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THE RECOVERY OF INCIDENTALLY ACQUIRED INFORMATION*

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The psychoanalytically derived hypothesis that marginal registrations are best recovered indirectly, under conditions minimizing the active-selective intention to remember, was examined using associative priming as an index of indirect recovery. A list of words was presented under intentional or incidental-and-distraction conditions and its memory was tested under free recall, recognition or priming conditions. About ten times as many words were recalled and five times as many recognized in the intentional than in the incidental condition. Although significant, the extent of the priming effect did not differ under the two conditions. The results are discussed in terms of Craik and Lockhart's levels of processing approach and Posner's distinction between conscious and automatic activation processes.

Intentional learning has generally been found superior to incidental learning, although the extent of the superiority appears to depend on several factors, among them the method of testing learning. In several studies, training trials were given under intentional or incidental procedures, and memory tested under either recall or recognition conditions (Dornbush and Winnick 1967; Eagle and Leiter 1964; Estes and Da Polito 1967; Postman et al. 1955). All of these studies showed superior recall performance for intentional learning and either no difference or an advantage for incidental learning in recognition performance.

The superiority of the intentional condition for recall performance was taken by Eagle and Leiter to indicate that the intention to learn

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induces the subject to adopt effective memorizing strategies which facilitate retrieval. This interpretation gains support from studies in which incidental learning was not inferior to intentional learning in recall performance when the orienting task for the incidental group involved categorization (Mandler 1967) or induced imaginal elaboration (Bower 1972). Estes and Da Polito (1967) interpreted their results in terms of a dual process theory (Kintsch 1970) which assumes recall to involve a retrieval process that can be modified independently of the information storage required for recognition performance. This analysis indicates that instructions to learn affect probability of retrieval without affecting learning in the sense of information storage.

A major thesis of psychoanalytically oriented approaches to the study of cognition and memory (Hilgard 1962; Klein 1970) is that the laws governing the processing of irrelevant incidental registrations are distinctively different from those governing the processing of focal, intended perceptions. It follows that the conditions favorable for the recovery of information are different in the two cases. It is argued that unnoticed material, even when initially unavailable to conscious report, can best emerge into awareness under conditions that favor uncritical, passive receptiveness rather than active intentional search, and that this material can therefore be best detected in free associations, fantasy productions, or effects on a secondary cognitive task. This thesis guided many of the studies on peripheral learning without awareness (Dixon 1971; Hilgard 1962) which, pursuing a line of research originated by Poetzl (1917), have produced evidence that initially unnoticed elements emerge in the free associations, fantasy productions and dreams of the perceiver. These studies have been reviewed by Haber and Erdelyi (1967) and Dixon (1971). Haber and Erdelyi further showed that free associations aid in the direct recovery of otherwise unavailable elements. Although the critical input conditions involved in the general thesis as to the interaction between input and output conditions have been variously defined in terms of levels of awareness, levels of attention and degrees of relevance to the task at hand, Klein (1970) tends to regard the latter as the critical factor, with subliminal stimuli representing only a special, perhaps extreme, instance of incidental stimulation. Most of the perception and memory studies guided by the psychoanalytic thesis have employed either only one input condition or only one mode of recovery, and therefore do not permit a proper evaluation of the hypothesis regarding the interaction between initial encoding and

subsequent retrieval operations. The few exceptions (e.g., Eagle et al. 1966; Pine 1960), however, do lend some support for this hypothesis. It should be noted that the argument in this work concerns the recovery of incidental stimulation, not only its storage. Since incidental registrations are less amenable to direct, voluntary reproduction, it is believed that standard measures of recovery such as free recall may actually underestimate the prospect of recovering them more than indirect measures based on free associations or fantasy.

