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RECALL AND RECOGNITION DURING POSTHYPNOTIC AMNESIA[1]

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Abstract: Posthypnotic amnesia appears to be associated with a temporary deficit in remembering. In order to determine the nature of this memory impairment more closely, 2 studies were conducted comparing recall and recognition testing of posthypnotic amnesia during a standardized scale of hypnotic susceptibility. Experiment 1, employing a group procedure with 453 naive Ss, indicated that recognition testing might abolish amnesia. Experiment 2, in which 50 experienced Ss were tested individually, confirmed the general superiority of recognition to recall during amnesia, but revealed a significant persisting deficit in retention on the recognition test, compared to recall after amnesia was lifted by the reversibility cue. The finding of relative rather than absolute superiority of recognition to recall during amnesia is tentatively interpreted in terms of 3 competing accounts of memory: two-stage theory, episodic ecphory, and levels of processing.

Posthypnotic amnesia refers to the subjectively compelling inability of the deeply hypnotized S to remember the events and experiences which transpired during hypnosis. An important property of this impairment in memory is that it can be lifted or reversed by the administration of a pre-

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arranged cue (Kihlstrom & Evans, 1976; Nace, Orne, & Hammer, 1974). The fact of reversibility means that posthypnotic amnesia must ultimately involve the act of remembering, rather than the acquisition or storage of memories. The critical material remains available in memory storage, and can even interact with other cognitive operations, as seen in studies employing the retroactive inhibition paradigm (e.g., Graham & Patton, 1968). Nevertheless, posthypnotic amnesia appears to be quite different from a simple failure to report material that the hypnotic S actually remembers perfectly well (Kihlstrom, 1977; Kihlstrom, Evans, Orne, & Orne[4]). The amnesic S appears to have a great deal of difficulty directly recollecting the events—as evidenced, for example, by the vague and fragmentary nature of what is reported while the amnesia suggestion is in effect (Evans, Kihlstrom, & Orne, 1973; Kihlstrom & Evans, in press a).

Memory may manifest itself in diverse ways. For example, a person may recall some prior experience, perhaps after receiving some general hints about what must be remembered; alternatively, she or he may recognize the prior experience when specifically reminded of the event in question; one memory may facilitate or inhibit the learning or expression of another; or the memory may give rise to a psychophysiological response. Of these, recall and recognition are of particular interest because they require the conscious representation of the memory, while in the other cases the cognitive or psychobiological interactions can take place outside of awareness. When we ask someone to "remember" something, we ordinarily mean that he or she should consciously recall or recognize it. In most cases of ordinary forgetting and amnesia, the person fails to remember in just this sense: careful investigation—if not the mere passage of time—typically shows that the required memories remain available to the person and are dynamically active with respect to other ongoing streams of behavior and experience.

In research on conscious remembering, a topic of major interest is the relationship between recall and recognition. It is easy to distinguish recall and recognition in operational terms: in recall tasks the person must produce the memory himself, while in recognition tasks the target information is supplied and the person must evaluate its familiarity or past occurrence in a particular context. It has proved much more difficult, however, to decide whether there are different cognitive processes associated with these procedural differences. The principal accounts of memory currently available offer competing answers to this question (for thorough reviews see Brown, 1976, and Crowder, 1976).

[4]Kihlstrom, J. F., Evans, F. J., Orne, E. C., & Orne, M. T. Attempting to breach posthypnotic amensia. Manuscript submitted for publication, 1978.

The most popular contemporary analysis of recall and recognition is exemplified by the two-stage theory outlined by Anderson and Bower (1972, 1974) and others (James, 1890; Kintsch, 1970, 1974; Norman, 1968; Peterson, 1967). This theory holds that new experiences are encoded into a pre-existing network of associated ideas and memories. Each memory is associated with other memories, then, as well as with "tags" which denote its properties and features of the context in which it was encoded. Remembering, according to this account, begins with a search through the network for the target, a process which usually generates several plausible candidate memories; this is followed by a decision as to which of the candidates is most likely to be the actual target. The search process is held to be highly dependent on the presence of a rich associational structure uniting the various items of information stored in memory, the nature of the search plan employed, the availability of appropriate organizational cues to guide search, and a suitable entry point; the decision process involves testing the various properties and contextual features of a candidate item against a criterion for the target specified by the original query to the memory system. According to the theory, recall involves both search and decision processes. Recognition, however, obviates the need for search because the candidate items are already perceptually present, and recognition only requires a decision as to whether a particular candidate meets the criterion.[5]

Still another view of recall and recognition is associated with the episodic ecphory approach of Tulving (1976; see also Tulving & Thomson, 1973) and the levels of processing theory proposed by Craik and Lockhart (1972; see also Craik, 1977; Lockhart, Craik, & Jacoby, 1976). The two theories differ somewhat in their account of the relationship between perception and memory. Tulving holds that the memory trace of a perceived event is uniquely encoded in memory as a set of features representing the event and the experiential context in which it took place; successful retrieval requires a match between these encoded features and those that are contained or implied in the memory probe. Craik and Lockhart, on the other hand, assert that memory is the by-product of perceptual activity; the ease with which an event can be remembered depends on several factors, including the number of different perceptual-cognitive operations performed at the time it occurred, the extent to which the event is elaborated within any particular level of processing, the degree to which the event fits its context, and the uniqueness of the match between the trace and the memory probe. The

[5]Landauer (1975) and Rabinowitz, Mandler, and Patterson (1977), while differing on the importance of organization in memory, have both proposed that recall and recognition alike involve both search and decision processes.

two theories appear to agree, however, that recall and recognition do not involve qualitatively different processes, or that one is a subset of the other. Both theories assert that successful remembering in any form requires only sufficient overlap between information associated with the memory trace, and corresponding information in the memory probe. Tulving (1976) holds that if there is a successful match, the trace enters consciousness as a remembered event; Lockhart et al. (1976), like Bartlett (1932) and Neisser (1967, 1976), propose that sufficient early contact between query and trace will support continued reconstructive activity until an adequate memory is formed. In any event, both theories hold that recall and recognition are essentially the same, except that in recognition the probe provides considerably more information about the target memory than is the case for recall.

