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Effectiveness of Intentional and Incidental Rehearsal Processes on Immediate and Delayed Recall

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ABSTRACT

It has been demonstrated that intent to learn has no effect on immediate recall in the incidental learning paradigm used by Jenkins. The present study further investigated this finding by factorially manipulating recall instructions (incidental vs. intentional learning), presentation rate of materials, retention interval, and type of orienting task. The results show that incidental semantic processing of information is sufficient for good retention of material in an immediate recall test. However, after a 24-hr delay between presentation of a word list and recall, subjects who used intentional processing strategies recalled more words than did subjects who used only incidental processing. This finding suggests that intentional rehearsal strategies are quite effective for delayed recall and that incidental semantic processing alone is not sufficient for long term retention of words. Several theories to account for the different pattern of results in immediate and delayed recall are discussed.

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Long Term Retention: When Incidental Semantic Processing Fails

There has been a good deal of recent interest in the contribution of semantic processing to memory for verbal materials presented in an incidental learning paradigm. In these studies, subjects are typically asked to perform an orienting task during presentation of a word list and then are tested for recall of that list. Jenkins (1974) has reviewed studies which consistently demonstrate that subjects who perform a task which requires processing at the level of word meaning show significantly better recall than subjects who perform a task involving orthographic or syntactic processing of the same words. Also, subjects given semantic orienting tasks show levels of recall and clustering comparable to those shown by intentional learners performing no orienting tasks (Hyde & Jenkins, 1969). An additional finding is that, for subjects performing orienting tasks, prior knowledge of whether recall will be tested has no effect on the level of recall and clustering (Hyde & Jenkins, 1969; Johnston & Jenkins, 1971).

Walsh and Jenkins (1973) eliminated amount of processing effort and processing time as possible explanations for the differential effectiveness of semantic and nonsemantic orienting tasks. They were able to demonstrate that the processing required by the orienting task is the significant determinant of recall. In addition, the apparent ineffectiveness of intent to learn has led Jenkins (1974) to conclude that "time, effort, and 'intention to learn' seem to have little or nothing to do with remembering" (p. 16).

This conclusion is not only important in its own right, but it also has major theoretical implications. In particular, the results reviewed by Jenkins (1974) are consistent with the Craik and Lockhart (1972) levels of processing formulation. Within this framework remembering is seen as a function of depth of analysis. Semantic orienting tasks would involve a deeper level

of processing than would nonsemantic orienting tasks and thus lead to superior recall performance.

However, the notion that intent to learn per se has no role in learning is questionable. Jacoby and Goolkasian (1973, exp. 2) found evidence that intentional learning subjects who performed a nonsemantic orienting task recalled more items than incidental learning subjects who performed only a nonsemantic orienting task. Hyde and Jenkins (1973) found that when a structured word list was used, subjects who performed a semantic orienting task and were forewarned about the recall test showed higher recall than subjects who only performed the orienting task. This indicates that there may be a processing advantage provided by intent to learn. Parenthetically, the groups used by Hyde and Jenkins did not differ on the degree of clustering, leaving open the question as to what kind of processing advantage is provided by intent to learn.

These contradictory data point to the necessity for more extensive examination of the role of intent to learn. In particular, past studies have not investigated long presentation rates of stimulus materials nor long retention intervals. Experiments reported to date have restricted presentation time per item to a maximum of 5 sec. The apparent sufficiency of this limit has been demonstrated by Walsh and Jenkins (1973) who found that subjects could perform two orienting tasks within a 4-sec period. This seems to indicate that subjects who are assigned only one orienting task do have time (if they are in an intentional group) to use other rehearsal strategies. Nevertheless, within these time constraints it is conceivable that when subjects (even those in intentional groups) are assigned an orienting task, they will use most of the available time to perform that task. This would imply that subjects performing orienting tasks did not initiate intentional rehearsal processes.

However, even if intentional rehearsal had occurred in some experiments which reported no effects due to this type of rehearsal, differential recall caused by intent may not have been observable in an immediate recall test. None of these experiments have included a test for delayed retention. Without data from a delayed recall test, the generality of the notion that intent has little or nothing to do with remembering is seriously restricted.