Testing of the psychoanalytic assumptions regarding the processing of incidental registrations has required the use of complicated and subtle methods of memory assessment, often involving subjective judgments. This is probably one explanation for the minimal impact of this theoretical and experimental work on studies of verbal learning. The latter field has been characterized by a more rigorous approach, stressing the use of objective, direct, quantifiable measures such as recall and recognition. The inital motivation of the present study was primarily heuristic, to express in terms of memory indicators accepted by students of verbal learning the input-output interaction postulated by psychoanalytically oriented students of cognition. It is hoped that this attempt will provide a modest encouragement to the interchange of ideas between two divergent approaches to memory, which have little communication despite their apparent concern with the same issues.

According to the psychoanalytic writers, the conditions favoring retrieval of unnoticed information are those involving the suspension of the critical function and the passive receptiveness to thoughts that come to mind (or 'take over' to use Klein's expression), rather than deliberate, active search guided by reality demands for selectiveness and accuracy. The measurement of indirect manifestations of memory under these conditions seems to be possible by utilization of the priming effect (Storms 1958) – the increased occurrence on a word association test of associates which have just been presented in a pretask. The priming effect has been obtained in a variety of conditions (Segal 1967), and has been found to provide a more sensitive measure of recovery than free recall (Grand and Segal 1966).

In the present study, a list of words was presented for incidental or intentional learning, and memory was tested in conditions of recall, recognition and priming. An interaction was expected between input and output conditions, with the superiority of intentional over incidental conditions most evident for free recall and least evident for priming.

Experiment

Method

The general procedure of the experiment involved the taped presentation of a list of 26 Hebrew words for intentional or incidental learning, and the testing of memory for these words through recall, recognition, or priming. A 2 × 3 Condition by Test factoral design was employed.

Conditions

*S*s in the intentional condition were instructed to listen to the list, since its retention would later be tested. In the incidental condition, the task was presented as an attempt to assess performance under distraction. A digit-symbol test was used as the orienting task, and *S*s were instructed to concentrate on this task, despite the simultaneous presentation of a list of words. Five *S*s in the incidental condition were discarded because they reported in the post-experimental inquiry that they had anticipated a retention test or had deliberately rehearsed the words.

Memory measures

Memory was measured for 20 of the 26 words, the first and last three words listed being excluded to avoid primacy and recency effects.

Recall was measured by instructing *S*s to list as many words as they could remember, regardless of order. The number of words correctly recalled in two minutes, ignoring the first and last three of the list, constituted the Recall score.

Recognition was measured by a forced choice procedure. The test sheet contained 20 rows, each including the correct word and three semantically related distractors. The order of the rows and the position of the correct word in each row was random. *S*s were instructed to encircle the correct word in each row and to guess if uncertain.

The priming test consisted of a 40-item discrete free association test, comprising 20 filler words and 20 cue words. Each of the cue words was associatively related to one word in the memory list, and was intended to prime or activate it. The 20 associated word pairs were selected from Hebrew association norms (Breznitz 1971) based on 550 Israeli students. The stimulus terms of the pairs were used as cue stimuli in the priming test, and the response terms (with the addition of the three initial and three final words) constituted the memory list. The frequency with which each of the response words was elicited by its cue stimulus averaged 21.7% according to the norms, with a range from 6.6% to 39.5%. For none of the pairs did the difference between male and female norms exceed 5%. Filler words were selected which had low associations with the words in the memory list.

Procedure

The experiment was conducted in small groups, each *S* receiving a booklet which contained all the instructions. The procedure was alike in all groups except for the differences in the input conditions and in the tests of retention employed. No information was divulged to the intentional groups regarding the kind of memory

test to be expected. After the initial instructions had been read, the taped list was played at a rate of about one word every 2.5 sec. This was followed by a filler task which required the marking of all even numbers smaller than 50 in a sheet containing two-digit random numbers. When 2.5 min had elapsed from the end of the list presentation, *S*s were instructed to stop and turn to the next page, which contained a recall, recognition or priming test. For the two groups receiving the recall test (recall groups), this was followed immediately by the recognition test. For the priming groups, the priming test was followed by the recall and recognition tests in that order, while the recognition groups were tested for recognition only.