With respect to the phenomenon of posthypnotic amnesia, then, there are good reasons to suppose that a comparison of recall and recognition memory would lead to a more detailed account of the processes underlying this amnesia. Williamsen, Johnson, and Eriksen (1965) performed such a study. In their Experiment I, deeply hypnotized Ss learned a list of six common words and then received a suggestion for posthypnotic amnesia. On an initial recall test, Ss showed a virtually complete inability to remember the critical material. After they performed some other tasks related to the learning experience, Ss were shown a list containing the six critical items and six distractors. On this recognition task, they showed considerable improvement in memory relative to their initial recall performance, although the recognition memory of the deeply hypnotized, initially amnesic Ss was still inferior to that shown by Ss in a waking control group. Barber and Calverley (1966) substantially replicated these findings.

The results obtained by Williamsen et al. (1965) and Barber and Calverley (1966) are highly suggestive, but they are still somewhat ambiguous. It is important, for example, to know if the results of recall and recognition testing correlate differently with measured hypnotic susceptibility. This important comparison was precluded in the study by Williamsen et al. (1965), because recall memory in the insusceptible control group was already at ceiling. Moreover, it is important to know if, after recognition testing, there is any further improvement in memory when the reversibility cue is given to lift the amnesia. Finally, quite different results were obtained by Williamsen et al. (1965, Experiment II) in a supplementary study. In Experiment I, recall and recognition testing were separated by some interval of time during which other test procedures were conducted. In Experiment II, these additional procedures were omitted, so that recall and recognition testing took place in close succession. Under these circumstances, there was no difference be-

tween the outcomes of the two testing procedures. This last finding suggests that the difference between recall and recognition memory during amnesia in Experiment I of Williamsen et al. (1965) may have been a function of events occurring during the time interval between the tests, and not a function of the difference between recall and recognition memory itself.

Given the potential theoretical importance of the empirical findings, it would seem that a further examination of the results of recall and recognition testing in posthypnotic amnesia is in order. There are two basic procedures that can be employed in such a study. The first, following the pattern set by Williamsen et al. (1965), involves teaching hypnotized Ss a list of words for which they are subsequently given amnesia suggestions. The second strategy involves testing S's memory for a series of events that has occurred during hypnosis. The latter procedure stays closer to the form of posthypnotic amnesia that is usually encountered in the laboratory and the clinic. Moreover, the results of such a study would provide some assessment of the generalizability of the earlier findings. Finally, posthypnotic amnesia for a series of hypnotic experiences is rapidly becoming a known quantity, principally because of the inclusion of an amnesia suggestion as part of the several standardized scales that have been devised for laboratory use (e.g., Hilgard, 1965). These considerations led the present authors to examine the results of recall and recognition testing procedures within the context of the standardized scales of hypnotic susceptibility.

Experiment 1

The first study was planned as a large-scale comparative investigation of the results of recall and recognition testing. The experiment was conducted in a group setting to facilitate the collection of data from the large number of Ss required by such a normative study, in full recognition of the limitations of the specific procedure employed.

Method

Subjects

A total of 453 male and female college students were recruited for an experiment on personality correlates of hypnotic susceptibility. The Ss were enrolled in the introductory psychology course at the University of New Hampshire and received credit toward their research participation requirement. All participants completed a short battery of personality questionnaires and one of two versions of the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A) of Shor and E. Orne (1962). A group of 196 Ss received the conventional version of HGSHS:A, which provides for written recall testing of posthypnotic

amnesia. Another 257 Ss received a version of HGSHS:A in which a recognition test of posthypnotic amnesia was substituted for the usual recall test. On the basis of their scores on HGSHS:A (discounting the amnesia item), Ss were classified as low (scoring 0-4), medium (scoring 5-7), or high (scoring 8-11) in hypnotic susceptibility.

Procedure

The HGSHS:A consists of an induction of hypnosis accompanied by a series of 12 representative hypnotic experiences, including a suggestion for posthypnotic amnesia. After the termination of hypnosis and testing of response to a posthypnotic suggestion, amnesia is evaluated by means of two memory tests. In the first, Ss are instructed to remember the events and experiences that transpired during hypnosis. Then the amnesia suggestion is canceled by means of a pre-arranged reversibility cue, and Ss are asked to report those events and experiences that they now remember but did not remember previously. Three minutes are provided for the test of initial amnesia, and 2 additional minutes are allowed for the reversibility test.

All Ss received the identical series of suggestions, including that for amnesia, administered by means of a tape-recording. The sole difference between the two groups consisted in the manner of testing posthypnotic amnesia. In the recall condition, Ss wrote out their memory reports on the appropriate pages of the usual HGSHS:A self-report response booklet. In the recognition condition, Ss were provided with a list of the 9 HGSHS:A suggestions that are considered in evaluating posthypnotic amnesia (critical items)[6] plus an additional 11 suggestions which did not actually occur during the hypnotic procedure (distractor items).[7]

Results

The mean HGSHS:A score, based on 11 items (excluding the amnesia suggestion) was calculated for Ss in the recall ($N = 196$; $\overline{X} = 6.45$, $S.D. = 2.33$) and recognition ($N = 257$; $\overline{X} = 6.92$, $S.D. = 2.30$) conditions. With groups of this size, the difference between mean HGSHS:A scores does reach statistical significance ($t = 2.14$, $d.f. = 451$, $p < .05$, 2-tailed);[8] in absolute terms, however, the difference is rather marginal. Moreover, because amnesia is correlated with

[6]Three items (head falling forward, eye closure, and amnesia) are not counted in scoring the amnesia item.

[7]An attempt was made to keep the distractor items distinct from the critical items, but at the same time insure that they appeared plausible elements in a group hypnosis experiment. Sample distractor items are: hand and arm stiff, cannot raise to indicate "present"; feel sweet taste and then sour taste in mouth, lick and pucker lips accordingly.

[8]Unless otherwise noted, all statistical tests are two-tailed.

hypnotic susceptibility (Hilgard, 1965), the observed difference should serve to mitigate against finding the expected difference between the two conditions in posthypnotic amnesia. All other things being equal, *Ss* in the recognition condition (who were somewhat more responsive to hypnosis) would be expected to be more amnesic, on the average, than those in the recall condition. These considerations suggested that the small difference in hypnotic susceptibility need not be considered in the analyses of posthypnotic memory which follow.

