such as fragment completion, free association, and category generation (Schacter, Bowers, & Booker, 1989). Some support for this possibility comes from preliminary research reported by Dorfman and Kihlstrom (Dorfman &

Kihlstrom, 1994), who gave subjects matched tests of explicit and implicit memory. The hypnotic subjects showed a profound amnesia on a test of cued recall, compared to control subjects. They also showed significant priming on a test of free association; unfortunately, the control subjects showed no priming at all. It is possible that the controls (but not the amnesic subjects) recognized the connection between the memorized wordlist and the free-association test, and deliberately withheld list items from their free-association responses.

A follow-up experiment, employing the process dissociation paradigm (PDP; Jacoby, 1991), in an attempt to tease apart the contributions of controlled and automatic processing to priming, also yielded ambiguous results. Employing Jacoby's method of opposition (MOO), Dorfman and Kihlstrom (1994) asked subjects either to include items from the study list in their free-association responses (the Inclusion condition), or to omit them (the Exclusion condition). Some (but not all) apparently amnesic subjects were nonetheless able to withhold studied items from their free association responses. Although the logic of opposition might lead to the conclusion that these subjects were not really amnesic after all, it is also possible that their ability to withhold list items reflected a kind of attributional effect. These subjects did not remember the words they learned, but they did know that they learned some words while they were hypnotized, and many reported that their responses during the word-association task evoked a feeling of familiarity. When this occurred, the subjects may have inferred that the items were, in fact, from the study list, and edited them out of their responses. Thus, the lack of conscious recollection does not necessarily preclude conscious control.

David and his colleagues (David et al., 2000) performed a more definitive experiment using the MOO and PDP to assess the differential contributions of automatic, unconscious and controlled, conscious processes to the priming effects observed during PHA. While the traditional PDP distinguishes only between controlled (voluntary, conscious) and automatic (involuntary, unconscious) memory retrieval processes, David et al. employed a variant which further distinguished between two forms of conscious memory: voluntary, such as deliberate recall or recognition, and involuntary, as in the Proust's "madeleine episode", where a conscious recollection comes involuntarily to mind (Richardson-Klavehn, Gardiner, & Java, 1994). In their experiment, David et al. gave suggestions for amnesia covering only half the studied items; the subjects then completed a stem-cued recall test of explicit memory, and a stem-completion test of implicit memory. As shown in Figure 13, both hypnotizable and insusceptible subjects showed a mix of voluntary conscious, involuntary conscious, and involuntary unconscious memory for the to-be-remembered (TBR) items; this mix also was evident for the to-be-forgotten (TBF) items in the insusceptible subjects (who, after all, did not experience PHA) and for controls who were not hypnotized. For the hypnotizable subjects, however, the TBF items – i.e., those covered by PHA -- showed quite a different pattern. The two consciously controlled components were very weak, with performance during PHA dominated by involuntary unconscious memory.

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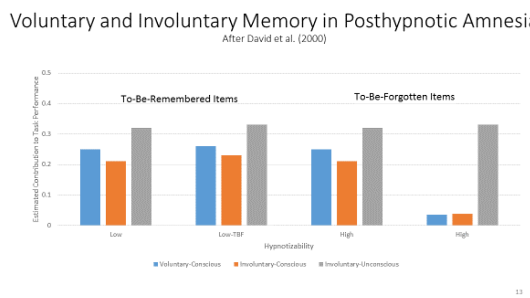

Recollection and Familiarity in Posthypnotic Amnesia

The study by David et al. (2000) supports the hypothesis that spared priming in PHA reflects a dissociation between explicit and implicit memory, but leaves open the question of whether amnesic subjects can capitalize on a priming-based feeling of familiarity to support performance on explicit memory tasks such as recognition. In fact, it is now understood that recognition by both amnesic and nonamnesic subjects and can be supported by both conscious recollection and a priming-based feeling of familiarity (Mandler, 1980; Yonelinas, 2002; Yonelinas, Aly, Wang, & Koen, 2010). For example, Tulving (1985) distinguished between two forms of recognition memory: recognition-by-remembering entails retrieval of an episodic memory as part of one's personal past (what Tulving called "autonoetic consciousness"), while this personal connection is absent in recognition-by-knowing, which allows a person to know about a past event without actually remembering it. Although Tulving likened "knowing" to semantic memory, it has become popular to interpret "knowing" in terms of a priming-based feeling of familiarity (e.g., Gardiner, 1988; for a review, seeKihlstrom, 2019c). Unfortunately, Tulving's "Remember-Know" paradigm has not been employed in research on PHA (hint, hint). Any such study should take care to distinguish "knowing", which Tulving construed as analogous to retrieval from semantic memory, with the intuitive “feeling” of familiarity (Kihlstrom, 2019c). The contribution of priming to episodic recognition is almost certainly represented by the latter, not the former.

Still, recent studies of recognition memory suggest that familiarity plays a role in whatever success amnesic subjects have on recognition tasks (Kihlstrom, 2019b). These studies have substituted a continuous measure of recognition confidence for the traditional, dichotomous, “Yes/No” ratings. For example, in the study illustrated in Figure 6 above, subjects made recognition judgments on a four-point scale where 1 = Certain that the item *was not* on the study list; 2 = think that the item was not on the list, but not certain; 3 = think that the item *was* on the list, but not certain; 4 = certain that the item was on the list. Such a rating scale yields three different criterion for recognition: a strict criterion, counting only items receiving a rating of 4; a moderate criterion counting items that received ratings of 3 or more; and a liberal criterion counting even those items that received a rating of 2. The value given for the recognition test reflects the moderate criterion.

