Hypnosis and memory: two hundreds years of adventures and still going!

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ABSTRACT

One of the most persistent beliefs about hypnosis is its ability to transcend mnemonic abilities. This belief has paved the way to the use of hypnosis in the clinical and legal arenas. The authors review the phenomena of hypnotic hypermnesia, pseudo-memories, and amnesia in light of current knowledge of hypnosis and memory. The investigation of the relation between hypnosis and memory processes has played an important role in our understanding of memory in action. Hypnosis provides a fertile field to explore the social, neuropsychological, and cognitive variables at play when individuals are asked to remember or to forget their past. We suggest promising avenues of research that may further our knowledge of the building blocks of memories and the mechanisms that leads to forgetfulness.

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Preface

Memory has been the object of scientific investigation for more than a century. It might come as a surprise to readers, including memory researchers, to discover that some of what we know today about memory, and the way we currently conceptualize it, is the byproduct of attempts to understand the effect of hypnosis on memory. In this article we will focus on two major areas where hypnosis has kindled new and exciting developments for memory researchers. The first is the area of false memory, where hypnosis has played a leading role in alerting researchers to (a) the possibility of creating false memories in the laboratory, (b) the unwarranted confidence hypnotized individuals place in the accuracy of their recall, and (c) clinical and forensic consequences associated with the instantiation of false beliefs. We next examine how hypnosis can be used to better understand autobiographical memories via analogs of functional amnesia, aberrations and alterations in self-identity, and psychological disorders. Finally, we will explore a number of research venues that promise to enrich our understanding of human memory.

One of the most longstanding beliefs about hypnosis is that a hypnotized individual is able to remember much more than a non-hypnotized person (Johnson and Hauck, 1999; Legault and Laurence, 2007; Ost, Wright, Easton, Hope, and French, 2013). The roots of this belief can be traced back to the practitioners of Animal Magnetism in the early 1800s, and most notably the Marquis de Puységur, who reported that his somnambulistic patients could recapture past events in minute detail, which they promptly forgot when "demagnetized." None of the remembered events seemed available in the patients' normal state. Hypermnesia (improved net recall over repeated trials), amnesia, and the belief that hypnosis is capable of uncovering or

revealing memories were to become intrinsically linked to the history of hypnosis, memory, and psychological experimentation for the next two hundred years (Laurence and Perry, 1988).

At the end of the 19th century, hypnosis found itself at the heart of experimental psychology. Luminaries in the nascent field of psychology, including William James, Wilhelm Wundt, Théodule Ribot, and Pierre Janet, to name a few, at one time or another, dabbled in hypnosis. What caught their attention were the amazing memory feats that hypnotized individuals seemed to perform and the various forms of suggested amnesias that they displayed--what Ribot (1882) labelled the "exaltations of memory." It was during this period of hypnotic effervescence that the observations of patients' hypnotic abilities led to theories about dissociation, multiple personalities, unconscious cognitions, and emotions. Hypnotic hypermnesia, post-hypnotic amnesia, and posthypnotic suggestion were at the vital center of the new psychology of the mind.

Nevertheless, what some patients were remembering or apparently forgetting raised questions and doubts in the minds of some hypnosis experimenters (e.g., Bernheim, 1891/1973). What if the traumatic memories recalled during hypnosis were in fact the product of suggestion? What if the remembrances were false memories? This latter question wended its way through the experimental literature and eventually to the courts of law where the debate thrust the ones who believed in the power of hypnosis to exhume seemingly forgotten memories in opposition to those who favored the idea that suggestions, beliefs, and expectancies shaped the narratives that the patients reported as memories (see Laurence and Perry, 1988). Sounds familiar? Indeed it does.

If the beginning of the 20th century saw the interest in clinical and experimental hypnosis wane, beliefs surrounding its purported memory powers did not. Hypnosis continued to be used in therapy to explore the past, and techniques such as hypnotic age regression stirred interest and provoked speculation and theory-building attempts in the clinical context (Reiff and

Scheerer, 1960). Ironically, what had unfolded as one of the most intense professional debates among psychologists at the end of the 19th century in Europe resurfaced at the end of the 20th century in America, again fuelled by beliefs surrounding the power of hypnosis on memory.

The trigger for the more recent debate was the enthusiasm of police forces for a 'new' investigative technique, forensic hypnosis, in the wake of which witnesses and victims of crimes were hypnotized to access crucial, yet consciously unavailable, information. Researchers soon challenged the extravagant claims of success touted by the hypno-investigators or Svengali squads as they were called, based on suspicions that the alleged success of hypnosis was a chimera, nothing more than the product of undue suggestion. As in the 19th century, the matter became more muddled and complex with the renewal of interest in multiple personality disorder and the belief that not only was hypnosis allowing unconscious memories to surface, but that the recovered memories were often embedded in different "personalities" altogether. Whereas the police use of hypnosis raised the question of whether suggestion leads to incorporating misinformation, the narratives of multiple personality patients raised the specter that suggestion could create completely new (and false) memories and crystallize imagined or fabricated self-identities.