Extent of Posthypnotic Recall

Figure 1 presents the distribution of the number of items remembered during the initial test of posthypnotic amnesia in the two conditions. It is apparent from inspection of Figure 1 that the two distributions differ markedly (Kolmogorov-Smirnov $D = .708$, $p < .001$). The *Ss* in the recognition condition showed a clearly higher level of memory than those *Ss* in the recall condition ($\overline{X} = 7.47$, *S.D.* = 1.85 versus $\overline{X} = 3.54$, *S.D.* = 2.11; $t = 20.68$, $d.f. = 451$, $p < .001$). Fully 48.5% of *Ss* in the recall condition met the standardized criterion for posthypnotic amnesia by recalling three or fewer items during the initial test of posthypnotic memory (95/196 *Ss*), while this criterion was met by

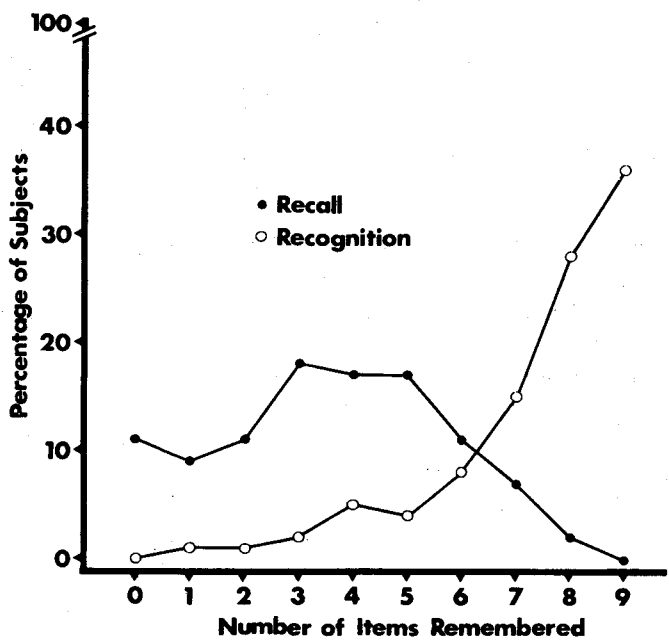

FIG. 1. Distribution of memory during posthypnotic amnesia for *Ss* in the recall and recognition conditions.

only 5.1% (13/257 Ss) of those Ss in the recognition condition. This difference is highly significant ($X^2 = 113.03$, $d.f. = 1$, $p < .001$).

The incidence of posthypnotic amnesia in the recall condition is somewhat higher than that usually found on HGSHS:A (Coe, 1964; Kihlstrom & Evans, 1976; Shor & Orne, 1963), and it is possible that the amnesia data obtained in this condition was contaminated by some number of Ss who misunderstood the test instructions, or who were not sufficiently motivated to provide adequate written memory reports during the posthypnotic test. Accordingly, a strict criterion of amnesia was adopted which required Ss to remember at least two additional items on the subsequent test of reversibility, in addition to meeting the criterion for initial amnesia (Kihlstrom & Evans, 1976). When this criterion was imposed, the incidence of "reversible" amnesia fell to 34.2% (67/196 Ss) for the recall condition and 3.5% (9/257 Ss) for the recognition condition. The group difference, however, remains highly significant ($X^2 = 72.79$, $d.f. = 1$, $p < .001$).

Relationship of Posthypnotic Amnesia to Hypnotic Susceptibility

The results presented so far clearly indicate that recognition memory is superior to recall memory during posthypnotic amnesia. Even so, the extent of recognition memory could still be a function of hypnotic susceptibility—in which case it would have to be concluded that both recall and recognition memory are affected by amnesia suggestions, recognition memory simply less so. Of course, the restricted range of the recognition memory scores will limit the size of the correlation with hypnotic susceptibility that may be obtained. Nevertheless, with samples of the size employed here, even very small correlations prove to be statistically significant, so the procedure may be considered to remain sensitive to recall-recognition differences. Our hypothesis requires both that the correlation for recall testing be significantly higher than that for recognition testing and that the latter correlation be statistically nonsignificant as well.

The usual means of evaluating response to posthypnotic amnesia suggestions entails scoring the initial amnesia and reversibility tests on a pass-fail basis. For this purpose, Ss who remembered no more than three items on the first memory test met the criterion for posthypnotic amnesia established by the standard scoring procedure (Shor & Orne, 1962), while those Ss who remembered at least two additional items on the second test met the criterion for reversibility suggested by Kihlstrom and Evans (1976). Table 1 shows the point-biserial correlation (r_{pb}) between various combinations of these pass-fail ratings and HGSHS:A scale score (corrected by excluding the amnesia item). Both initial amnesia and reversibility were significantly correlated with hypnotic susceptibility in

TABLE 1

POINT-BISERIAL CORRELATIONS BETWEEN VARIOUS INDICES OF POSTHYPNOTIC MEMORY AND HGSHS:A SCORE

Test	Condition		z Test of Difference
	Recall	Recognition	
Initial Amnesia[a]	.32***	.04	2.88***
Reversibility[b]	.47***	.12	3.67***
Reversible Amnesia[c]	.45***	.13	3.43***
Partial Amnesia[d]	.32***	.07	2.18*

[a]Pass: Recall or recognize ≤ 3 items on initial amnesia test.

[b]Pass: Recall or recognize ≥ 2 additional items on subsequent test of reversibility.

[c]Pass: For those who recall or recognize ≤ 3 items on initial amnesia, recall or recognize ≥ 2 additional items on subsequent test of reversibility.

[d]Pass: Recall or recognize > 3 items on initial amnesia and ≥ 2 additional items on reversibility.

*$p < .05$.

