

Recovery of Memory After Posthypnotic Amnesia

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Documentation of the reversibility of posthypnotic amnesia has been hampered by the correlation of hypnotizability with the initial level of response to amnesia suggestions. In a sample of 691 subjects, groups differing in hypnotic susceptibility could be matched for initial amnesia recall, thereby eliminating the ceiling effect. At virtually every point along the distribution of initial amnesia response, hypnotizable subjects were significantly better able than insusceptible subjects to recapture the previously blocked memories after the amnesia suggestion was lifted. Conversely, those subjects who showed reversibility of amnesia were more responsive overall to hypnosis than those who did not. Reversibility is of value in distinguishing between amnesia and pseudoamnesia and between partial amnesia and nonamnesia. Furthermore, reversibility helps define posthypnotic amnesia as a process involving the disruption of retrieval processes in memory.

Posthypnotic amnesia refers to the subject's inability to recall the events of hypnosis following the termination of the hypnotic state. After just a few words of suggestion on the part of the experimenter, a deeply hypnotized subject will awaken from hypnosis unable to remember the experiences that he has just had, or perhaps he will recall a few experiences with great difficulty. Just as dramatic as the subject's initial difficulty in remember-

ing the critical material is the reversibility of the amnesia. On presentation of a prearranged cue, the critical memories flood back into awareness, and the hitherto amnesic subject is then able to remember the experiences of hypnosis vividly and clearly. The ease with which this disruption in memory can be induced and lifted in hypnotizable subjects marks posthypnotic amnesia as one of the most striking phenomena of hypnosis.

This study was conducted at the Unit for Experimental Psychiatry, The Institute of Pennsylvania Hospital. It was supported in part by Grant MH 19156 from the National Institute of Mental Health, U.S. Public Health Service, and in part by a grant from the Institute of Experimental Psychiatry.

The authors would like to thank Cynthia Bendon and Debra E. Berdan for their help with the statistical analysis and the following colleagues for their comments during the preparation of this paper: Harvey D. Cohen, Mary R. Cook, Charles Graham, Betsy E. Lawrence, Emily Carota Orne, Martin T. Orne, David A. Paskewitz, Lani L. Pyles, Tony VanCampen, William M. Waid, and Stuart K. Wilson. Particular appreciation is extended to Julio M. Dittborn, Peter B. Field, Donald N. O'Connell, Peter W. Sheehan, and Ronald E. Shor, whose experiments at the Unit for Experimental Psychiatry provided much of the data for the present research.

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Despite wide agreement that reversibility is an important aspect of posthypnotic amnesia (e.g., Cooper, 1972; Hilgard, 1965, 1966; Orne, 1966), the recovery of memory after amnesia has not been widely studied. Reversibility is not scored as part of the amnesia item on the standardized hypnotic procedures developed for laboratory use, and with few exceptions it has not been used in other research as part of an objective criterion of posthypnotic amnesia. This lack of emphasis is unfortunate because, as Orne (1966) has suggested, reversibility may be an essential property of posthypnotic amnesia.

For example, a wide variety of factors unrelated to amnesia may also affect a subject's expressed memory for hypnotic experiences. Studies by Cooper (1972) have indicated that the average subject may fail to report as many as 40% of the critical items even in the absence of a previous amnesia suggestion. We presume that this apparent forgetfulness results from the subject's inadvertent neglect

of some material while making his report. Moreover, studies of such special populations as children (Cooper, 1972) and schizophrenics (Lavoie, Sabourin, & Langlois, 1973) indicate that some subjects may show a low level of posthypnotic memory because of a lack of effort in the recall task or because of a failure to attend to and process the material in the first place. These potentially confounding factors can be distinguished from suggested amnesia in that they appear to result in a more permanent (i.e., nonreversible) failure of memory.

Despite its apparent significance, the study of reversibility has been hampered by a thorny statistical problem. The amount of material recalled by subjects during posthypnotic amnesia imposes a ceiling on the amount of additional new material that can be recaptured after the amnesia has been lifted. Thus, inspection of a subject sample of any adequate size that has been administered one of the standardized hypnosis procedures clearly shows that during the time the amnesia suggestion is in effect, hypnotizable subjects recall significantly fewer items than do insusceptible subjects. When amnesia is lifted, the hypnotizable subject will then recall significantly more new material, so that by the conclusion of the memory testing the hypnotizable and insusceptible groups will recall essentially the same amount of material (Nace, Orne, & Hammer, 1974). The correlation between initial recall during amnesia testing and hypnotic susceptibility level, however, makes it possible to attribute the greater postamnesia recall of the hypnotizable subjects simply to the relatively greater pool of previously unretrieved items left available for subsequent recall rather than to any specific effects of the reversibility cue as such. Because of the limiting ceiling effect imposed on the memory data, it is necessary to demonstrate reversibility in a way that is independent of the subjects' initial levels of posthypnotic amnesia.