The importance of beliefs in shaping memory narratives

We owe in part to hypnosis the realization that beliefs shape memory reports (see Mazzoni and Kirsch, 2002; Mazzoni, Scoboria and Harvey, 2010). Accordingly, what people remember when hypnotized depends, in part, on their beliefs about the effect of hypnosis on memory. One popular belief is that when participants recall events during hypnosis, they recall more detailed and accurate memories compared with recall of the same events without hypnosis. This belief can probably be traced to the clinical work of Janet (1889/1973) who was one of the first therapists to use hypnosis to both help patients recover memories of traumatic events, which he assumed caused their pathological conditions, and to modify their memories

for these adverse events (see for example the well known case, “Marie” (Laurence and Perry, 1988, p.236-237). Rooted in the work of early practitioners, like Janet, the belief that hypnosis can recover buried memories of traumatic events came to permeate many therapeutic approaches.

How prevalent are these beliefs today? Yapko (1994) conducted a survey of over 850 psychotherapists in private practice, which revealed unexpectedly high rates of endorsement of beliefs regarding hypnosis as a vehicle to enhance memory. Seventy-five percent of the therapists surveyed agreed “hypnosis enables people to accurately remember things they otherwise could not” (Yapko, 1994, p. 234). Poole, Lindsay, Memon, and Bull (1995) reported comparable rates in an extensive survey of licensed clinical psychologists in the United States and Great Britain, revealing that therapy aimed at recovering memories was widespread. Later, Legault and Laurence (2007) replicated these findings in a sample of more than 200 psychiatrists, psychologists and social workers in Canada. Most recently, Ost, Wright, Easton Hope and French (2013), surveyed psychologists and hypno-therapists in the UK on repressed memories and satanic abuse and concluded: “The results of this survey indicate that, despite the extensive literature that has developed in the last 20 years, a number of psychological therapists hold beliefs that many memory scientists would view as controversial, in short, beliefs about memory which fail to be supported by scientific data” (p.16).

Similar beliefs about hypnosis and memory are held by laypersons. For example, Whitehouse, Orne, Orne, and Dinges (1991) reported that 93% of college-age participants believed that hypnosis enhances memory retrieval. Johnson and Hauck (1999) found that 88% of the respondents agreed to some degree that "hypnosis enables people to accurately remember things they could not otherwise remember (p.17)." Most recently, Green, Page, Rasekhy, Johnson, and Bernhardt (2006) sampled college students' beliefs about hypnosis in four countries (Australia, German, Iran, U. S.) and reported no cross-cultural differences in response

to the latter statement about hypnosis and memory, but fully 90% of participants, on average, agreed with it.

The influence of beliefs and expectations on memory with or without hypnosis has important clinical and legal ramifications. Belief about memory shapes not only personal memory in hypnosis, but also waking memory reports (Mazzoni, et al., 2010; Mazzoni, Clark and Nash, 2014) to the point of creating new identities (Cox and Barnier, 2013). Clinicians surveyed by Legault and Laurence (2007) reported that 17.5 % of women entering therapy without actual memories of abuse 'recovered' those memories during therapy whether hypnosis was used or not (Laurence and Freedman, 2009). Therapists who reported making use of many 'recovery" techniques (including hypnosis) were the ones who reported a greater number of recovered memories. The interplay of beliefs, expectancies, and recall of life narratives is still an open field in need of investigation. The transmission of false beliefs (and expectations) and their potential consequences is a crucial aspect of our understanding of memory in action.

Does hypnosis improve memory? Empirical evidence

Is the belief that hypnosis enhances recall confirmed by the scientific literature? Although some studies have indeed found evidence for hypnotic hypermnesia, better-controlled studies have revealed how inaccurate memory reports can be in hypnosis. Crucially, these studies contributed to the shift in focus of memory research away from the sheer quantity of recollections towards the quality of memory reports. For decades, researchers (for example, Gordon Bower, Fergus Craik, Robert Lockhart, Endel Tulving, to name a few) had assessed memory in terms of how many items participants remembered, and on this basis established the effectiveness of encoding and retrieval conditions. Little attention was devoted to memory accuracy and the errors of memory (Koriat, Goldsmith and Pansky, 2000). But we now know that suggestions in hypnosis (see Labelle, Laurence, Nadon and Perry, 1990; Green, Lynn and Malinovski, 1998), as well as other types of suggestion (Mazzoni and Memon, 2003), including

misinformation, can modify recall and recognition in predictable directions (Cox and Barnier, 2013; for a review see Mazzoni and Lynn, 2007; Mazzoni and Scoboria, 2007) and engender complex false memories (Mazzoni, Loftus, Seitz and Lynn, 1999).

Hypnotic Hypermnesia

Since the early 1970s, researchers have investigated normal (waking) hypermnesia and reminiscences (higher cumulative recall over time). In laboratory investigations of hypnosis and memory the material-to-be-recalled may refer either to autobiographical events--sometimes from the person's remote past--or to non-autobiographical material, such as filmed scenes, spoken stories, and word lists.