**$p < .01$.

***$p < .001$.

the recall condition, but neither correlation was significant in the recognition condition; moreover, the correlations obtained in the recall condition were significantly larger than their counterparts obtained in recognition testing. The same results were obtained when the pass-fail ratings of initial amnesia and reversibility were employed as joint criteria to produce a somewhat more rigorous rating of reversible amnesia (Kihlstrom & Evans, 1976). Finally, of Ss who failed to meet the standard criterion for virtually complete initial posthypnotic amnesia (N = 101 and 244 in the recall and recognition conditions, respectively), those Ss who nonetheless met the criterion of reversibility were classified as partially amnesic, following the suggestion of Kihlstrom and Evans (1976). Partial amnesia, so defined, showed a significant correlation with HGSHS:A score in the recall condition but not in the recognition condition; the two resulting correlations were also significantly different.[9] Thus, in addition to differences in the simple extent of posthypnotic memory, a number of different analyses show that the relationship between amnesia response and hypnotizability is rather different in the two conditions.

Comparison of Hypnotizable and Insusceptible Ss

In order to clarify the foregoing results, those Ss who fell in the range

[9]The same results were obtained with Pearson correlation coefficients (r) employing the full distribution of initial amnesia and reversibility scores. Total memory (amnesia plus reversibility) was not correlated with hypnotizability in either the recall or recognition conditions. This is congruent with previous studies (Kihlstrom & Evans, 1977; Nace et al., 1974).

of medium hypnotic susceptibility (i.e., HGSHS:A scores of 5-7) were eliminated from the pool, and further analyses were performed only on those Ss who scored as clearly insusceptible (HGSHS:A scores of 0-4) or clearly hypnotizable (HGSHS:A scores of 8-11). This selection procedure resulted in the exclusion of 87 Ss from the recall condition and 94 Ss from the recognition condition.

Table 2 confirms the finding of a strong association of posthypnotic amnesia with hypnotic susceptibility for Ss in the recall condition, but not for Ss in the recognition condition. For example, when Ss were classified according to the standardized criterion for amnesia on HGSHS:A, 63.6% of the high susceptible Ss, but only 32.6% of the low susceptible Ss, in the recall condition showed amnesia; in the recognition condition, the proportions of high susceptible Ss and low susceptible Ss showing amnesia were more or less equal (6.8% and 8.9%, respectively). Partial posthypnotic amnesia occurred significantly more often in the hypnotizable Ss (45.8%) than the insusceptible Ss (10.3%) in the recall condition. In the recognition condition, however, the frequency of amnesia did not differ between the high (16.4%) and low susceptible Ss (9.8%). When the strict criterion for reversible amnesia was employed to classify Ss, the association between hypnotizability and amnesia was

TABLE 2

INCIDENCE OF INITIAL, PARTIAL, AND REVERSIBLE POSTHYPNOTIC AMNESIA FOR HYPNOTIZABLE AND INSUSCEPTIBLE Ss

Condition	HGSHS:A Score	N	Amnesia Criterion		X^2
			Pass	Fail	
Standardized Criterion of Initial Amnesia					
Recall	High	66	42	24	
	Low	43	14	29	8.86*
Recognition	High	118	8	110	
	Low	45	4	41	.02
Proposed Criterion of Partial Amnesia					
Recall	High	24	11	13	
	Low	29	3	26	6.78*
Recognition	High	110	18	92	
	Low	41	4	37	.61
Proposed Strict Criterion of Reversible Amnesia					
Recall	High	66	39	27	
	Low	43	5	38	22.43**
Recognition	High	118	7	111	
	Low	45	1	44	.33

Note.—See Table 1 for criteria for "pass."

*p .01.

**p .001.

very strong for those Ss in the recall condition (high susceptible Ss, 59.1% versus low susceptible Ss, 11.6%); but remained nil for those Ss in the recognition condition (high susceptible Ss, 5.9% versus low susceptible Ss, 2.2%). Still, some 6% of the clearly hypnotizable Ss met the strict criterion for reversible amnesia in the recognition condition.

The Ss who meet the criterion for initial posthypnotic amnesia but fail to show subsequent reversibility are not properly classified as amnesic (Kihlstrom & Evans, 1976). Examination of Table 2 shows that a small number of such Ss were found in the present sample. These 16 Ss (recall: 3 high susceptible Ss, 9 low susceptible Ss; recognition: 1 high susceptible S; 3 low susceptible Ss) were eliminated from the remaining analyses because of the ambiguous nature of their initial failure of recall. The mean number of items remembered during initial amnesia testing is shown in Figure 2 for the remaining 97 Ss in the recall condition (63 high susceptible Ss, 34 low susceptible Ss) and the 159 Ss left in the recognition condition (117 high susceptible Ss, 42 low susceptible Ss). A treatment-by-levels analysis of variance of this data showed, as expected, significant main effects of both type of test (recall or recognition: $F = 250.59$, $d.f. = 1, 252$; $p < .001$) and hypnotic susceptibility (high or low: $F = 18.06$, $d.f. = 1, 252$; $p < .001$). Most important, however, was

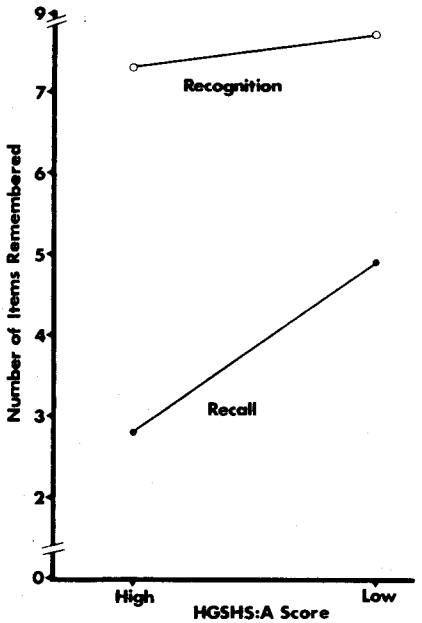

FIG. 2. Average number of items remembered during posthypnotic amnesia for hypnotizable and insusceptible Ss in the recall and recognition conditions.

the significant interaction obtained between hypnotic susceptibility and condition of testing ($F = 10.43$, $d.f. = 1, 252$; $p < .002$). Thus, hypnotizable Ss showed significantly poorer memory than insusceptible Ss in the recall condition ($t = 5.28$, $d.f. = 95$, $p < .005$), but not in the recognition condition ($t = 1.34$, $d.f. = 153$, n.s.).