In order to develop these lines of investigation, the present study explored the effects of using a longer presentation rate (10 sec) as well as performance on a delayed recall test (24 hr). If a 5-sec presentation rate is long enough to allow intentional learning subjects given orienting tasks to use their own kind of rehearsal, and if this rehearsal has no special effect on remembering, then it would be expected that rate of presentation would have no effect. On the other hand, if a longer presentation rate is needed for subjects to be able to use intentional rehearsal then under the 10-sec rate the effectiveness of intent to learn would be revealed. Specifically, for the intentional learning subjects given orienting tasks, we would expect that levels of recall under the long presentation rate would be comparable across sets of words assigned semantic versus nonsemantic orienting tasks. Furthermore if intent to learn provides any kind of advantage for long term retention, we would expect this to be reflected in the groups given the long presentation rate and the delayed recall test.

To manipulate the variable of intent to learn, three instructional conditions were used. In the first condition subjects were not assigned any orienting tasks but were informed about the recall test. They were instructed to use any kind of rehearsal which they felt would aid in recall. In a second condition, subjects were similarly instructed but also performed an orienting task on each item. Subjects in the third condition performed an

orienting task but were not forewarned about the recall test. Type of orienting task was manipulated as a within-subject variable as was done by Till & Jenkins (1973). In addition, for subjects performing orienting tasks, there were some items that were assigned no specific orienting task. This was done to test the usefulness of a within-subjects measure of recall of words not assigned an orienting task. It might be expected that (only in the second condition) the proportion of recall of such words would be similar to the proportion of recall by subjects in the first condition.

To optimize the experiment's sensitivity to differences between instructional conditions (Hyde & Jenkins, 1973) and to investigate clustering patterns, a structured word list was used.

Method

Subjects.

Subjects were 96 male and female undergraduates at the University of Colorado, participating to fulfill an introductory psychology course requirement. There were eight subjects in each cell of the design.

Materials.

Stimuli were 40 concrete nouns, four in each of 10 taxonomic categories. Each noun in a category was a highly rated member of that category as determined by the Battig and Montague (1969) norms. Each noun was printed on a 35 mm slide with one of four letters "A", "B", "C", or "D" printed beneath the word. Also each one of the four nouns in a category appeared with a different letter. Each of these letters corresponded to a particular orienting task. Subjects were provided with a task code card which assigned a specific orienting task to each letter. A Latin square design was used to obtain four different task code assignments. These words were presented in a randomized

list with the restrictions that no two members of the same category and no two identical orienting tasks occurred consecutively. Four additional words were added at the beginning of the list as practice words, and four were added at the end to allow for recency effects. These eight words were also concrete nouns but were unrelated to the 10 categories used.

Procedure.

Subjects were randomly assigned to one of 12 different groups. Groups were defined by the factorial combinations of three levels of an instructional variable, two retention intervals, and two presentation rates. The instructional manipulations concerned performance of orienting tasks and knowledge of subsequent recall. One set of subjects was informed of the recall task, did not perform orienting tasks, and was encouraged to perform any mental operations which would help them to remember the words. This instructional condition will be labelled FR to refer to free processing. A second group of subjects was informed of recall and was required to perform orienting tasks. These subjects were instructed that, after they completed each orienting task, they should perform any mental operations which would help them to remember the words. This instructional condition will be labelled IC-FR to reflect the incidental and free processing instructions. The third set of subjects performed orienting tasks but was not forewarned about the recall test. The label for this condition will be IC.

The four orienting tasks involved writing on a sheet of paper a category name, adjective, or rhyme word which was relevant to the nouns presented or doing no specific task. Previous research (reviewed by Jenkins, 1974) indicated that the category name and adjective orienting tasks would involve semantic processing, while the rhyme word orienting task would be nonsemantic processing. Each subject was given one of four task code cards which assigned

a particular task to a particular letter. Thus every subject in an orienting task group performed all four orienting tasks.