Age regression is one of the methods of choice to uncover otherwise "forgotten" memories. In age regression participants, including patients, are asked to "go back in time" and "relive" some past event. Sometimes, notably in the clinical setting, regression can involve highly implausible memories in the womb and even earlier reports of a purported past life. For many people, the experience of regression can be profound, vivid, and compelling. True (1949) claimed that when participants were age regressed, they successfully named the day of the week of childhood birthdays. Yet better-controlled studies failed to replicate these findings (for a summary of this research see Nash, 1987). In fact, convincing evidence is lacking that participants in any real psychological or physical sense regress to an earlier stage of development or that memories retrieved following regression are uniquely or specifically accurate. As early as 1951, Martin Orne alerted the scientific community about the intrusions of confabulations in hypnotically age-regressed individuals. Confronted with the fact that the historical veracity of a past life, memories of life in the womb, or an early childhood memory can rarely be independently corroborated, researchers turned to experimental designs to control for the memory source and better evaluate the potential influences of hypnosis on memory.

In a review of laboratory studies and accounts of forensic cases in which hypnosis has

been used to enhance eyewitness recall, Relinger (1984) concluded that hypnosis is more likely to facilitate the free recall of meaningful material (e.g., live or filmed scenes such as simulated crimes) than material such as word lists or nonsense syllables. Researchers then sought to evaluate Relinger's conclusion. As Erdelyi (1994) has shown convincingly, when studies are divided according to type of memory tests (recall versus recognition) and types of stimuli used (meaningless versus meaningful), it becomes much easier to evaluate any hypermnesic effect of hypnosis on memory. Examining studies that have targeted recognition, the answer is clear: There is no hypnotic hypermnesia in recognition, whether it is with meaningful or meaningless material (e.g., Zelig and Beidleman, 1981).

In studies that have measured recall of meaningless (e.g., nonsense syllables) versus meaningful material (e.g., films extracts, meaningful pictures), the outcome is also clear: There is no hypermnesia for meaningless stimuli (see for example, Salzberg and DePiano, 1980). Nevertheless, for meaningful stimuli, a majority of studies did report a hypnotic hypermnesic effect above and beyond normal recall (e.g., Stager and Lundy, 1985). Consistent with Relinger's (1984) review, Erdelyi (1994) concluded that hypnotic hypermnesia is evident for the free recall of "high sense" material (e.g., poetry, pictures, films) as opposed to, say, recognition memory for lists of words or syllables.

But there is a caveat. Most studies reviewed by Relinger (1984) and Erdelyi (1994) that reported a positive hypermnesia effect did not take into account the fact that simply asking participants to repeat the retrieval leads to a normal increase in recall. The studies that have used a typical 'waking hypermnesia design' in which participants' recall is brought to plateau, before any hypermnesic technique is used, produced mixed results, favoring mostly an absence of a hypermnesic effect or a very small, unreliable one (e.g., Dinges, Whitehouse, Orne, Powell, Orne, and Erdelyi, 1992; Nogrady, McConkey and Perry, 1985). For example, Dywan and Bowers (1983) determined that a twofold increase in the number of accurate items reported

when memories were elicited in hypnosis was more than offset by a threefold increase in the number of errors compared with the error rate in nonhypnotic controls (see also Dinges et al., 1992; Whitehouse, Dinges, Orne, and Orne, 1988 for similar results). In their meta-analysis of 24 forensically relevant studies, Steblay and Bothwell (1994) concluded that, relative to waking conditions, hypnosis produced overall more recall errors, more intrusions of uncued errors, and higher levels of memories for false information relative to nonhypnotic methods. In short, research points at best to an ephemeral hypermnesic effect: "now you see it, now you don't." At worst, we will see that hypnotically enhanced recall poses risks of false memory creation. Moreover, the increased recall following a hypermnesia suggestion during hypnosis may reflect nothing more than normal (nonhypnotic) hypermnesia (Erdelyi, 1994).

Memory enhancement or memory creation?

Contrary to the lay view that memory accurately portrays experienced events, contemporary cognitive scientists agree that memory is a fallible and pliable construction, strongly influenced by current beliefs, feelings, expectations, images, and guesses about past events (Conway and Pleydell-Pearce, 2000; Loftus, 2003; Mazzoni and Kirsch, 2002). Most researchers concur that even the most ordinary memories are a composite of accurate and inaccurate recollections.

In this light, it comes as no surprise that suggestive procedures--hypnosis being just one of them—can distort the content of recollections. The possibility of creating false memories in hypnosis was identified as early as the late 19th century. In a now-classic demonstration, Bernheim (1891/1973) suggested a false event to a patient (i.e., that she had gone to the bathroom four times, and on her last visit she had fallen and hit her nose). The patient remembered the suggested event and reported using the bathroom, explaining that it was because of diarrhea, and mentioned falling on the fourth visit and hitting her nose. After hypnosis, Bernheim apparently could not shake her belief in the memory.