Correction for Guesing in the Recognition Condition

It is possible that the high level of memory apparently shown by the hypnotizable Ss in the recognition condition was an artifact of guessing. Although confidence ratings for the recognition decisions were not obtained in this study, each S's recognition score may be corrected for chance by treating the amnesia assessment as if it were a "true-false" test, and applying the following formula:

$$\text{Corrected Recognition Score} = \frac{\text{Number Right} - \text{Number Wrong}}{\text{Total}}$$

The corrected recognition scores for the 117 hypnotizable Ss averaged .81 (*S.D.* = .21), while the mean for the 42 insusceptible Ss was .84 (*S.D.* = .18), a difference that is not statistically significant ($t = .86$, $d.f. = 157$). In the spirit of signal-detection analysis, the distributions of true-positive and false-positive recognition decisions (hits and false alarms, respectively) were inspected and found to be virtually identical for the hypnotizable and insusceptible Ss. Specifically, the average number of false-positives obtained was .24 for the insusceptible Ss and .19 for the hypnotizable Ss ($t = .55$, $d.f. = 157$).[10] Apparently, then, within the limits of the procedure employed, it appears from the low rate of false-positives as well as the corrected recognition scores that the apparently good memory of the hypnotizable Ss in the recognition condition was not an artifact of guessing.

Experiment 2

The study just described appeared to indicate that posthypnotic amnesia exerted differential effects on retention as measured by recall and recognition tests. As was expected, recognition was generally superior to recall. More important, the relationship between memory during suggested posthypnotic amnesia and hypnotic susceptibility appeared to differ, depending on how memory was assessed: when amnesia was measured by a recall test, hypnotizable Ss showed a clear retention deficit during the time the amnesia suggestion was in effect, and enhanced recovery of previously unrecalled memories after the suggestion was canceled. These two essential features of initial amnesia and subse-

[10]The only critical items to be recognized at a rate of less than 83% were arm immobilization and posthypnotic suggestion.

quent reversibility did not distinguish hypnotizable and insusceptible Ss when a recognition test was employed, however. The findings seemed to indicate that amnesia was entirely abolished by recognition testing.

These rather dramatic effects required confirmation, however. We were stuck by the difference between our findings and those of Williamsen et al. (1965), who found that recognition testing led to a substantial but *incomplete* breaching of posthypnotic amnesia. Their Ss were somewhat more experienced with hypnosis than Ss employed in the study just described, in that their experiment followed an initial session with HGSHS:A, while ours took place during HGSHS:A itself. We also recognized that a small minority of Ss did, in fact, meet one or more criteria for posthypnotic amnesia in the recognition condition; and that the true significance of this result might have been obscured by the inaccuracies introduced by our exclusive reliance on HGSHS:A assessments of hypnotizability. Accordingly, a second experiment was conducted employing more experienced Ss and an individual standardized hypnotic procedure.

Method

Subjects

A group of Stanford University students enrolled in an introductory psychology course were administered a 10-point version of HGSHS:A. All individuals who received scores of 6 or more were invited to return for a further experiment involving the Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C) of Weitzenhoffer and Hilgard (1962). The Ss received credit toward their research participation requirement for HGSHS:A session; they were paid $2.00 for the session involving SHSS:C. The sampling procedure was intended to maximize the possibility of observing posthypnotic amnesia on SHSS:C; however, it did insure that few Ss would score in the range of low hypnotizability on that scale. The final sample consisted of 50 Ss classified as low to moderate in hypnotizability (scoring 0-7; $N = 22$) or high in hypnotizability (scoring 8-11; $N = 28$) on the basis of SHSS:C scores, again discounting the amnesia item of the scale.

Procedure

The SHSS:C, like HGSHS:A, consists of an induction of hypnosis accompanied by suggestions for 12 representative hypnotic experiences. These items include suggested amnesia which is evaluated by recall tests of initial amnesia and subsequent reversibility. These tests are similar in format to those of HGSHS:A, except that retention is tested orally and each test continues for an unspecified time until S reaches an impasse. All Ss received the identical procedure administered by one of several Es.

The only alteration in the standardized SHSS:C procedure was the insertion of a written recognition test between the initial recall test of amnesia and the administration of the pre-arranged reversibility cue and final recall test. The recognition test was similar to that employed in Experiment 1 and listed the 11 critical SHSS:C items that are considered in evaluating posthypnotic amnesia (i.e., eliminating the amnesia suggestion itself) plus 22 items referring to plausible experiences that had not actually occurred during the session. No confidence ratings were collected for the individual recognition decisions.

Results

The mean SHSS:C score, based on 11 items (excluding the amnesia suggestion), was 7.40 (*S.D.* = 1.68) for the final sample of 50 Ss. A total of 26 Ss (52.0% of the sample) met the standard criterion for posthypnotic amnesia by recalling 3 or fewer of the 11 critical items.

Recall and Recognition During Amnesia; Recall After Reversibility

Table 3 shows the average number of critical items remembered on the recall and recognition tests of amnesia and the final recall test of reversibility, for Ss classified as low-medium and high in hypnotizability. A repeated-measures analysis of variance revealed significant effects for both level of hypnotizability ($F = 12.12$, $d.f. = 1, 48$; $p < .001$) and the sequence of tests ($F = 180.80$, $d.f. = 2, 96$; $p < .001$), and only a marginal interaction between the factors ($F = 2.97$, $d.f. = 2, 96$; $p < .10$). Individual comparisons of the retention tests in both groups showed a significant increment in memory between the recall and recognition tests during amnesia (Ss low-medium in hypnotizability: $t = 9.21$, $d.f. = 21$, $p < .001$; Ss high in hypnotizability: $t = 9.07$, $d.f. = 27$, $p < .001$), and again between the recognition test of amnesia and the recall test of reversibility (Ss low-medium in hypnotizability: $t = 3.51$, $d.f. = 21$, $p < .005$; Ss high in hypnotizability: $t = 4.81$, $d.f. = 27$, $p < .001$).