One to four subjects from one of the 12 groups were run at a time. Before the test list was presented, subjects were given a practice list of four words to familiarize them with the orienting tasks and presentation rate. The test words were presented for 1 sec each with a carousel slide projector. The presentation of each word was followed by a 4- or 9-sec interstimulus interval depending on which presentation rate was being used. During the interstimulus interval nothing was shown.

Half of the subjects were randomly assigned to an immediate recall condition and the other half were assigned to a 24-hr retention interval condition. For subjects who were forewarned about the recall test, the instructions made no reference to when the recall test would be administered. After presentation of the list subjects in the 24-hr delay condition were not explicitly told when they would have to recall the words.

During the recall test, subjects were given a maximum of 10 min for written free recall. Following the recall tests, subjects in the 24-hr delay groups were asked whether they had expected the recall test and whether they had consciously rehearsed the test items. This postexperimental subject feedback determined that one subject in the delayed recall FR condition had written down the list of words for rehearsal during the retention interval. Therefore he was replaced by another subject.

Results

An analysis of variance of mistakes made on the orienting tasks indicated that there were significantly more errors for the 5-sec presentation rate

than for the 10-sec rate, $F(1,60) = 8.03$, $p < .01$. No other effects were significant.

Table 1 shows the means and standard deviations of recall performance. In order to facilitate comparison between results obtained in

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Insert Table 1 about here

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this study and the current literature, recall data were first analyzed for the groups with immediate recall and a 5-sec presentation rate. For the purpose of a balanced analysis of variance, the recall performance of FR subjects was randomly partitioned into four sections corresponding to the four orienting tasks. That is, for FR subjects recall of words which appeared with a particular code letter was analyzed as though those words had been assigned a single orienting task. The analysis of variance showed that there was a significant instructional effect, $F(2,21) = 5.29$, $p < .025$; a significant orienting task effect, $F(3,63) = 16.83$, $p < .0001$; and a significant interaction between instructional condition and orienting task, $F(6,63) = 4.11$, $p < .01$. The instructional condition main effect and this variable's interaction with orienting task was due to the equal recall performance by the FR subjects across the random assignment of orienting tasks. On the other hand, for the subjects performing orienting tasks (IC-FR and IC), semantic orienting tasks produced better recall than the nonsemantic orienting task, $F(1,15) = 13.98$, $p < .005$. In addition, semantic orienting tasks yielded recall levels not significantly different from those shown by the FR group. These results clearly replicate the findings of Jenkins and his colleagues despite our procedural modifications. Such replication indicates that the present experiment is studying the same kinds of processes as were examined by the Jenkins

Table 1

Means and Standard Deviations[a] of Words Recalled as a Function of Group and Orienting Task

Group	Orienting Task: Category	Adjective	Rhyme Word	No Task	Total
IC-FR					
Immediate					
5 sec	4.25(1.39)	4.50(1.42)	2.75(1.91)	1.62(1.60)	13.12(4.16)
10 sec	4.88(1.36)	5.25(2.25)	5.50(2.14)	2.12(1.96)	17.75(5.39)
24-hr Delay					
5 sec	1.25(0.89)	2.38(1.60)	1.00(0.53)	0.25(0.71)	4.88(1.81)
10 sec	3.12(1.46)	3.25(1.67)	1.88(1.46)	1.62(1.30)	9.88(4.70)
IC					
Immediate					
5 sec	3.88(1.12)	5.00(1.07)	2.88(0.99)	0.50(0.76)	12.25(1.49)
10 sec	6.75(1.18)	6.00(1.07)	4.00(1.69)	1.50(0.93)	18.25(3.28)
24-hr Delay					
5 sec	1.62(1.19)	1.12(0.99)	1.38(0.92)	0.50(0.53)	4.62(1.41)
10 sec	1.38(1.19)	1.38(1.30)	0.75(1.17)	0.50(1.07)	4.00(2.07)
FR[b]					
Immediate					
5 sec	5.12(2.42)	5.12(2.95)	5.75(2.55)	4.75(2.43)	20.75(8.92)
10 sec	6.62(1.92)	6.88(1.73)	6.88(1.81)	6.12(1.88)	26.50(6.12)
24-hr Delay					
5 sec	2.50(2.07)	1.88(0.83)	2.00(0.53)	2.25(1.98)	8.62(2.83)
10 sec	4.12(2.80)	3.88(3.14)	3.75(1.67)	4.75(2.87)	16.50(9.80)

[a]Standard deviations are presented in parentheses.