Nace et al. (1974) recognized this problem and attempted to measure reversibility in terms of the ratio of items that were actually recovered following the cue to the total number of items potentially still available for

recall after the first test. Within the limits imposed by their relatively small sample (60 subjects), Nace et al. (1974) succeeded in showing that highly hypnotizable subjects apparently recovered a significantly greater proportion of their previously unrecalled memories than did insusceptible subjects. The present study used a larger sample and adopted an alternative method of evaluating reversibility to explore in greater detail the relations among hypnotic susceptibility, initial amnesia, and subsequent reversibility.

In brief, the strategy involved taking advantage of the lack of a perfect correlation between hypnotic susceptibility and posthypnotic amnesia. For example, a correlation of $r_b = .39$ ($p < .01$) was obtained during the standardization of the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A; Shor & Orne, 1962, 1963). Although in general hypnotizable subjects recall less than do insusceptibles during amnesia, some insusceptible subjects actually recall relatively few of the trance events, whereas some hypnotizable subjects are able to give a fairly full account of their experiences while hypnotized. In a sufficiently large sample, then, groups of hypnotizable and insusceptible subjects can be matched for level of recall during initial amnesia testing, thereby eliminating the problem of the ceiling effect. When amnesia is reversed, hypnotizable subjects should recover more new items than the insusceptible subjects with whom they have been matched. It should also be possible to show that the use of reversibility as an additional criterion for posthypnotic amnesia enhances the relation between amnesia and overall hypnotic responsiveness.

METHOD

Subjects

The HGSHS:A (Shor & Orne, 1962) was administered to 691 male and female college student volunteers. The subjects were run in groups ranging in size from 4 to 30 participants. On the basis of their scores on the HGSHS:A, the subjects were classified as low (0-4), medium (5-7), or high (8-12) in susceptibility to hypnosis.

Procedure

The HGSHS:A is a work sample containing an induction of hypnosis accompanied by a series of

12 representative hypnotic suggestions. The last of the items on the scale is the suggestion of temporary amnesia for the events of the hypnosis session. The suggestion is administered just before hypnosis is terminated by a 20-1 count and reads as follows:

When I get to "one" you will be fully alert, in your normal state of wakefulness. You probably will have the impression that you have slept because you will have difficulty in remembering all the things I have told you and all the things you did or felt. In fact, you will find it to be so much of an effort to recall any of these things that you will have no wish to do so. It will be much easier simply to forget everything until I tell you that you can remember. You will remember nothing of what has happened until I say to you: "Now you can remember everything!" You will not remember *anything* until then. (Shor & Orne, 1962, p. 11)

After hypnosis is terminated the subject is given 3 minutes to recount his hypnotic experience by writing his memory report in a specially provided response booklet. Then the experimenter continues:

All right, now listen carefully to my words. *Now you can remember everything.* Please . . . write down a list of anything else that you remember now that you did not remember previously. (Shor & Orne, 1962, p. 11)

This time, the subject is given 2 minutes to complete his written memory report.

The first test, which took place immediately after the termination of hypnosis, was the amnesia condition. Those subjects who recalled three or fewer of the nine critical items were given passing scores on the amnesia item of the HGSHS:A¹ by the standardized criterion. The second test, which asked for the additional material remembered since the administration of the cancellation cue, was the reversibility condition.

RESULTS

The mean HGSHS:A scale score for the group of 691 subjects was 7.31, with a standard deviation of 2.70. A total of 31% of the subjects passed the standardized criterion for posthypnotic amnesia. The amnesia item showed a correlation of $r_b = .35$ with the total scale score, which was corrected to 11 items by eliminating the amnesia item itself. These parameters are representative of similar volunteer samples (Shor & Orne, 1962). The distribution of posthypnotic amnesia recall was plotted separately for the groups of high-, medium-, and low-hypnotic susceptibility. As expected, there was substantial overlap observed in the three distributions, which per-