TABLE 3

Number Of Suggestions Remembered On Three Tests Of Posthypnotic Retention

Hypnotizability	*N*	Amnesia Test		
		Recall	Recognition	Reversibility
Low-Medium	22			
$\bar{X}$		5.32	9.50	10.23
S.D.		2.44	1.47	1.02
High	28			
$\bar{X}$		3.04	7.39	9.39
S.D.		2.33	3.12	1.73

As the analysis of variance suggests, even within the restricted range of SHSS:C scale scores employed here, there was a strong correlation between hypnotizability and the number of items reported on the initial recall test of amnesia ($r = -.54$, $p < .001$). The correlation between hypnotizability and recognition test performance was only slightly smaller ($r = -.44$, $p < .01$), and the difference between the two did not reach statistical significance ($t = 0.96$, $d.f. = 47$). Somewhat surprisingly, there was also a correlation between hypnotizability and total recall after administration of the reversibility cue ($r = -.28$, $p < .05$); presumably this is a reflection of residual posthypnotic amnesia (Kihlstrom & Evans, 1977), mediated by the generally high hypnotizability, and consequent strong response to amnesia suggestions, in this selected sample.

Recognition Memory

The Ss in the low-medium and high hypnotizability groups were also compared in terms of their performance on the recognition test alone, considering all items affirmed by S as having occurred—regardless of whether the items had been recalled on the initial amnesia test. After applying the adjustment for guessing described earlier, the corrected recognition scores for Ss in the high hypnotizability group ($\bar{X} = .74$, $S.D. = .18$) were found to be lower than that for Ss in the low-medium hypnotizability group ($\bar{X} = .88$, $S.D. = .12$), and significantly so ($t = 3.12$, $d.f. = 48$, $p < .01$). Similarly, Ss in the two hypnotizability groups differed in the average number of hits or true-positives (Ss high in hypnotizability: $\bar{X} = 7.00$, $S.D. = 3.14$; Ss low-medium in hypnotizability: $\bar{X} = 9.32$, $S.D. = 1.81$; $t = 3.08$, $d.f. = 48$, $p < .01$); the number of false alarms (false-positives) was quite low in both groups (Ss high in hypnotizability: $\bar{X} = .32$, $S.D. = .67$; Ss low-medium in hypnotizability: $\bar{X} = .23$, $S.D. = .43$; $t = .55$, $d.f. = 48$).

Ss with Initial Amnesia

In this experiment, we were particularly interested in those 26 Ss who met the criterion for posthypnotic amnesia on the initial recall test. As might be expected, because 21 Ss came from the high hypnotizability group, their performance over the three retention tests did not differ appreciably from what has already been described. Compared to their rather impoverished level of memory on the initial recall test ($\bar{X} = 1.92$, $S.D. = 0.89$), they showed a substantial gain on the recognition test, even though the amnesia suggestion was still formally in effect ($\bar{X} = 6.88$, $S.D. = 2.89$; $t = 9.20$, $d.f. = 25$, $p < .001$); and they showed a further significant gain on the final recall test of reversibility ($\bar{X} = 9.19$, $S.D. = 1.74$; $t = 5.53$, $d.f. = 25$, $p < .001$). Three Ss

continued to meet the criterion for amnesia on the recognition tests; of the remaining 23 Ss, 12 appeared to manifest a partial amnesia on the recognition test, in that despite a substantial gain in memory, they recalled at least two new items on the subsequent recall test of reversibility (Kihlstrom & Evans, 1976).

Discussion

The two experiments described in this paper are complimentary, in that the normative study of Experiment 1 controlled directly for time of recall and recognition testing, while Experiment 2 assessed the generalizability of the outcome of Experiment 1. The findings of the research converge on the conclusion that recognition testing can produce a significant breach in posthypnotic amnesia. While Experiment 1 suggested that recognition testing might abolish amnesia entirely, Experiment 2 found that with experienced Ss, more rigorously assessed for hypnotizability and also presumably more deeply hypnotized on average, the breach was often incomplete: recognition memory continued to be negatively correlated with hypnotizability, and the amnesia was fully relieved only after administration of the reversibility cue. Thus, the research confirms the findings of Williamsen et al. (1965) and Barber and Calverley (1966) and extends the findings to a different type of critical material.[11]

During posthypnotic amnesia, then, recall is much more seriously impaired than recognition—although at least under some circumstances recognition is also clearly affected by the amnesic process. The fact that the amnesia shown by Ss on a recall test is sometimes completely relieved during a subsequent recognition test (as in the present Experiment 2) does *not* mean that the apparent initial amnesia represents mere pretense or role-enactment. All of the approaches to memory described earlier agree that recognition compensates for something that is missing in the situation of ordinary free recall. Thus, such a finding should, at least in principle, permit us to specify more closely the nature of the memory impairment in posthypnotic amnesia. At present, however, the state of affairs within memory theory means that this specification will be difficult to achieve: interpretation of these empirical results depends largely on one's preferred theory of memory. Therefore, any conclusions which might be drawn must be regarded as tentative, and as reflecting some degree of pluralism with respect to the several competing theories.

Experiment 1, taken in isolation, is easily interpretable in terms of the classical two-stage theory of remembering advocated by Anderson and

[11]It is possible, of course, to suggest explicitly to the hypnotized S that he will be unable either to recall or recognize the critical material (Wells, 1940). The details of this form of posthypnotic amnesia have not yet been the subject of systematic study.

Bower (1972, 1974) and others. According to the theory, recognition obviates search; thus, the finding that it abolishes posthypnotic amnesia would suggest that the locus of the memory impairment lies in the search process by which the person actively gains access to the critical memories, and not the decision process by which candidate items are subsequently tested against some criterion of acceptability. This conclusion, in turn, would be consistent with the finding of other recent studies (Evans & Kihlstrom, 1973; Kihlstrom & Evans, in press b; Spanos & Bodorik, 1977) that posthypnotic amnesia is characterized by a disruption in at least some aspects of the organization of recall. However, this argument appears to depend on there being no disruption whatsoever in recognition, aside from the inadvertent omission of one or two items, and Experiment 2, as well as the studies of Williamsen et al. (1965) and Barber and Calverley (1966) show appreciable recognition failure among hypnotizable Ss. The simplest solution to this empirical difficulty, postulating independent amnesic processes affecting search and decision respectively, is clearly unpalatable. Moreover, the two-stage theory of recall is itself increasingly under challenge (e.g., Lockhart et al., 1976; Tulving, 1976).