[b]FR subjects did not perform orienting tasks. For the analysis, words were randomly partitioned according to this variable for these subjects.

group. Also, these results showed that assigning no specific orienting task in the IC-FR group is an inaccurate estimate of FR subjects' recall performance. Recall of words assigned no specific orienting task was less for the IC-FR than for the FR group, $F(1,14) = 9.18$, $p < .01$. Hence the words assigned no orienting task were not included in subsequent recall analyses.

The main thrust of the study was to separate out the role of intent to learn from the other types of processing done on a word. Since orienting task assignment is meaningless for the FR group, and because we were interested in differential recall performance as a function of orienting task, the FR group was not included in the major analyses of recall data.

Four analyses of variance, one for each of the four combinations of retention interval and presentation rate, were calculated to compare performance of IC-FR and IC subjects across the three orienting tasks. These recall data are presented in Figure 1. Each panel of the figure corresponds to the set of data involved in one of the four analyses of variance.

Insert Figure 1 about here

The analysis of variance for the words recalled at the 5-sec presentation rate with immediate recall showed no significant difference between the IC-FR and IC groups and no interaction between group and orienting task. The effect of orienting task was significant, $F(2,28) = 9.34$, $p < .0025$. Again this is due to good recall of words assigned semantic orienting tasks and relatively poor recall of words assigned the nonsemantic (rhyme word) task, $F(1,28) = 16.40$, $p < .001$. The analysis of variance for the level of recall using the 5-sec rate with delayed recall showed no significant effects. Thus with the 5-sec rate, recall was not influenced at all by intent. Any significant