In line with Bernheim's findings, by the late 1970s and early 1980s, a burgeoning number of reports of suggestion-induced memory distortions emerged (M. T. Orne, 1979). Laurence and Perry (1983) provided one of the most dramatic empirical demonstrations of false memory in hypnosis. In their study, while hypnotized, highly hypnotisable participants were regressed to a night of the previous week and received the suggestion that a loud noise awakened them. If they reported having heard the suggested noise, they were asked to describe it in detail. Sixty-three percent of the participants accepted the suggestion and reported hearing the noise. Of these, 76% subsequently developed false memories of the noise. Confronted one week later with the actual recording of the session, all participants maintained their beliefs that the memory was genuine.

Very early memory reports are also vulnerable to suggestive influences through hypnosis and a variety of other suggestive procedures (e.g., dream interpretation: Mazzoni et al., 1999; imagery: Mazzoni and Memon, 2003). For example, Malinoski, Lynn, and Sivec (1998) interviewed 40 hypnotized and 40 nonhypnotized participants about their earliest memories. The first time participants were asked to report their earliest memory, only 3% of the nonhypnotized participants recalled a memory earlier than 2 years, a finding that contrasts with the 23% of hypnotized participants who reported a memory earlier than age 2 (and 20% earlier than 18 months). After the second interview, only 8% of nonhypnotized participants reported a memory earlier than 2 years, whereas 35% of hypnotized participants reported memories earlier than 18 months (30% earlier than a year).

Expectancy, criterion shift, and increased confidence.

More recent work is aimed at understanding whether expectancy and warnings moderate the effect of hypnosis on memory. Burgess and Kirsch (1999) found that when the suggestion contained warnings about the creation of false memories in hypnosis, fewer inaccurate memories were reported after hypnosis. Nevertheless, the effect of the warning

during hypnosis was minimal. Notably, in no instance did hypnotic induction produce an increase in memory accuracy compared with performance in controls.

In another study, warnings minimized memory distortions during but not after hypnosis (Green et al., 1998). However, Bryant and Barnier (1999) partly confirmed the Burgess and Kirsch (1999) findings by showing that highly hypnotizable participants retracted memories retrieved after a suggestion only when they were not hypnotized. Accordingly, the expectancy for memory enhancement in hypnosis is not easy to challenge, and highly hypnotizable individuals often maintain their belief in created memories.

So far, the evidence reviewed implies that increases in correct responses are generally offset by increases in incorrect responding, leaving accuracy unchanged, or at times decreased. Nevertheless, the most frequently reported problem with hypnotically assisted recall is that during or after hypnosis, witnesses may erroneously report items that they would normally reject on the basis of uncertainty (see, for example, Krass, Kinoshita, and McConkey, 1989; Scoboria, Mazzoni, Kirsch, and Milling, 2002). The observed increase in incorrect responses has been most often explained by a lowering of participants' criterion shift (Dinges et al., 1992; Erdelyi, 1994). A number of these studies, however, have shown that hypnosis is associated with enhanced confidence in responses, regardless of whether they are correct or erroneous and that hypnotizability moderates the effect. This increase in confidence has been clearly documented in a study in which participants received misleading questions in and out of hypnosis (Scoboria, Mazzoni and Kirsch, 2008). When asked in hypnosis to rate confidence in the correctness of their memories, the more highly hypnotizable individuals' confidence ratings were inflated, relative to confidence expressed without hypnosis.

For a memory researcher, the observed increase in confidence ratings following multi-trial recalls is somewhat surprising, and at odds with the usual interpretation of a lowered criterion shift leading to a hypermnesic effect. As suggested by Dywan (1995), one would

expect the new items retrieved to be held with less confidence if they were the result of a lower criterion shift. As Dywan (1995) proposed, hypnosis may create an illusion of remembering that leads to a misattributional report. Consistent with other studies on the creation of false memories and consistent with the attributional theories of memory (Whittlesea and Williams, 2001a, 2001b, Mazzoni and Kirsch, 2002), visual imagination and source monitoring might play a major role (Mazzoni and Memon, 2003) as visual mental images with specific perceptual-like qualities can be mistaken for memories. Visual images convey a sense of recollection that mimics that of true memories (Mazzoni and Memon, 2003). Whether it be through the use of imagery, perceptual fluency, or the feelings of involuntariness of responses that often accompany hypnosis, the end-result may be that the 'new" memories are quite similar to the 'old' ones, at least experientially (Laurence, Day and Gaston, 1998). The experience of remembering in these cases has changed, and a criterion shift might not be necessary to explain memory enhancement (Dywan, 1998). This illusion of remembering may lead a hypnotized person to believe that his or her recall has improved, even though some or most of what is recalled is incorrect. Inflated confidence in hypnotically-enhanced eyewitness memories is one of the issues that led the courts to rule that hypnosis is inadmissible, based on the presumption that jurors would be compelled by confidently held testimony. In conclusion, there is little theoretical or empirical justification for using hypnosis to enhance memory.