The episodic ecphory view of Tulving (1976; Tulving & Thomson, 1973) and the levels of processing view of Craik and Lockhart (1972; Craik, 1977; Lockhart et al., 1976), while differing on whether the appropriate metaphor for remembering is retrieval or reconstruction, agree that a crucial factor in successful remembering is the amount of overlap between the information provided in the query to the memory system and that which is available in the memory trace itself: sufficient overlap either results in a match or initiates reconstructive activity. Compared to ordinary free recall, the query in recognition testing provides a relatively great amount of information concerning the target material stored in memory, thus maximizing the potential overlap between query and trace. Under conditions of free recall, by contrast, S must be in a position to initiate contact with the target memories with minimal environmental support—by capitalizing on whatever cues are provided in the query or by fragmentary memories remaining in consciousness, or by his knowledge of the sorts of things that must have been involved in the target event. The profound failure of recall in posthypnotic amnesia, and the relative success of recognition procedures, suggests that the amnesic S is unable to self-generate these sorts of cues. But recognition testing does not always succeed, even when the query contains a great deal of information appropriate to the target memory. The common denominator, then, appears to be the absence of appropriate trace information—either to support the self-generation of cues or to guarantee contact with query information. This, in turn, may be described as a dissociation of particular memories from conscious con-

trol; note, however, that successful contact with one memory does not guarantee that others will also be remembered. Thus, the dissociation must separate certain episodic memories from each other, as well as from the rest of the memory system.

The present results, by underscoring both the success and failure of recognition procedures, may require a shift in the emerging theoretical understanding of the cognitive disruption which underlies posthypnotic amnesia. In the past, this understanding has relied heavily on the two-stage model of memory and the metaphor of organized search (Evans & Kihlstrom, 1973; Kihlstrom & Evans, in press b). However, this theoretical structure now appears somewhat unsatisfactory, and it may be more useful to think in terms of the lack of contact between query and trace information suggested by the episodic ecphory and levels of processing approaches. Because these theories view recall and recognition as opposite points on a continuum, they can encompass the findings concerning the disorganization of recall—though perhaps without use of a "search" metaphor; they have the additional advantage of allowing for the possibility of complete or partial recognition failure as well. In the final analysis, however, the present experiments must be considered more suggestive than definitive; but they do call our attention to the need for studying those circumstances under which recognition and recall succeed as well as those circumstances under which they fail.

References

Anderson, J. R., & Bower, G. H. Recognition and retrieval processes in free recall. *Psychol. Rev.*, 1972, *79*, 97-123.

Anderson, J. R., & Bower, G. H. A propositional theory of recognition memory. *Memory and Cognition*, 1974, *2*, 406-412.

Barber, T. X., & Calverley, D. S. Toward a theory of "hypnotic" behavior: Experimental analyses of suggested amnesia. *J. abnorm. Psychol.*, 1966, *71*, 95-107.

Bartlett, F. C. *Remembering: A study in experimental and social psychology.* Cambridge: Cambridge Univer. Press, 1932.

Brown, J. (Ed.) *Recall and recognition.* New York: Wiley & Sons, 1976.

Coe, W. C. Further norms on the Harvard Group Scale of Hypnotic Susceptibility, Form A. *Int. J. clin. exp. Hypnosis*, 1964, *12*, 184-190.

Craik, F. I. M. Depth of processing in recall and recognition. In S. Dornič (Ed.), *Attention and performance. VI: Proceedings of the Sixth International Symposium on Attention and Performance, Stockholm, Sweden, July 28-August 1, 1975.* Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977. Pp. 679-697.

Craik, F. I. M., Lockhart, R. S. Levels of processing: A framework for memory research. *J. verb. Learn. verb. Behav.*, 1972, *11*, 671-684.

Crowder, R. G. *Principles of learning and memory.* Hillsdale, N. J.: Lawrence Erlbaum Associates, 1976.

Evans, F. J., & Kihlstrom, J. F. Posthypnotic amnesia as disrupted retrieval. *J. abnorm. Psychol.*, 1973, *82*, 317-323.

Evans, F. J., Kihlstrom, J. F., & Orne, E. C. Quantifying subjective reports during posthypnotic amnesia. *Proc. 81st Ann. Conv., APA*, 1973, *8*, 1077-1078.

GRAHAM, K. R., & PATTON, A. Retroactive inhibition, hypnosis, and hypnotic amnesia. *Int. J. clin. exp. Hypnosis*, 1968, *16*, 68-74.

HILGARD, E. R. *Hypnotic susceptibility*. New York: Harcourt, Brace & World, 1965.

JAMES, W. *The Principles of psychology*. New York: Holt, 1890. 2 vols.

KIHLSTROM, J. F., & EVANS, F. J. Recovery of memory after posthypnotic amnesia. *J. abnorm. Psychol.*, 1976, *85*, 564-569.

KIHLSTROM, J. F., & EVANS, F. J. Residual effect of suggestions for posthypnotic amnesia: A reexamination. *J. abnorm. Psychol.*, 1977, *86*, 327-333.

KIHLSTROM, J. F., & EVANS, F. J. Generic recall during posthypnotic amnesia. *Bull. Psychonom. Soc.*, in press. (a)

KIHLSTROM, J. F., & EVANS, F. J. Memory retrieval processes during posthypnotic amnesia. In J. F. Kihlstrom & F. J. Evans (Eds.), *Functional disorders of memory*. Hillsdale, N. J.: Lawrence Erlbaum Associates, in press. (b)

KINTSCH, W. Models for free recall and recognition. In D. A. Norman (Ed.), *Models of human memory*. New York: Academic Press, 1970. Pp. 331-373.

KINTSCH, W. *The representation of meaning in memory*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1974.

LANDAUER, T. K. Memory without organization: Properties of a model with random storage and undirected retrieval. *Cogn. Psychol.*, 1975, *7*, 495-531.

LOCKHART, R. S., CRAIK, F. I. M., & JACOBY, L. Depth of processing, recognition, and recall. In J. Brown (Ed.), *Recall and recognition*. New York: Wiley & Sons, 1976. Pp. 75-102.

NACE, E. P., ORNE, M. T., & HAMMER, A. G. Posthypnotic amnesia as an active psychic process: The reversibility of amnesia. *Arch. gen. Psychiat.*, 1974, *31*, 257-260.