Control conditions

Two additional groups were used to obtain base rate performances on the priming and recognition tests. The priming-control group consisted of 83 first-year students who were administered only the word association test, in exactly the same form used in the main experiment as a priming test. This control group was necessary in view of Segal's (1967) finding that priming effects operate within a word association test itself, with the cue stimuli appearing earlier in the list, affecting responses to subsequent cue stimuli. This finding suggests that the frequency with which a certain response is elicited by a given cue in a word association test might vary, depending on its position in the test and on the nature of the cue stimuli preceding it.

The recognition-control group consisted of 130 first-year students who were given the recognition sheet and instructed to try to guess the words read to the other groups. This group seemed to provide a better estimate of guessing rate than that based on the assumption of randomness (see Lieberman 1968).

Subjects

*S*s in the main experiment were 202 students (71 males and 131 females) whose native language was Hebrew. There were from 30 to 38 *S*s in each experimental group.

Results

Unless otherwise noted, the results reported pertain to the first memory test administered to a given group. Table 1 presents the means of the number of words correctly reproduced by each of the six experimental groups. These means, it should be noted, are based on the raw number of words (out of twenty) correctly reproduced in recall, recognition or priming, and are thus not corrected for guessing. A Condition by Test ANOVA of these data revealed a highly significant effect for the interaction, F (2, 196) = 29.86, $p < 0.001$. Although this analysis might not be entirely appropriate in view of the heterogeneity of variances, the interaction is readily apparent from a cursory inspection of the data of table 1: the effect of level of attention on memory seems to depend on the memory measures employed, recall being most affected and priming least affected by the difference in encoding conditions. Thus, about ten times as many words were recalled and about

Table 1
Means of number of words correctly reproduced by recall, recognition and priming, for incidental (INC) and intentional (INT) learning conditions.

Memory test	Recall		Recognition		Priming	
Condition	INC	INT	INC	INT	INC	INT
Mean	0.548	5.395	6.576	14.867	5.500	5.971
Standard deviation	0.810	3.538	2.222	3.431	3.194	3.205
N	31	38	33	30	36	34

twice as many words were recognized in the intentional condition as in the incidental condition, while essentially no difference was obtained for priming. A more refined analysis of these results follows.

Priming

We will first examine the data for priming. The following analyses were performed so as to determine first, whether the list presentation had any effect on the word-association performance of experimental *S*s in the incidental and intentional conditions, and, second, the relative extent of this effect in the two conditions.

Two methods of analysis were employed to examine each of the two questions, the first using *S*s and the second items as the unit of analysis. First, each *S* in the priming-control group was found to emit an average of 3.71 target words with a standard deviation of 3.00. *T*-test comparisons revealed that *S*s in the experimental groups emitted significantly more critical words on the average than the control group. The control-incidental comparison yielded $t\ (117) = 3.19$, $p < 0.002$, and the control-intentional comparison yielded $t\ (115) = 3.92$, $p < 0.001$. The comparison between the two experimental groups, however, yielded $t\ (68) = 0.62$ which is not significant.

The second, somewhat more sensitive, method for evaluating the extent of the priming effect involved determining for each of the 20 target words the proportion of *S*s responding with that word to the appropriate word stimulus. This was done separately for each of the experimental groups and for the priming-control group. The 20 proportions obtained for the incidental group were compared to those of the control group by means of a *t*-test for matched pairs, yielding a $t\ (19) = 4.15$, $p < 0.001$. The respective intentional-control comparison yielded $t = 5.92$, $p < 0.001$. The correlation between the 20 proportions for the incidental group and those for the control group was 0.90, and the respective correlation for the intentional and control groups was 0.86. Substantially, the same results were obtained when the proportions of correct responses in the experimental groups were compared to the respective proportions estimated from the Hebrew norms. Once again, however, a *t*-test comparison of the 20 paired proportions of the two experimental groups yielded $t = 1.24$, which is not significant. The correlation between the two sets of proportions was 0.90.

It can be concluded that (a) a clear priming effect was obtained for both of the

experimental groups; and (b) the extent of this effect was no greater for focal than for marginal information.