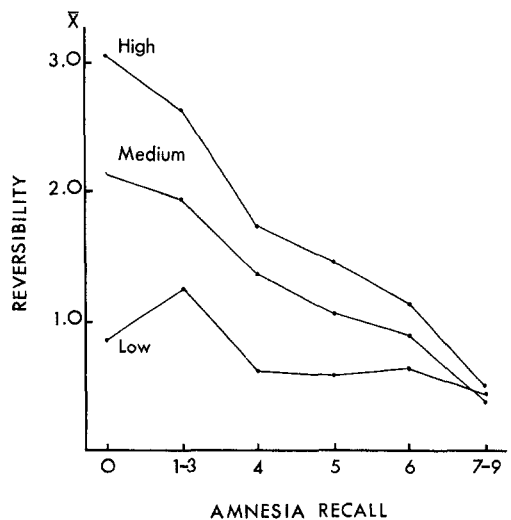


FIGURE 1. Recovery of memory after reversibility cue as a function of hypnotic susceptibility (high, medium, or low) and level of initial amnesia. (Those subjects recalling three or fewer items on the first test passed the standardized criterion for posthypnotic amnesia.)

mitted the isolation of groups of subjects who were matched for recall during the amnesia test but who differed in hypnotic susceptibility.

Reversibility of Posthypnotic Amnesia

The matching procedure and the results of the relevant comparisons are illustrated in Figure 1, which shows the mean number of new items recalled during reversibility for the groups of high-, medium-, and low-hypnotizable subjects who were matched for initial level of recall during amnesia. Each of the 18 subgroups so formed contained at least 30 subjects, except for insusceptible subjects initially recalling 0 or 1-3 items ($n = 14$ and 15, respectively), and hypnotizable subjects recalling 7-9 items ($n = 8$).

It is clear from Figure 1 that hypnotizable subjects recall more new items during reversi-

¹ On the HGSHS:A, the amnesia suggestion itself was not included as one of the suggestions to be recalled; two additional items, occurring either before or during the formal induction of hypnosis, were excluded from consideration as well. This is the standard procedure for scoring the amnesia item on HGSHS:A.

bility than do unsusceptible subjects, even though these groups are matched for initial amount of recall during the amnesia condition. Further, an overall analysis of variance yielded a significant interaction, $F(10, 673) = 2.56$, $p < .01$,² indicating that the difference in reversibility varied jointly with both the extent of initial recall during suggested amnesia and the level of hypnotic susceptibility.

Individual analyses of variance of the data portrayed in Figure 1 indicated a significant effect of hypnotic susceptibility on reversibility (all p s $< .01$) at five of the six levels of initial amnesia recall (see Table 1). Corresponding t tests at each of these five levels showed that even though the level of recall was the same on initial amnesia testing, the highly hypnotizable subjects recovered significantly more new items during reversibility than did the unsusceptible subjects (all p s $< .02$); the reversibility recall of the medium-susceptible subjects fell in the middle and in most cases differed significantly from that of both the hypnotizable and unsusceptible groups. Only when the subjects initially recalled at least seven of the nine possible items were there no differences between the high-, medium-, and low-hypnotizable groups. These subjects had virtually complete recall on the first test, and the ceiling effect of the limited item pool may have effectively prevented these subjects from showing any reversibility.

TABLE 1

REVERSIBILITY OF AMNESIA ON THE HARVARD GROUP SCALE OF HYPNOTIC SUSCEPTIBILITY, FORM A: SUMMARY OF STATISTICAL TESTS

No. items recalled on amnesia test	No. new items recalled on reversibility test		
	Overall analysis		High vs. low
	F	df	t test
0	6.48*	2, 83	4.07***
1-3	5.52*	2, 125	3.32***
4	13.12*	2, 119	4.54***
5	6.55*	2, 134	4.02***
6	5.43*	2, 130	2.56**
7-9	.18	2, 84	—

Note. Subgroups are matched for initial level of amnesia recall. High = high-hypnotizable group; low = low-hypnotizable group.

* $p < .01$.
 ** $p < .02$.
 *** $p < .005$.

Relation of Reversibility to Overall Hypnotic Responsiveness

If reversibility is an integral component of posthypnotic amnesia and not merely redundant, subjects who recover more new memories after amnesia has been lifted should be more responsive to other suggestions administered during hypnosis than would those who do not show reversibility. Up to now the empirical status of this prediction has been unclear, since the confounding of reversibility with the initial level of recall has made the usual correlational techniques inappropriate as a means of answering the question. However, the same logic that was used to evaluate reversibility itself can also be used to evaluate the contribution of reversibility to the prediction of hypnotic responsiveness.

The pattern of reversibility observed in Figure 1 suggests that during the reversibility test even unsusceptible subjects might be expected to recall an additional item simply as a result of reminiscence factors inherent in any second test of memory. Accordingly, a criterion of reversibility was adopted that required subjects to recover at least two additional items during the reversibility test. Subjects recalling two or more new items were considered to have met the criterion for successful reversibility. The criterion for reversibility was passed by 35% of the subjects, and 19% passed both the amnesia and reversibility criteria. The correlation between initial amnesia and subsequent reversibility, both scored on a pass-fail basis, was $r_t = .64$ ($p < .001$).