Hypnosis and Functional Disorders of Memory

Memory is at the core of our identity, social relationships, and ability to plan for the future based on past experiences. Not surprisingly, when memory is impaired, it creates difficulties across many areas of human functioning. Functional amnesia is arguably one of the most compelling and controversial forms of forgetting, whether seen in a clinical or a forensic context, because it involves an apparently sudden memory loss typically associated with psychological trauma, rather than with brain damage or disease (McNally, 2003). Functional

amnesia involves three major features: (1) a subjectively compelling apparent inability to consciously access autobiographical memories and information (i.e., disrupted explicit memory), (2) a continuing influence of the "forgotten" information on behavior, thought, and action (i.e., a dissociation between implicit and explicit memory), and (3) reversibility of the effect (see Cox and Barnier, 2003). Functional amnesia is a major feature of the poorly understood, and often dramatic, psychological disorders of dissociative fugue, dissociative amnesia, and dissociative identity disorder (Giesbrecht, Lynn, Lilienfeld, et al., 2008), and has, for the past three decades, figured prominently in controversies about repressed and recovered memories (Erdelyi, 2006).

Functional amnesia is particularly interesting because it: (1) appears to eliminate detailed and complex autobiographical memories for a substantial period of time; (2) the forgetting seems involuntary, unlike a great deal of everyday forgetting where effort is required to suppress upsetting memories; and (3) it resolves spontaneously and often dramatically. Accordingly, functional amnesia goes to the heart of theoretical and applied questions about malingering, memory accessibility, and the relation between cognition and emotion. However, the spontaneous, transient, and complex nature of functional amnesia has limited its systematic investigation, making laboratory analogs of the phenomenon appealing.

In PHA, the hypnotist suggests that following hypnosis a person will be unable to recall material (traditionally stimuli learned or events experienced during hypnosis but extending also to experiences before hypnosis) until they receive a reversibility cue. Typically, for high but not low hypnotizable individuals, PHA leads to disrupted explicit memory, discrepancies between implicit and explicit memory, and reversibility when the hypnotist provides a cue to the participant, such as "Now you can remember everything" (Barnier, 2002). Researchers have documented PHA for items learned or experienced during hypnosis, such as word lists (e.g., Kihlstrom, 1980), for information learned prior to hypnosis (for e.g., Barnier, Bryant,

Briscoe, 2001), and even for past personal experiences (e.g., Barnier, 2002).

The similarities between functional amnesia and PHA (i.e., impaired explicit memory, a dissociation between explicit and implicit memory, and reversibility) have spurred researchers to use PHA as a laboratory paradigm to model and explore disorders of personal memory. For example,, Barnier and her colleagues (Barnier, 2002; Cox and Barnier, 2003) and other investigators (Mendelsohn, Chalamish, Solomonovich, and Dudai, 2007) have argued that posthypnotic amnesia (PHA) can be used to model functional amnesia. Barnier has conducted programmatic research on PHA as a model of functional amnesia. Her research has focused on personal, emotional everyday life events, in contrast with much previous research that focused on simple material or less meaningful experiences such as word lists and the events of hypnosis (e.g., Kihlstrom and Evans, 1976; Spanos, Radtke, and Dubreuil, 1982). For example, Barnier (2002) asked high and low hypnotizable participants to recall a memory from their first day at high school and their first day at university. Following a hypnotic induction, she provided half of the participants with a PHA suggestion for their first day at high school and the remainder of participants with a parallel suggestion to forget their first day at university. Before she administered the reversibility cue to cancel PHA, she assessed, by way of category generation and social judgment tasks, participants' implicit memory for the events and probed for their explicit recall of the events a second time. Barnier found a dissociation between explicit and implicit measures for high hypnotizable individuals, but not for low hypnotizable individuals. For highs, their explicit recall returned to the unimpaired baseline level of lows' recall following the reversibility cue. Accordingly, her research provided a useful method for investigating temporary and reversible forgetting of autobiographical memories.

As Cox and Bryant (2008) noted, Cox and Barnier's (2003) research provides a useful technique for examining shifts in memory accessibility, allowing comparisons with clinical disorders of memory, including dissociative identity disorder and post-traumatic stress disorder

where intrusive memories of trauma are often suppressed (Brewin, 2001). During hypnosis, Cox and Barnier (2003) first invited high and low hypnotizable participants to recall memories of a first romantic relationship in response to 10 cue phrases. They then administered a PHA suggestion that targeted either the entire period or specific memories from that period. After PHA was administered, and again after the PHA suggestion was cancelled, explicit memory was assessed by cued recall (5 cue phrases that had been presented at elicitation/"old cues") and five "new cues" that had not been presented previously. Interestingly, PHA had the greatest impact on high hypnotizable, but not low hypnotizable individuals' recall (forgetting of "old cues") when the suggestion targeted the entire period rather than specific events. Moreover, high hypnotizable individuals exhibited dissociation between explicit and implicit memories, as indexed by a social judgment task. The authors argued that the pattern of results was consistent with predictions derived from Conway and Pleydell-Pearce's (2000) model of autobiographical memory, which holds that autobiographical memory is organized in terms of three interconnected levels: lifetime periods measured in months, years, decades; general events (e.g., days, weeks, months); and event-specific knowledge. A more global suggestion to forget a particular period would be expected to be particularly effective in that it would target all memories in a particular period and tag related memories in the period with the goal to not remember. Accordingly, the finding that the PHA suggestion that targeted the entire period had a greater impact on recall performance than the PHA suggestion that targeted specific events is consistent with Conway and Pleydell-Pearce's model.

