

Recall of Interrupted and Non-interrupted Tasks as a Function of Experimentally Induced Anxiety and Motivational Relevance of the Task Stimuli¹

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THERE IS considerable clinical and experimental evidence that verbal recall of past experiences reflects varying degrees of change and distortion from the original events. It is recognized, of course, that strength of original learning, frequency of usage, and congruency with recent events constitute major determinants of recall. Personality theorists, however, have generally maintained that motivational factors may exert additional systematic and selective effects on memory processes. The fact that attitudes (4, 19, 22), and punishment (23) or failure (11, 16, 20, 24) associated with previously learned verbal material, have been demonstrated to influence the content and strength of recall tendencies lends substantial support to this assumption.

Since its introduction by Zeigarnik (15), the interrupted task method has been widely used for the study of these motivational determinants of selective recall phenomena. Ss are presented with a set of problem tasks composed of relatively "familiar" stimulus material such as anagrams or picture jigsaw puzzles. Each S is permitted to complete some of the tasks while the remaining tasks are interrupted prior to successful solution. Following administration of the entire series of tasks, individuals are asked to name or

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describe as many of the tasks as they can remember. Several such experiments indicate the recall of successes (completions), as compared to failures (incompleted tasks), is related to certain personality characteristics (1, 2, 5, 6, 11, 21) and instructional set conditions (10, 13, 15, 20). One pattern of results in this area has been generally attributed to the effects of anxiety and defense mechanisms on memory processes, i e, under conditions of anxiety arousal, interruption ("failure") on a task evokes defense reactions that mediate the "forgetting" of these tasks. However, experiments specifically designed to test this assumption (1, 13, 20, 21,) have not yielded uniform or highly reliable differences in recall (3).

The present investigation was concerned with the development of experimental procedures and tasks for the study of the motivational determinants of selective recall in children, and explicitly with the testing of two hypotheses derived from the presumed effect of anxiety on recall. The predicted relationship between anxiety and selective recall is based on the assumptions that (a) interruption evokes anxiety reactions only if, and when, the subject is prevented from reaching a "desired" goal, i e, interruption under conditions of ego-involvement and (b) the temporal contiguity of the anxiety reactions and associations aroused by the task decreases the probability of recall of that task. Thus, under conditions of anxiety arousal individuals should recall relatively more completed than incompleted tasks. However, the *magnitude* of the difference between recall of completed and incompleted tasks is influenced by a number of non-motivational variables (3). Therefore, the more general hypothesis was tested in this experiment, i e, that differential recall of completed and incompleted tasks will vary as a function of the degree of anxiety arousal.

The second assumption stated above suggests an additional hypothesis concerning selective recall. The relative decrement of recall of interrupted tasks is presumably a function of the contiguity of anxiety arousal with the previously formed associations to the task stimuli. If this assumption is correct, it would be expected that tasks involving stimulus material which has acquired anxiety arousing properties should be recalled relatively less often than tasks composed of neutral stimulus material. The fact that differential recall of success and failure tasks is related to avoidance tendencies in

other experimental situations (10, 18) lends empirical support for this hypothesis

The specific experimental predictions may be restated as follows.

1 The differential recall of interrupted and non-interrupted tasks will be dependent upon the degree of experimentally aroused anxiety. That is, relatively fewer incompletes, as compared to completed, tasks will be recalled by individuals in the ego-oriented group than in the task-oriented group

2 Tasks composed of stimuli assumed to have acquired anxiety arousing properties will be recalled less frequently than control tasks

EXPERIMENTAL METHOD

Subjects

The sample consisted of 33 female and 27 male *Ss* enrolled in the fourth and fifth grades of an urban elementary school² Each *S* was randomly assigned to either an ego-oriented (E) or a task oriented (T) group and to one of two conditions of interruption. One-half of the *Ss* in each group were interrupted after correctly placing 6 pieces in the assigned puzzles and the other half after placing 9 pieces. The point of interruption proved to be a non-significant effect throughout the analysis and, therefore is excluded from consideration in this report.

Materials

The experimental materials consisted of six jig-saw puzzles especially constructed for this study. Puzzles were uniform in size (8½ by 11 in.) and number of pieces (12), and were of approximately equal difficulty as determined by a preliminary study.