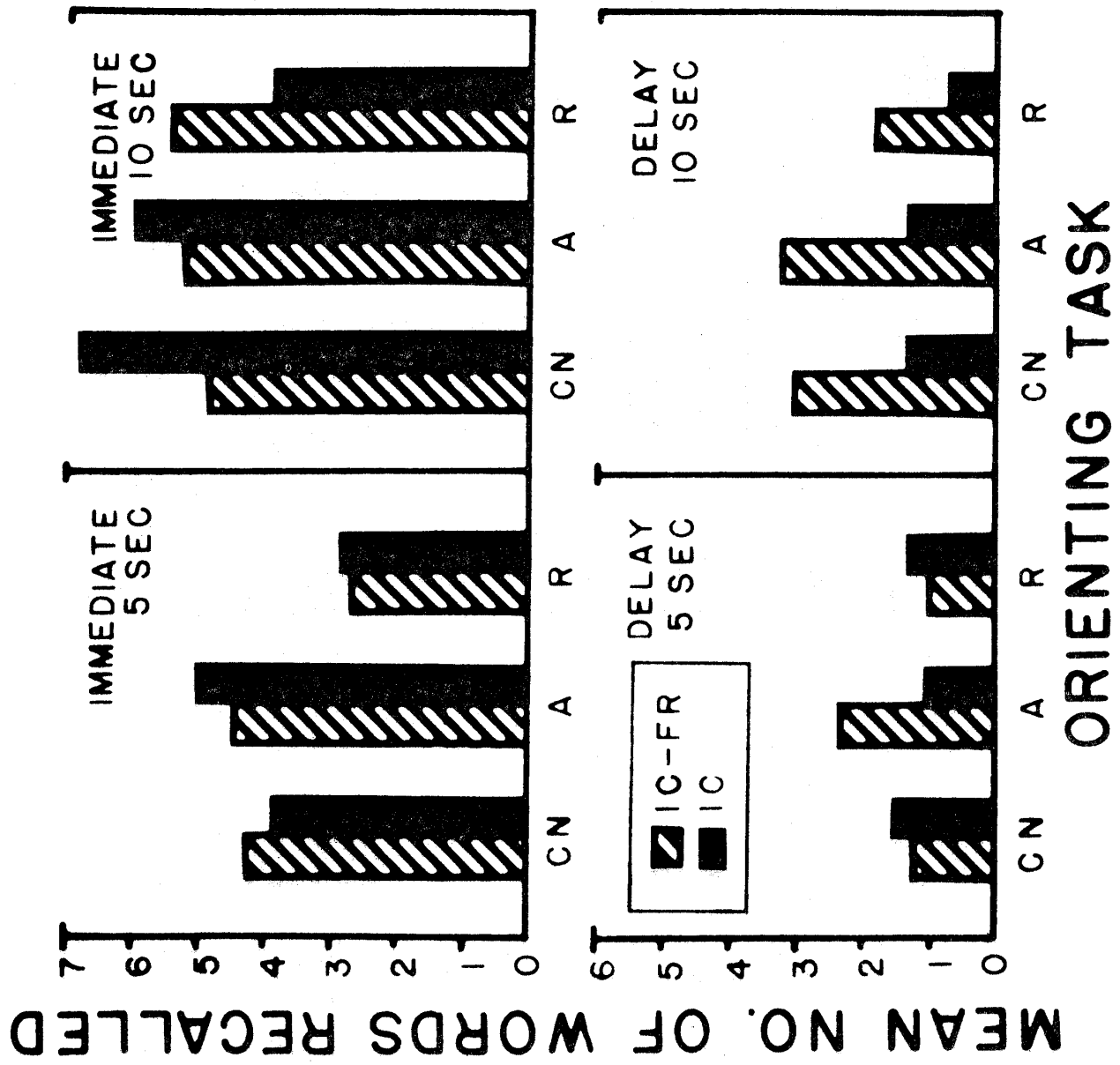

Figure Caption

Figure 1. Mean number of words recalled as a function of groups and orienting tasks. Each panel shows the recall data from IC-FR (intentional learning with orienting tasks) and IC (incidental learning) subjects under one of the four combinations of presentation rate (5 vs. 10 sec) and retention interval (0 vs. 24 hr). The orienting tasks are category naming (CN), adjective naming (A), and rhyming (R).

differences in recall were due solely to the nature of the orienting task.

At the 10-sec rate of presentation one begins to see differences in the pattern of the results. An analysis of variance for the 10-sec rate with immediate recall showed no significant group or orienting task effects, but the interaction between the two was significant, $F(2,28) = 5.44$, $p < .025$. In the IC group the characteristic differences in recall due to orienting task are seen. However, the IC-FR group showed comparable levels of recall across orienting tasks. Also the IC group recalled more words which were assigned the category name orienting task than did the IC-FR group, $F(1,14) = 8.80$, $p < .025$. Looking at the delayed recall for the 10-sec rate, it can be seen that the IC-FR group generally did better than the IC group. An analysis of variance confirmed this impression, $F(1,14) = 10.07$, $p < .01$. In addition, a significant effect due to orienting task was found, $F(2,28) = 3.64$, $p < .05$. Recall of words assigned a semantic orienting task was better than recall of words assigned the rhyme task, $F(1,28) = 7.25$, $p < .025$.

The presentation of these subanalyses was motivated by a significant 4-way interaction in the comprehensive analysis of variance (excluding the FR condition and the no task orienting assignment), $F(2,112) = 3.45$, $p < .05$. In addition to the 4-way interaction, other significant effects were found in this analysis. Overall, no delay in recall yielded better performance than the 24-hr delay, $F(1,56) = 162.52$, $p < .0001$, and the 10-sec rate of presentation produced better recall than the 5-sec rate, $F(1,56) = 19.36$, $p < .00025$. The effect of orienting task was significant, $F(2,112) = 13.23$, $p < .0001$. This result was caused by a significant difference between recall of words assigned a semantic orienting task versus the nonsemantic task, $F(1,112) = 25.52$, $p < .0005$. Thus semantic processing in general produced better recall

than nonsemantic processing.