Figure 14 shows more detailed findings from that experiment (Kihlstrom, 2019b, Experiment 1). The subjects studied a list of 16 items, four drawn from each of 4 taxonomic categories. The recognition test consisted of 64 items: the 16 “critical targets”; 16 “critical lures” drawn from the same categories and matched to the targets; 16 “neutral targets” matched to the critical targets; and 16 “neutral lures” matched to the neutral lures (and, perforce, to the critical targets and critical lures as well). Recognition was quite poor under the strict criterion.

As the criterion for recognition was loosened, recognition of critical targets increased progressively, but remained less than perfect even after application of the loosest criterion; false recognition of critical lures increased as well; but false recognition of neutral targets and lures only occurred under the liberal criterion.

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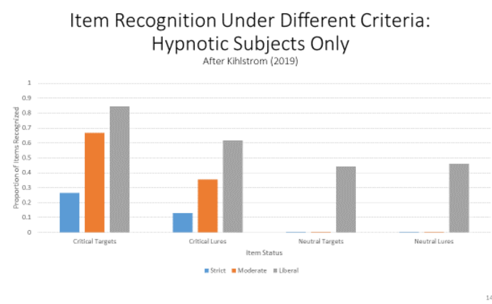

Even with the increase in false alarms, *d’* increased as the analysis shifted from the strict to the moderate criterion; *d’* dropped off somewhat with the liberal criterion, but was still higher than under the strict criterion. Similar findings were obtained with patients who were amnesic following electroconvulsive therapy, when they were encouraged to loosen their criterion for recognition (Dorfman, Kihlstrom, Cork, & Misiaszek, 1995). In both cases, it appeared that the subjects were able to capitalize on the priming-based feeling of familiarity to improve their performance on the recognition test. This semantic priming apparently extends to additional items from the categories on the study list, which is why critical lures receive higher confidence ratings than targets or lures from the neutral categories. By analogy to the associative memory illusion (Deese, 1959; Park, Shobe, & Kihlstrom, 2005; Roediger & McDermott, 1995), these false alarms may represent a categorical memory illusion (Knott, Dewhurst, & Howe, 2012; Smith, Ward, Tindell, Sifonis, & Wilkenfeld, 2000).

The role of priming-based familiarity in recognition may help explain the findings of an experiment by Smith and colleagues (Smith, Oakley, & Morton, 2013). In a variant on the standard priming paradigm, hypnotizable subjects performed a free-association test, and then received a suggestion for amnesia covering both the fact of the test and the responses they had given. On a second free-association test, which contained the same cues as the first one, plus some additional cues, these subjects showed about 47% overlap between the two sets of responses. By contrast, unhypnotized control subjects instructed to generate different responses on the second test showed only about 3% overlap, while another control group, given no particular instruction, showed about 89% overlap. Interestingly, the amnesic subjects displayed longer response latencies on the second test, compared to the first, and the increase in response latencies was correlated with the number of novel responses given. This suggests that the amnesic subjects recognized some of the cues from the second list as repetitions from the first list, and edited their responses accordingly – resulting in the lengthened response latencies. Smith et al. rejected conscious withholding as an explanation for their findings, but suggested that the targeted material is *unconsciously* blocked from further processing. Another possibility is that the subjects responded to a priming-based feeling of familiarity by producing a second response which did not seem familiar.

Neural Correlates of Posthypnotic Amnesia

Although recent years have seen an upsurge of neuropsychological and neuroimaging studies of hypnosis (Del Casale et al., 2012; Halligan & Oakley, 2013; Kihlstrom, 2013; Landry & Raz, 2015; Oakley & Halligan, 2013), so far only one of these has focused directly on PHA. Mendelsohn and colleagues (Mendelsohn, Chalamish, Solomonovich, & Dudai, 2008) began by showing highly hypnotizable subjects a documentary film in the normal waking state; a week later, they entered an FMRI scanner, were hypnotized, received a suggestion for PHA, and were queried about the events depicted in the film. Compared to controls, the subjects showed a clear impairment in (cued) recall for the events of the film; however, they showed no deficit in memory for incidental details of the context in which they had viewed the film. Whole-brain analysis of the fMRI image revealed a substantial reduction in activity, compared to control group who viewed the same film but received no suggestion for PHA. The changes particularly affected portions of the left temporal pole and extrastriate cortex, regions thought to be involved in memory retrieval. There was also increased activity in the left rostrolateral prefrontal cortex, a region thought to be involved in the regulation of memory retrieval strategies. These shifts were reversed when the suggestion for PHA was canceled.

The finding of altered activity in fronto-temporal regions during PHA is broadly consistent with neuroimaging studies of other forms of top-down memory inhibition, including various forms of DF (Anderson, Bunce, & Barbas, 2016; Anderson & Hanslmayr, 2014) and dissociative amnesia (Bell, Oakley, Halligan, & Deeley, 2011; Staniloiu & Markowitsch, 2014). However, this area of research is in its infancy, and any definitive conclusions are precluded by the vast differences in paradigms employed in the various studies. Nevertheless, the ease with which PHA can be induced in hypnotizable subjects, suggests that continued neuroimaging research on PHA and other phenomena of hypnosis will shed light on the neural mechanisms of not only hypnosis, but also of the fascinating, but frustratingly rare, dissociative disorders.

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