Groups of subjects were classified according to the reversibility criterion (pass or fail) and, as before, matched in terms of their initial level of amnesia recall. Table 2 shows the mean score for each of these groups on the remaining 11 items of the HGSHS:A (the amnesia item itself was excluded from consideration). Each group contained at least 25 subjects, except for the group of 3 subjects who recalled 7-9 items during amnesia and who recovered at least two additional items after amnesia. At each level of initial amnesia

² Unless otherwise noted, all statistical tests are one-tailed.

TABLE 2
MEAN HARVARD GROUP SCALE OF HYPNOTIC
SUSCEPTIBILITY FORM A SCORE AS A FUNCTION OF
INITIAL AMNESIA AND REVERSIBILITY

Amnesia recall ^b	Reversibility recall ^a						<i>t</i> <
	Pass			Fail			
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
0	48	7.10	2.20	38	5.26	2.85	3.28**
1-3	82	7.62	2.09	46	5.78	2.42	4.33**
4	49	6.98	2.32	71	4.92	1.98	5.07**
5	37	6.54	2.46	101	4.85	2.42	3.59**
6	25	6.12	2.11	108	5.55	2.43	1.18*
7-9	3	4.00	2.83	84	5.18	2.11	— ^c

^a Criterion for passing item: Recall \geq 2 additional items on second test.

^b Criterion for passing item: Recall \leq 3 items on first test.

^c Subgroup *n* was too small to permit *t* test.

* $p < .15$.

** $p < .005$.

sia recall from 0 to 5 items, those subjects who met the criterion for reversibility scored significantly higher (all p s $< .005$) on the HGSHS:A than did those who did not show reversibility; for those recalling 6 items during the initial amnesia test, a similar but non-significant trend ($p < .15$) was noted.

DISCUSSION

Hypnotizable subjects showed an inability to recall the events and experiences of hypnosis following suggestions for posthypnotic amnesia compared to the relative ease of recall in insusceptible subjects. These subjects were also better able to recapture the previously blocked memories after the amnesia suggestion had been lifted. This significant difference in reversibility cannot be accounted for merely by the initial difference in memory observed in the amnesia test between these groups, since it occurs at virtually every point along the distribution of posthypnotic recall. Reversibility is clearly related to hypnotic depth: Hypnotizable subjects are more likely to show reversibility, and subjects who show reversibility are more responsive to hypnosis in general.

Partial Amnesia and Pseudoamnesia

Beyond documenting the phenomenon of reversibility after posthypnotic amnesia, this research provides a basis for refining the definition of amnesia. As noted earlier, various

nonamnesic processes appear to be contaminated with suggested amnesia, with the result that the subject's pass-fail score on the amnesia item of the standardized scales may not accurately represent his actual experience of amnesia. Two examples will illustrate this point.

First, it will be noted in Figure 1 that for subjects who are moderate or high in hypnotizability, the amount of material recovered is an inverse function of the amount recalled initially; this is to be expected on the basis of the ceiling effect described earlier. However, for insusceptible subjects, the amount recovered remains approximately the same, regardless of the initial level of recall. In other words, after allowing for simple reminiscence effects, insusceptible subjects who appear to show posthypnotic amnesia on initial testing do not show any substantial recovery of additional memories after posthypnotic amnesia. This suggests that the initial recall deficit observed in the insusceptible subjects does not reflect posthypnotic amnesia at all but rather may be attributable to some other process—perhaps to a high degree of ordinary forgetfulness or a lack of motivation to retrieve and/or report the information. This behavior on the part of some subjects might be referred to as a pseudoamnesia.

Moreover, significant differences in reversibility were obtained even between those hypnotizable and insusceptible subjects who nonetheless failed the conventional scoring criterion for initial amnesia. Thus it appears that some deeply hypnotizable subjects, though able to recall some of the critical material despite the suggestion for amnesia, nevertheless find the process of remembering relatively difficult, inefficient, and unproductive. That this initial difficulty in remembering is relieved when the reversibility cue is given to cancel the amnesia suggests that these subjects may experience a partial posthypnotic amnesia. The notion that amnesia is not an all-or-none process has already received support from studies of the paralinguistic aspects of memory during amnesia (Evans, Kihlstrom, & Orne, 1973; Kihlstrom, 1975) and the organization of recall during posthypnotic amnesia (Evans & Kihlstrom,

1973; Kihlstrom, 1975). Partial amnesia is important because it seems to permit observation of the process of being influenced by the amnesia suggestion—a view that is obscured in the more dramatic total amnesia observed in the most deeply hypnotized subjects.