In a fascinating recent study, Mendelsohn and his colleagues (Mendelsohn, et al., 2007) used fMRI to investigate the effects of suggestions for PHA on brain activity associated with real-life episodic memories of a viewed film and the context in which the film was viewed. The study compared high hypnotizable participants who were able to experience PHA with high hypnotizable participants who were unable to experience PHA. A week after participants

viewed a documentary movie depicting a routine day in the life of a young Israeli woman, the researchers administered a hypnotic induction in the fMRI scanner followed by PHA suggestions to forget the movie details until they received a reversal cue. Participants were tested while performing a computerized retrieval test and scanned twice for their recall of the movie and the context (e.g., during the movie, the door to the room was closed); first after hypnosis was terminated and while they experienced the posthypnotic suggestion, and second, following the cancellation of the suggestion.

The researchers found that people in the PHA group (who could experience PHA) forgot many more details from the movie than people in the non-PHA group (who could not experience PHA). After the suggestion was cancelled, recall across groups was equivalent and memory loss reversed. PHA memory loss was highly selective: memories for the context were preserved for people in the PHA group, despite reports of impaired memories for the movie. Importantly, the researchers found that activity in occipital, temporal, and prefrontal areas of the brain differed among the groups, and, in the PHA group, between suggestion and reversal conditions. They argued that the brain activation seen in PHA reflects a dampening—some form of rapid, early inhibition of memory—due to increased activity in the prefrontal cortex (Barnier, Cox, and Savage, 2008). Although the findings reviewed are based on an analog of functional memory impairments, they point researchers in interesting directions and beg the question of how findings derived from analog studies differ from studies of patients with functional amnesia.

Hypnotic suggestions can also be used to model fundamental alterations in identity as core to one's personality as identification of the self as a man or woman. Burn, Barnier, and McConkey (2001) selected very high and highly hypnotizable participants and suggested during hypnosis that they would become more and more like the opposite sex in many ways. Most of the very high hypnotizable participants and many of the highly hypnotizable

participants responded positively to this rather surprising suggestion. Participants then heard two stories, one about a male individual and one about a female. Participants remembered more of the story consistent with their suggested sex change. Even confronted with contradictory information, most of the participants maintained their delusional response. Postexperimental inquiries revealed that these participants modified their information processing and selectively attended to the story consistent with their sex change, perceiving the story as more self referential and personally meaningful.

Cox and Barnier (2013) examined the relation between a suggested self-identity delusion and the availability of autobiographical memories. The researchers provided participants with the suggestion that they would become more and more like one of their siblings (or a new non-existing sibling). Highly hypnotizable participants produced more specific memories in line with their new identity, with memories rich in sensory-perceptual details that often represented a reinterpretation of previous experiences and served to bolster the reality of the suggested delusion. The findings supported Conway's (1996) self-memory system hypothesis, which predicts that shifts of identity should lead to a corresponding shift in the availability of autobiographical memories.

In a series of studies aimed at creating laboratory analogues of actual delusional beliefs (e.g., mirror self-misidentification, delusion of alien control), Barnier and her colleagues (Barnier et al., 2008; Cox and Barnier, 2010) have shown convincingly that hypnotically suggested delusions can help us understand the social and cognitive factors involved in these delusions and ultimately provide interesting clues as to how they can be eliminated or treated. These experiments also underscore the role that autobiographical memory plays in the maintenance of these disorders.

Hypnosis can also play an important role in the investigation of mood, autobiographical memory, and self-identity. Some researchers (e.g. Maccalum, McConkey, Bryant, Barnier,

2000) have shown that specific moods induced during hypnosis affect the type of autobiographical memories reported in response to positive (happy), negative (sad), and neutral cues. More specifically, whereas low hypnotizables were not affected by the mood inductions, highs responded differently to the different cues in the sad condition. Asked to retrieve specific personal memories for each cue provided by the experimenter (for example *smile* or *angry*), highs had less access to specific positive memories while in a sad mood. This finding is consistent with previous research indicating that individuals experience more difficulty retrieving positive memories when depressed (Goddard, Dritschel, and Burton, 1996). In this case, hypnosis helped researchers understand the relation between the valence of the emotional state and memory output, and indicates that hypnotic mood induction can be a useful procedure to examine the relation between mood and autobiographical memory. Combined, the studies reviewed imply that hypnotically elicited delusions can affect information processing and may prove to be highly relevant to understanding potential links between delusional beliefs and autobiographical memory, as well as the subjective experiences of individuals who suffer from delusions.

One can extrapolate that hypnosis may in the future provide a means to restructure personal identity by reshaping memories. Although in clinical practice hypnosis has been used from time to time during the past two centuries to create punctual positive personal pseudo-memories, little empirical work has been done to date in assessing the use of hypnotic suggestions to create a network of pseudo-memories to shape a positive and functional self-identity.