There were several other significant interactions. For immediate recall the 10-sec rate produced better recall than the 5-sec rate, but this difference was reduced on delayed recall, $F(1,56) = 4.94$, $p < .05$. Also, for the IC-FR subjects the orienting task effect was greater on delayed recall than on immediate recall, while for IC subjects the reverse was true, $F(2,112) = 4.06$, $p < .025$. Finally, the IC-FR and the IC subjects did approximately as well on immediate recall (mean recall equaled 13.56 for IC-FR and 14.25 for IC), but they showed differences on the delayed recall test (6.44 for IC-FR and 3.81 for IC), $F(1,56) = 5.78$, $p < .025$.

Clustering scores were calculated from the recall data. The ARC'' method (Pellegrino, 1971) was used as it controls for differences in levels of recall across groups. Table 2 shows the mean category clustering and mean clustering by orienting task assignment. It appears that the FR groups showed more category clustering on the recall task than did either of the groups with

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Insert Table 2 about here

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orienting tasks. An analysis of variance of these clustering scores showed a significant group effect, $F(2,84) = 21.14$, $p < .0005$. A subsequent Neuman-Kuels test confirmed the impression that the FR condition differed from the IC-FR condition ($p < .05$) and the IC condition ($p < .01$). The IC-FR condition did not differ from the IC condition. This analysis of variance also revealed that clustering on immediate recall was greater than for delayed recall, $F(1,84) = 15.09$, $p < .0005$. Furthermore, the 10-sec rate of presentation produced more clustering than the 5-sec rate, $F(1,84) = 6.40$, $p < .01$. There was a significant interaction between group and time of recall, $F(2,84) = 4.99$, $p < .01$. This was due to the near zero level clustering for IC-FR and IC

Table 2

Mean Category Clustering and Mean Clustering According to Orienting Task Assignment as a Function of Instructional Group, Time of Recall, and Rate of Presentation

Time of Recall and Presentation Rate	Type of Clustering				
	Category			Orienting Task[a]	
	Instructional Group			Instructional Group	
	FR	IC-FR	IC	IC-FR	IC
Immediate					
5 sec	.159	.019	.027	.005	-.013
10 sec	.315	.086	.016	.000	.008
24-hr Delay					
5 sec	.042	-.003	-.002	-.011	-.010
10 sec	.104	.022	.001	-.031	-.002

[a]FR subjects did not perform orienting tasks and therefore could not cluster according to this variable.

groups regardless of time of recall, while the FR groups showed a drop in clustering as a function of time of recall.

To investigate clustering by task assignment, clustering scores were computed using the ARC" method. The means for these clustering scores are shown in Table 2. The FR condition is not included in this measure because task assignment has no meaning for these subjects. The preponderance of very low scores indicates that in general there was no clustering according to task. An analysis of variance showed that there were no significant effects.

Discussion

The present study confirmed the hypothesis that previous experiments dealing with the interaction of intent to learn and semantic-nonsemantic orienting tasks have not used sufficiently long presentation rates to allow subjects to employ intentional rehearsal processes. This statement is supported by the results from the immediate recall test. When a long presentation rate (10 sec) was used, the IC-FR subjects remembered as many words on which they had performed a nonsemantic orienting task as they did words which involved a semantic orienting task. Yet IC subjects given the 10-sec rate recalled more words for which they had carried out a semantic processing task than they did words which involved a nonsemantic orienting task. On the other hand, when the 5-sec rate was used, subjects in the IC-FR condition seem to have been restricted to the processing involved in the orienting tasks since they performed identically to subjects in the IC group. We claim that, due to time constraints, these IC-FR subjects were not able to perform the kind of processing which allowed the IC-FR group with the 10-sec rate to equalize levels of recall across orienting task assignments.