Although the present data support the value of reversibility in distinguishing between amnesia and pseudoamnesia and between partial amnesia and nonamnesia, it is not yet clear how reversibility is to be used as an item in refining the current hypnotizability scales. Various means of scoring the amnesia and reversibility tests of the HGSHS:A are currently being evaluated (e.g., Nace et al., 1974) in the hopes of developing an objective scoring procedure that will more adequately reflect the subject's actual experience of remembering during and after posthypnotic amnesia.

Significance of Reversibility

The phenomenon of reversibility, as has been noted by others (Hull, 1933; Orne, 1966), indicates that posthypnotic amnesia is distinct from a simple failure to acquire or store the critical material. Rather, posthypnotic amnesia appears to involve the disruption of the retrieval functions of memory, preventing the active recall of material that is actually present in storage. Of course, future research must still define more precisely the processes by which amnesia occurs. Recent research in normal memory (e.g., Anderson & Bower, 1972; Kintch, 1970; Tulving & Thomson, 1973) suggests that the disruption in memory retrieval observed during posthypnotic amnesia might result from the hypnotized subject's inability to use various organizational cues and strategies that are required to gain access to available memories. In fact, there is now considerable evidence that at least one of these organizational cues—the temporal sequence of the events during hypnosis—is adversely affected during amnesia (Evans & Kihlstrom, 1973; Kihlstrom, 1975). The relative absence of such cues and strategies may render the process of recall relatively difficult, inefficient, and unproductive during posthypnotic amnesia. If posthypnotic amnesia is seen as a dis-

ruption of retrieval, a paramount problem for study is the role of the reversibility cue in restoring access to memories that have been temporarily lost.

REFERENCES

- Anderson, J. R., & Bower, G. H. Recognition and retrieval processes in free recall. *Psychological Review*, 1972, 79, 97-123.
- Cooper, L. M. Hypnotic amnesia. In E. Fromm & R. E. Shor (Eds.), *Hypnosis: Research developments and perspectives*. Chicago: Aldine-Atherton, 1972.
- Evans, F. J., & Kihlstrom, J. F. Posthypnotic amnesia as disrupted retrieval. *Journal of Abnormal Psychology*, 1973, 82, 317-323.
- Evans, F. J., Kihlstrom, J. F., & Orne, E. C. Quantifying subjective reports during posthypnotic amnesia. *Proceedings of the 81st Annual Convention of the American Psychological Association*, 1973, 8, 1077-1078.
- Hilgard, E. R. *Hypnotic susceptibility*. New York: Harcourt, Brace & World, 1965.
- Hilgard, E. R. Posthypnotic amnesia: Experiments and theory. *International Journal of Clinical and Experimental Hypnosis*, 1966, 14, 104-111.
- Hull, C. L. *Hypnosis and suggestibility: An experimental approach*. New York: Appleton-Century-Crofts, 1933.
- Kihlstrom, J. F. The effects of organization and motivation on recall during posthypnotic amnesia (Doctoral dissertation, University of Pennsylvania, 1975). *Dissertation Abstracts International*, 1975, 36, 2473B-2474B. (University Microfilms No. 75-24082)
- Kintch, W. Models for free recall and recognition. In D. A. Norman (Ed.), *Models of human memory*. New York: Academic Press, 1970.
- Lavole, G., Sabourin, M., & Langlois, J. Hypnotic susceptibility, amnesia, and IQ in chronic schizophrenia. *International Journal of Clinical and Experimental Hypnosis*, 1973, 21, 157-168.
- Nace, E. P., Orne, M. T., & Hammer, A. G. Posthypnotic amnesia as an active psychic process: The reversibility of amnesia. *Archives of General Psychiatry*, 1974, 31, 257-260.
- Orne, M. T. On the mechanisms of posthypnotic amnesia. *International Journal of Clinical and Experimental Hypnosis*, 1966, 14, 121-134.
- Shor, R. E., & Orne, E. C. *Harvard Group Scale of Hypnotic Susceptibility, Form A*. Palo Alto, Calif.: Consulting Psychologists Press, 1962.
- Shor, R. E., & Orne, E. C. Norms on the Harvard Group Scale of Hypnotic Susceptibility, Form A. *International Journal of Clinical and Experimental Hypnosis*, 1963, 11, 39-47.
- Tulving, E., & Thomson, D. Encoding specificity and retrieval processes in episodic memory. *Psychological Review*, 1973, 80, 352-373.

(Received April 22, 1976)