Posthypnotic amnesia and intentional forgetting

In addition to providing a valuable analog of functional memory disorders, posthypnotic amnesia may facilitate our understanding of intentional and more seemingly automatic forgetting. PHA appears to be associated with a breakdown of normal retrieval strategies

(Kihlstrom and Evans, 1971). Evidence for this breakdown derives from the apparent lack of structure (serial recall, recall in clusters) in the material that participants recall (Kihlstrom and Wilson, 1984; Spanos, MacLean, and Bertrand, 1986; Coe, 1989). Whether the disrupted retrieval is (a) the product of response strategies that participants adopt when instructed to forget information they would normally retain in memory (e.g. Spanos, 1986), or (b) the consequence of a breakdown in the subject's executive functions, is still open to investigation.

Suggested amnesia may be highly selective (e.g., for particular semantic categories in a word list or a specific memory) or extensive, representing a "blanket" amnesia. For example, the last item of Form C of the Stanford Hypnotic Susceptibility Scale (SHSS:C; Weitzenhoffer & Hilgard, 1962) is the suggestion is to forget everything that happened during the hypnotic session. Amnestic responses can be examined in terms of social demands (extrinsic factors) and the individuals' cognitive, affective, and neurophysiological makeup.

Two major forms of intentional forgetting are directed forgetting (DF) (e.g., Basden, Basden and Gargano, 1993) and intentional suppression of memories such as in the Think-NoThink procedure (Anderson and Green, 2001). Few studies have compared DF with forgetting elicited by hypnotic suggestion. So far, results have been mixed, indicating some common, although not identical, retrieval inhibition process. In the most recent study, David, Brown, Pojoga, and David (2000) concluded that both DF and PHA could implicate different cognitive mechanisms or share some similarities through retrieval inhibition. One of the main difficulties in comparing DF and PHA is in equating the instructions to forget. In the list-method DF, participants are told following the presentation of the first list that it was a practice run and they can ignore the list, and that the next list presented is the one to remember. Hypnotized participants, on the other hand, are told that they will forget the first list until the amnesic-release cue is provided. From the participants' perspective, these two sets of instructions may be perceived as disparate memory tasks and, in fact, convey very different

task demands.

Accordingly, some studies comparing DF with PHA procedures have obtained differences in performance (Kilhstrom, 1983). Compared with DF, PHA produced greater amnesia (fewer items are recalled), and the reversal cue triggered the return of most memories (in high hypnotizable individuals). In contrast, the DF effect was much weaker, both for forgetting and for re-accessing memories when the reversal cue was presented (Basden, Basden, Coe, Decker, and Crutcher, 1994). Until the contexts can be equated it will be difficult to investigate the role that hypnosis, hypnotizability, or amnesia play in a DF framework. Nonetheless, these studies reveal the intriguing possibility that at least in high hypnotizable individuals there may be a forgetting mechanism that has eluded DF researchers and is worth pursuing.

Voluntary suppression, exemplified by the Think-NoThink task, represents another interesting arena of investigation where the use of hypnosis and PHA could further knowledge of the mechanisms involved in voluntarily attempting to not think about something. The typical intentional suppression procedure (Anderson and Green, 2001) is a retrieval induced forgetting task that induces a non-intentional form of memory inhibition. In a cued-recall task, participants learn a list of word pairs (cue-target) to a certain (usually high) criterion. A subset of the target words is then tagged for 'forgetting' (F), whereas the majority of words are tagged for 'remember' (R), and still other words (baseline targets) are not re-presented during this phase. During the Think-NoThink phase, cues for the R and for the F words are presented, and participants are asked either to remember the targets (R targets) or "not to think" about the corresponding targets (F targets). Instructions for the Not thinking condition request that participants make their minds "blank." This task is reminiscent of Wegner's (1989) ironic effects paradigm. When individuals are asked to voluntarily not think about something, it often triggers the paradoxical emergence of the 'forbidden' word or thought. Bowers and Woody

(1996) examined the potential ironic effects of voluntarily suppressing a specific thought in high and low hypnotizable individuals, in and out of hypnosis, with and without suggested PHA. Of all the different groups tested, only high hypnotizables, hypnotized participants who received a PHA suggestion aimed at suppressing the thought showed a significant decrease in number of intrusions.

Although no published studies to date have compared performance in PHA with intentional suppression, as measured by the Think-NoThink task, the results of a series of unpublished studies by the first author indicate that highly hypnotizable individuals are better at inhibiting target words in this latter task, compared with medium and low hypnotizable participants. The suppression effect was obtained without hypnosis, implying that the hypnotic induction is not necessary to produce forgetting due to inhibition. These studies illustrate well how hypnosis, hypnotizability, and specifically PHA can inform memory research and suggest new areas of investigation that may not be readily amenable to study with traditional methods of directed forgetting.

In the Mendelson et al. (2008) study referred to earlier, the authors contended that the simultaneous lifting of the amnesia and the restoration of brain activity in regions crucial to retrieval strongly imply that memory suppression occurred at early stages of the retrieval process. The researchers remarked that the amnesia produced by the posthypnotic suggestion "affects an executive pre-retrieval monitoring process, which produces an early decision on whether to proceed or not on retrieval, and in case of a [question about the movie], aborts the process" (p. 165). Is this executive pre-retrieval monitoring process at play in intentional suppression? Is this process responsible for the difference in retrieval inhibition found when DF and PHA are compared? It is likely that studies similar to the Mendelson et al. (2008) could assist in understanding the cognitive processes involved in DF, PHA, and intentional inhibition.