NEISSER, U. *Cognitive psychology*. New York: Appleton-Century-Crofts, 1967.

NEISSER, U. *Cognition and reality: Principles and implications of cognitive psychology*. San Francisco: W. H. Freeman, 1976.

NORMAN, D. A. Toward a theory of memory and attention. *Psychol. Rev.*, 1968, *75*, 522-536.

PETERSON, L. R. Search and judgment in memory. In B. Kleinmuntz (Ed.), *Concepts and the structure of memory*. New York: Wiley & Sons, 1967. Pp. 153-180.

RABINOWITZ, J. C., MANDLER, G., & PATTERSON, K. E. Determinants of recognition and recall: Accessibility and generation. *J. exp. Psychol.: Gen.*, 1977, *106*, 302-329.

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. *Int. J. clin. exp. Hypnosis*, 1963, *11*, 39-47.

SPANOS, N. P., & BODORIK, H. L. Suggested amnesia and disorganized recall in hypnotic and task-motivated subjects. *J. abnorm. Psychol.*, 1977, *86*, 295-305.

TULVING, E. Ecphoric processes in recall and recognition. In J. Brown (Ed.), *Recall and Recognition*. New York: Wiley & Sons, 1976. Pp. 37-73.

TULVING, E., & THOMSON, D. M. Encoding specificity and retrieval processes in episodic memory. *Psychol. Rev.*, 1973, *80*, 352-373.

WEITZENHOFFER, A. M., & HILGARD, E. R. *Stanford Hypnotic Susceptibility Scale, Form C*. Palo Alto, Calif.: Consulting Psychologists Press, 1962.

WELLS, W. R. The extent and duration of posthypnotic amnesia. *J. abnorm. Psychol.*, 1940, *9*, 137-151.

WILLIAMSEN, J. A., JOHNSON, H. J., & ERIKSEN, C. W. Some characteristics of posthypnotic amnesia. *J. abnorm. Psychol.*, 1965, *70*, 123-131.

Rückruf und Erkennen während der posthypnotischen Amnesie

John F. Kihlstrom und Ronald E. Shor

Abstrakt: Die posthypnotische Amnesie scheint mit einem vorübergehenden Versagen des

Erinnerns in Verbindung zu stehen. Um die Natur dieser Behinderung im Erinnern zu bestimmen, wurden 2 Untersuchungen durchgeführt, die die Testresultate für Rückruf und Erkennen in der posthypnotischen Amnesie, an einem standardisierten Maszstab für Hypnoseempfindlichkeit erzielt, miteinander verglichen. Experiment 1, das sich eines Gruppenverfahrens mit 453 naiven *Vpn.* bediente, deutete an, dass das Prüfen des Erkennens eine Amnesie vertilgen könne. Experiment 2, in dem 39 erfahrene *Vpn.* individuell geprüft wurden, bestätigte die generelle Überlegenheit des Erkennens über Rückruf während der Amnesie, offenbarte jedoch nach Aufheben der Amnesie durch umkehrenden Befehl ein bedeutendes, hartnäckiges Defizit des Behaltens beim Erkennenstest im Vergleich zum Rückruf. Die Entdeckung der mehr relativen als absoluten Überlegenheit des Erkennens über Rückruf während der Amnesie wird vorläufig in der Form von 3 konkurrierenden Vorstellungen des Gedächtnisses ausgedeutet: eine zweiphasische Theorie, episodische Ekphorie und Ebenen des Prozessierens.

Le rappel et la reconnaissance pendant l'amnésie posthypnotique

John F. Kihlstrom et Ronald E. Shor

Résumé: L'amnésie posthypnotique semble associée à un affaiblissement temporaire du processus de rappel mnémonique. Afin de déterminer plus précisément la nature de cette déficience du rappel, deux études furent réalisées, permettant de comparer les méthodes de rappel et de reconnaissance, dans l'évaluation de l'amnésie posthypnotique, au cours d'une épreuve standardisée de susceptibilité hypnotique. L'expérience 1, où une épreuve de groupe fut administrée à 453 Ss naïfs, a révélé que l'épreuve de reconnaissance était susceptible d'abolir l'amnésie. L'expérience 2, réalisée auprès de 39 Ss initiés à l'hypnose, a utilisé une procédure d'évaluation individuelle. Les résultats ont confirmé la supériorité générale de la reconnaissance sur le rappel pendant l'amnésie , mais ils ont révélé une déficience persistente de la rétention à l'épreuve de reconnaissance par rapport à celle du rappel, après la levée de l'amnésie (signal de réversibilité). Ces résultats, montrant une supériorité relative, plutôt que absolue, de la reconnaissance sur le rappel pendant l'amnésie, font l'objet de 3 tentatives d'interprétation basées sur 3 explications concurrentes de la mémoire: la théorie dite "des deux étapes", la théorie de l'ecphorie épisodique, et celle qui fait appel aux niveaux d'analyse de l'information.

La memoria y el reconocimiento durante la amnesia posthipnótica

John F. Kihlstrom y Ronald E. Shor

Resumen: La amnesia posthipnótica parece asociada a una debilitación temporánea de la evolución de la memoria mnenómica. Dos estudios determinar más precisamente el carácter de esta debilitación de la memoria, y hacen una comparación de los métodos de la memoria y del reconocimiento durante una prueba "standard" de susceptibilidad hipnótica. El primer experimento, con 453 Ss nunca hipnotizados (pruebo de grupo), ha revelado que la prueba del reconocimiento puede eliminar la amnesia. El segundo experimento, con 50 Ss hipnotizados muchas veces, ha utilizado métodos de valuación individual. Los resultados han confirmado la superioridad del reconocimiento sobre la memoria durante la amnesia; pero han revelado una deficiencia persistente de la retención durante la prueba del reconocimiento en comparación a la prueba de la memoria, después del señal de riversibilidad. Estos resultados que muestran una superioridad relativa, más que absoluta, del reconocimiento sobre la memoria durante la amnesia, permiten tres interpretaciones fundadas sobre tres explicaciones concurrentes de la memoria: la teoría de "dos etapas," la teoría de la ecforia episódica y la teoría de los niveles de análisis de la información.