The delayed recall results also substantiate the conclusion that intentional rehearsal processing did not occur in the 5-sec presentation rate conditions. This is illustrated by the fact that intent to learn had no effect on delayed recall when the 5-sec rate was used. However, when the longer rate was used intent to learn provided an advantage in delayed recall performance.

The reliability of these results and their applicability to earlier work on incidental learning are reinforced by the fact that when the usual parameters of presentation rate and immediate recall were used previous results were replicated. This would indicate that the procedure and materials employed in this study were not the causal factors involved in producing results contrary to the traditional hypothesis that intent to learn has no role to play in learning. Similarly, incomplete performance of the orienting tasks can be ruled out as an explanation for recall performance differences between IC-FR and IC conditions. This is because the factor of intent to learn was not significant in the analysis of errors made on the orienting tasks. This analysis also revealed that fewer errors were made when the 10-sec presentation rate was used. This implies that subjects in the 5-sec rate condition were completely occupied with performance of the orienting task.

It may be argued that the differences in delayed recall performance of IC-FR and IC subjects given the 10-sec presentation rate were caused by IC-FR subjects performing some kind of maintainance rehearsal during the delay period. There are two reasons which cause rejection of this argument. First, only those subjects who indicated that they were not anticipating a delayed recall test, and those who had anticipated the test but indicated that they did not rehearse the material in the interim, were included in the analyses. Second, a difference in delayed recall performance as a result of intent to

learn was found only when the 10-sec presentation rate was used. If this difference were caused by differential rehearsal during the delay interval, then differences in delayed recall due to intent to learn should have also been found for the 5-sec rate. But no such effect occurred when this rate was used. Therefore it is clear that differential expectation of the delayed recall test was not the cause of performance differences on that test. Rather, such recall differences are a result of differential amounts of intentional rehearsal processing which occurred during presentation of the list.

Thus the results of this study show that intent to learn is a significant variable in recall performance. This variable's effect was observed both in immediate and delayed recall performance. In immediate recall, IC-FR subjects were able to use some kind of processing which allowed equal recall of words assigned semantic and nonsemantic orienting tasks. Of further interest is the finding that when IC-FR subjects had sufficient time to use intentional rehearsal during list presentation, their delayed recall performance was superior to that of the IC subjects. This was true even for words assigned semantic orienting tasks which are assumed to induce deep levels of encoding (Craik & Lockhart, 1972). These results clearly indicate that the conclusion reached by Jenkins and his coworkers (Hyde & Jenkins, 1969, 1973; Johnston & Jenkins, 1971; Till & Jenkins, 1973; Till et al., 1975; Walsh & Jenkins, 1973) concerning the ineffectiveness of intent to learn is invalid.

The present results also have important implications for current theories of memory. Although Craik and Lockhart's (1972) levels of processing idea can explain most of the incidental learning literature, the current findings are not easy to accomodate within the levels of processing framework. Even though incidental semantic processing was shown to be beneficial for immediate recall, it was inadequate for optimal performance on delayed recall. In order

to handle this latter finding the levels of processing notion may have to include the assumption that intentional rehearsal causes items to be even more deeply encoded than is the case when processing is limited to a semantic orienting task. However, this deeper processing assumed to be afforded by intent to learn was not evidenced on the immediate recall test. It may be that incidental semantic processing provides a level of encoding which is adequate for good short term retention but which is not effective for long term retention. This implies that the levels of processing framework may have to incorporate a distinction between short and long term retention.

Craik and Tulving (1975) have offered a new theoretical explanation of the effectiveness of semantic encoding. Their idea is that this kind of encoding does provide a deep level of processing, but that an additional factor in remembering is the extent of encoding elaboration of the item to be remembered. That is, no matter what level of processing is achieved by a particular kind of encoding, recall can be improved if the encoding involves a great degree of elaboration of the item. This notion may be applicable to the current results. Specifically, it is possible that intentional rehearsal provides a greater amount of encoding elaboration than semantic orienting tasks. As a result, intentional learning subjects would recall more than subjects who performed only semantic orienting tasks. However, this account of the present findings is also inadequate in light of the fact that the superiority of intentional rehearsal processing was evident only on a delayed recall test. Again, this more recent formulation seems to require the same kind of distinction between short and long term retention as was mentioned in connection with the levels of processing framework.