Memory accuracy

Although researchers have demonstrated that hypnosis should not be used to facilitate recall, some researchers have investigated whether hypnosis could be used to improve memory accuracy. Wagstaff, Cole, Wheatcroft, Anderton and Madden (2008) evaluated the possibility that suggestions provided in hypnosis might attenuate (rather than increase) the misinformation effect and false memories. The study was based on the rationale that expectancies and demand characteristics established by suggestions are responsible for the increase in false memories and confidence that is typically observed during and after hypnosis. Nevertheless, expectancies and demand characteristics can be manipulated with the goal of reducing false memories. When the researchers informed participants that they could discriminate correct and incorrect to-be-recalled items during hypnosis, the typical misinformation and inflated confidence effects were not evident.

In a similar vein, Oeberst and Blank (2012) have shown that the misinformation effect can be completely reversed through what the authors call an "enlightenment" procedure, in which the researchers ask participants to search for two contradictory items in memory, rather than for the typically single "correct" answer. This procedure apparently enhances source monitoring (Johnson, Hashtroudi and Lindsay, 1993) by testing separately the contribution to the final memory of what is remembered about the items and what is remembered about the source of the item. The Wagstaff et al. (2008) and Oerst and Blank (2012) studies raise the intriguing possibility that hypnosis might produce a change in the way participants interpret the memory task, enhance comparison of what is remembered and from what source, and facilitate which mental contents are reported among the various mental contents activated.

Accordingly, hypnosis holds potential to enhance the metacognitive monitoring system, which is responsible during retrieval for assessing the source and adequacy of memories (Koriat et al., 2000; Mazzoni and Hanczakowski, 2011; Johnson et al., 1993). Suggestions might be phrased to enhance scrutiny of material retrieved and to direct participants' attention

specifically towards memory characteristics (for e.g., sensory details, self-referentials) that research on source monitoring has shown to discriminate true and false memories, hypothetically engendering more successful monitoring of accurate memories and rejection of false memories. The possibility of using hypnosis to discriminate true and false memories would not only represent a major contribution to memory research, but also would represent a welcome development in the forensic and clinical domains (see for example Wagstaff, Wheatcroft, Burt, Pilkington, Wilkinson, and Hoyle, 2011).

Involuntary autobiographical memories

Involuntary autobiographical memories 'pop up' in everyday life during undemanding monotonous tasks, with no intention or directive to retrieve them (Berntsen, Staugaard, and Sorensen, 2013; see Vannucci, Mazzoni, and Batool in press). One of the markers of these memories is the feeling of involuntariness, which people also often experience when retrieval occurs in hypnosis. A potentially productive line of research would be to address the frequency and comparability of memories that emerge on a seemingly involuntary basis in hypnotic and nonhypnotic contexts and to explore the extent to which similar or different resting state conditions characterize retrieval of hypnotic and awake involuntary memories. Recent studies have shown that hypnosis activates anterior default mode areas in the brain (e.g. McGeown, Mazzoni, Venneri, & Kirsch, 2009), and the retrieval of involuntary memories seems to be facilitated during mind wandering states in which the default mode is also active (Vannucci et al, in press; for a review on mind wandering see Schooler, Smallwood, Christoff, Handy, Reichle, et al., 2011). The recent development of new methodologies that elicit involuntary memories in the laboratory (see Schlagman and Kvavilashvili, 2008; Vannucci et al, in press; Berntsen et al., 2013) imply that future studies in this area might provide insight into the nature of involuntary memory retrieval.

Prospective memory?

It is intriguing to contemplate that posthypnotic suggestion (PHS) could be considered a form of prospective memory (Einstein and McDaniel, 1996), which is the type of memory that makes it possible for us to remember what to do in the future (e.g. ask a question or take a pill at a certain pre-defined time during the day). People seemingly set up their own cues as reminders for the time and place where a particular action is to occur. PHS is a suggestion given during hypnosis to take place after hypnosis is terminated. It is conceived as a way to remember to do something at a certain time; that is, when a cue is presented. How do people remember to open a window when they do not remember the instructions (given in hypnosis) but do so at the specified time or in the specified context? How do people set up the cues that will serve as reminders to perform the action? It would be quite interesting to use PHS as a method to study prospective memory. These are questions that can animate research for some years to come.

Concluding remarks

We have proffered but a few ideas regarding how hypnosis can be used to further our knowledge of memory. We foresee a productive interaction between hypnosis and memory research. Hypnosis represents an excellent model for understanding social, cognitive, and neurological processes involved in remembering and forgetting personal events,. More specifically, hypnosis provides a fruitful methodology to model memory disorders and their relation to self-identity, a welcome venue to differentiate voluntary from involuntary forgetting, and a broad and fertile field in the investigation of memories in everyday life.

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