Recognition

We will now turn to the data on the recognition groups. Since the recognition test included 20 4-alternative items requiring forced choice, one is expected to get five items correct by chance. An alternative estimate of guessing rate is the performance of the recognition-control group. For this group the mean number of correct words marked was 4.59, with a standard deviation of 1.96. This is significantly different from what would be expected if the responses of control *S*s were determined on a random basis. *T*-test comparisons revealed that both of the experimental groups performed significantly better than the control group (t (161) = 5.77, $p < 0.001$ for the incidental condition). A comparison of the intentional and incidental conditions, however, revealed a highly significant difference in favor of the intentional condition.

T-tests based on items as the unit of analysis were also performed. For each of the 20 multiple choice recognition items, the proportion of *S*s marking the correct word was determined separately for the incidental, intentional and control groups. The correlation between the 20 proportions obtained for the incidental group and the corresponding proportions obtained for the control group was 0.50 ($p < 0.02$), and the respective correlation for the intentional and control groups was 0.38 ($p < 0.05$). These correlations testify to the existence of consistent response biases in multiple-choice recognition tests, and support the use of control groups to estimate base-rate performance.

T-test comparisons based on the matched proportions yielded the following values: $t = 4.56$ for the incidental-control comparison; $t = 20.45$ for the intentional-control comparison; and $t = 10.42$ for the incidental-intentional comparison, all significant at better than the 0.001 level.

If the results of the control group are taken as an estimate of guessing performance, the scores obtained by the experimental groups can be corrected for guessing using the formula 20 (O-E/1-E), where O represents the obtained recognition rate and E represents the recognition rate expected on the basis of guessing. Using this formula, the means of the corrected recognition scores for the incidental and intentional groups are found to be 2.88 and 13.30 respectively. Thus in comparison to priming, for which no difference was obtained between the two experimental conditions, recognition performance in the intentional condition exceeds that obtained in the incidental condition by a factor of 4.6:1.

It will be recalled that the recognition test was also administered to the priming groups (following priming and recall tests) and to the recall groups (following free recall). For the priming-incidental and -intentional conditions, mean recognition scores were 6.56 and 13.12 respectively. The mean recognition scores for the recall-incidental and -intentional conditions were 6.00 and 13.00 respectively. These figures are highly similar to those obtained for the recognition group. In sum, they show that with the present procedure, recognition memory (after correction for guessing) is about five times better in the intentional condition than in the incidental condition. Most note-worthy is the finding that this difference obtains in

the priming group where the priming test failed to reveal any difference between the two experimental conditions.

In a recent study on the Poetzl phenomenon, Erdelyi (1972) has argued that the relative effectiveness of fantasy over direct-type memory measures for recovering elements of marginal stimuli may be attributed to the relaxation of response criteria in fantasy production. This relaxation leads to higher rates of responses than those obtained with intentional recall and allows for the emergence of low confidence traces. This type of explanation, it should be noted, cannot account for the differential effectiveness of the priming and recognition measures, since these measures involved identical rates of responses.

Recall

The recall performance of the intentional groups markedly exceeded that of the incidental groups. Eighteen out of the 38 *S*s in the incidental condition recalled none of the words. It is difficult to determine the guessing base rate for recall, but it can be assumed to be negligible. Since any correction for guessing would probably only increase the discrepancy between the two conditions, it can be safely concluded that recall memory is ten times or more better for the intentional than for the incidental condition.

As indicated, a recall test was also administered to the priming groups. For these groups, the mean number of words recalled was 0.33 for the incidental condition and 3.94 for the intentional condition. Once again, the clear superiority of the intentional condition is maintained in free recall performance, despite the fact that the first-administered priming test failed to yield any difference.

Discussion

The results of the present study clearly indicate that the degree of superiority of intentional learning over incidental learning varies, depending on the method of testing memory. This superiority is most evident for free recall performance and least evident for priming.