Another approach would be to interpret these results using a distributed memory model such as that proposed by Hunt (1971, 1973). Hunt's model includes

the concept of an intermediate memory (ITM) which retains only that information which is currently under examination. This model could be applied to our results with a few assumptions. It is possible that previous research dealing with levels of processing effects in immediate recall has been confined to a study of information in ITM. This idea is supported by the fact that maximum presentation rates have been restricted to 5 sec. Simon (1974) has reviewed evidence which suggests that 5-10 sec of processing are required before a chunk of information can enter long term memory (LTM). With the 10-sec rate used in our experiment, it may be that the only information which entered LTM was items processed by intentional learning subjects. Hence, long term retention of items which were processed only by orienting tasks was poor. On the other hand, it may be that with the 10-sec rate even incidentally processed items entered LTM but were not elaborated to a sufficient extent (cf. Craik & Tulving, 1975) to allow the level of recall obtained by intentional processing of items. Whether or not incidentally processed items are indeed available in LTM is a question which must be answered in order to evaluate this idea.

In addition, there are a number of subsidiary findings of interest. First, the performance of IC-FR subjects on recall of words assigned no specific orienting task was surprisingly poor. It was expected that recall of these words would approach the level of recall reached by FR subjects. Instead these words were poorly recalled, probably due to subjects treating them as being less important than items assigned specific orienting tasks.

The clustering data demonstrated that performance of orienting tasks of different types is sufficient to reduce or prevent clustering during recall. Category clustering for subjects who performed orienting tasks was virtually eliminated, irrespective of intent to learn. This finding is in line with

Till and Jenkins (1973) who found that associative clustering was prevented if different orienting tasks were performed on each of the members of an associative pair. Likewise, clustering by orienting task was not found in the present experiment, in agreement with the Till and Jenkins (1973) results. Apparently this kind of experimenter-defined segmentation of the list has no direct effect on internal organization.

Another interesting result is the crossover effect that was found for the 10-sec rate groups on immediate recall (see Figure 1). Specifically, IC subjects recalled more words which were assigned a category name orienting task than did IC-FR subjects. Moreover, the IC subjects did not differ from the FR group on recall of these words. This indicates that performance of a category name orienting task or performance of intentional rehearsal result in comparable amounts of recall even when a 10-sec presentation rate is used. However, when these two types of processing are used sequentially (as was the case for the IC-FR subjects given the 10-sec rate) recall is worse than when either type is used alone.

We offer two kinds of hypotheses for this counterintuitive effect in immediate recall. The first kind of hypothesis pertains to a notion of interference. It is possible that the IC-FR group's performance of the orienting task interfered with the effectiveness of intentional rehearsal. In particular, the category clustering data suggest that this interference may involve disruption of internal organization of the list. This may explain why the intentional rehearsal by the IC-FR subjects did not produce a level of recall equal to that of the FR subjects. Similarly, intentional rehearsal processing by IC-FR subjects may have interfered with the effectiveness of processing involved in performance of the semantic orienting tasks.

The other kind of hypothesis relates to the amount of time devoted to each type of processing. The IC-FR subjects may not have been able to spend as much time on either type of processing activity (orienting task or intentional rehearsal) as was spent on each by the IC and FR subjects. Latency data would be valuable for tests of this hypothesis.

In conclusion, the results of this study strongly suggest that for subjects performing orienting tasks a presentation rate of no more than 5 sec per item is insufficient to allow those subjects to initiate intentional rehearsal. We feel that this is one reason why Jenkins and his co-workers failed to find any effect of intent to learn. With a longer presentation rate we have been able to demonstrate an effect of intentional rehearsal. Specifically, this type of rehearsal produces equivalent levels of recall across orienting tasks. Furthermore, intentional rehearsal is superior to incidental semantic processing for long term retention of material. Our results were obtained using a within-subject manipulation of orienting tasks. Increased generality should be provided by further experimentation.

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