The results for recall and recognition are generally consistent with previous research in that the intentional condition is clearly superior to the incidental condition in free recall performance, and somewhat less so for recognition performance. The inferiority of incidental learning even for recognition performance might appear inconsistent with previous findings, but is more likely a result of the particular orienting task employed in the present study. Thus, in the study by Eagle and Leiter (1964) where recognition in an incidental condition was superior to that in an unhindered intentional condition, the orienting task employed – classifying words as verbs or nouns – induced some degree of

semantic analysis. The orienting task in the present study apparently minimized the semantic processing of the distracting stimuli, thus resulting in inferior recognition performance. Indeed, in another study (Eagle and Ortoff 1967), a similar orienting task resulted in a clear impairment of recognition performance in a distraction condition, as compared to an unhindered intentional condition. Apparently, a moderate depth of processing, neither too elaborative nor too superficial, is optimal for recognition memory.

In the last-mentioned study, the distraction group was found to show more recognition errors based on acoustic similarity than the focal group. This finding was taken to suggest that reduced attention tends to block the semantic analysis of incoming stimuli. This is consistent with Craik and Lockhart's (1972) view that when processing capacity is diverted to an irrelevant task, processing of the relevant material tends to be constrained to a structural level of analysis. That this is not entirely the case is evident from the results for priming obtained in the present study, which suggest some degree of semantic analysis of the incidental information.

The results for priming indicate that both the incidental and the intentional conditions were effective to about the same degree in activating responses to the word association test. In both conditions, the effects were rather subtle, as is normally the case with priming, but they were significant. The intriguing problem is to specify just what it is about priming that makes it least sensitive to the effects of level of attention, when sizeable differences are obtained in recognition and recall performance. Since the distinctive characteristic of the priming condition appears to be its allowing the emergence of acquired information in the absence of a deliberate intention to remember, the results of the present study as a whole can be taken to suggest that information registered in the absence of a deliberate intention to learn can best be recovered under conditions that minimize a deliberate set to remember.

This account of the findings does not, however, specify the nature of the underlying process. The psychoanalytic thesis as to the different laws governing the processing of irrelevant and relevant stimuli has often been cast in terms of the distinction between primary and secondary processes (Hilgard 1962), but this distinction has never been stated articulately enough to allow exact specification in information-processing terms of the vicissitudes of attended and unattended registrations. Of the more recent information-processing approaches,

there are two which might provide a suitable framework for the interpretation of the results in process terms. The first framework is offered by Craik and Lockhart (1972) who interpret the results of incidental learning studies as indicating that memory performance is a function of the depth of processing required by the orienting task. The finding that the effects of different orienting tasks are not the same for all tests of memory is incorporated in this framework by assuming that the optimal form of processing depends on the trace utilization requirements of the subsequent memory test. Thus, the deep, elaborative processing induced by an intentional condition, while it aids access to stored information, might hinder the discrimination necessary for recognition performance. This argument can be extended to account for the priming results of the present study by assuming that only a minimal degree of processing is necessary for the activation of a memory trace by a subsequent word association task, and that processing beyond this stage does not increase the prospects of activation. As can be noted, this explanation, although at this point highly tentative, does not require the assumption that attended and unattended registrations undergo qualitatively different courses.

The latter assumption underlies the theoretical conceptualization of Posner and his co-workers (Posner and Warren 1972; Posner and Snyder 1975), who distinguish between conscious processes and automatic activation processes, the latter defined as occurring in the absence of intention, without giving rise to awareness, and without interfering with other mental activity. There is evidence (Conrad 1974; Warren 1972) suggesting that input words tend to activate or prime the meanings of other words along associative pathways and that this effect can occur without conscious attention and even despite the apparent intention to avoid such automatic build-up of information. Whether the priming effects obtained in the present study (and in other studies) can be regarded as an instance of Posner's 'automatic activation' remains to be determined. For one thing, in reaction time studies the effects of automatic activation have been shown to dissipate within very brief periods of time (Warren 1972), although Posner and Snyder (1975) argue that on other occasions the effects might remain for longer periods. If the associative priming measure employed in this study reflects an automatic activation process, the finding that it is indifferent to encoding strategies is clearly consistent with Posner's definition of automatic processes.

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