In order to study the effects of anxiety arousing task-stimuli on recall, six pictures chosen from the Blacky Test (8) were cut out and each attached to the pieces of a puzzle. These pictures were considered particularly appropriate in view of the evidence that these stimuli are related to the arousal of "defensive processes" in perceptual task situations (17). Six control puzzles and pictures were constructed by attaching stimuli of presumably neutral connotation to mirror images of the critical puzzles. Each picture puzzle had a different and distinctive colored border. Some attempt also was made to control for the complexity of the verbal description of the critical stimuli.

A description of the task stimuli in each set is listed below.

<i>Critical</i>	<i>Control</i>
Oral eroticism	Lake with boy and girl near bank
Oral Sadism	Cowboy on a horse
Oedipal conflict	Desert scene, cactus, sand dunes
Sibling rivalry	Girl with a dog
Masturbation guilt	Two white scotty terriers
Identification process	Man in automobile

² Appreciation is extended to the officials of the Cedar Rapids Public School system, and to the superintendent, teachers and students of the elementary school where the study was conducted.

Procedure

Each *S* was administered one practice and the 12 experimental puzzles in separate random order of presentation. Puzzles to be interrupted, and the pattern of interruption, were also randomly determined for each *S*. The only restriction was that three puzzles within each set (critical and control) should be interrupted. *Ss* were permitted to view for 30 seconds a miniature picture of the task stimulus prior to beginning each puzzle.

The instructions for Group T were task-oriented, that is, *Ss* were informed that *E* was interested in determining which of these puzzles were most suitable for boys and girls of their age. Further, if *E* decided a particular puzzle was not suitable, *Ss* would be stopped and asked to go to the next puzzle. Interruption was accompanied by the comment that the puzzle "takes too long" or "seems too difficult." *Ss* were interrupted on the assigned tasks after successfully placing either six or nine of the pieces in the puzzle.

The *Ss* in the Group E were administered the puzzles under instructional conditions designed to arouse anxiety. *Ss* were informed these puzzles would give *E* an indication of their general mental ability in comparison to other boys and girls in their class. *E* was also interested in finding out which class could do best on the puzzles. Therefore, *S* should do his best so he would not be the one to spoil the chances of his class. *Ss* in this group were further informed that *E* knew how much time each puzzle should take boys and girls their age and if the puzzle took too long, or appeared too difficult for them, *E* would ask them to go on to the next task. *E*'s observations of the manifest signs of discomfort, as well as some incidental performance data on the tasks (presented in the discussion section) indicate these instructions, in general, accomplished the designed purpose.

During the administration of each puzzle, *E* recorded the time and sequence of placement of each piece of the puzzle. Immediately following the completion of the series of 12 tasks, *Ss* were asked to recall as many of the pictures on the puzzles as they could remember. *Ss* were then asked to state whether each of the recalled puzzles has been finished or not finished. Finally, the miniature picture of each task stimulus was shown to *S* and he was instructed to state whether the puzzle with that picture on it had been completed or not.

RESULTS

The first hypothesis stated that under conditions of ego-involvement individuals would recall relatively fewer incompleting, as compared to completed, tasks than under task-oriented conditions. The results confirm this expectation. Analysis of variance of the data in Table 1 yielded a statistically significant interaction between instructional condition and completion-incompletion ($F = 5.02$, $df = 1,56$; $.05 > p > .02$). The comparisons involving simple treatment effects were not significant although the difference between the frequency of recall of incompleting and completed tasks under ego-

oriented conditions was close to an acceptable level of confidence ($F = 2.99$, $df = 1,56$, $.10 > p > .05$)

TABLE 1

FREQUENCY OF RECALL OF INTERRUPTED AND NON-INTERRUPTED TASKS FOR EACH EXPERIMENTAL CONDITION

	Critical		Control		Total	
	I	C	I	C	I	C
Task-orient						
Mean	1 84	1 73	2 07	1 80	3 91	3 53
Var.	54	66	99	97	1 69	72
Ego-orient						
Mean	1 33	1 67	1 77	2 00	3 10	3 67
Var	89	56	78	87	2 28	1 67
Total	3 17	3 40	3 84	3 80	7 01	7 20

Significantly fewer incompleting tasks were recalled under ego-oriented than under task-oriented conditions ($F = 4.51$, $df = 1,56$, $.05 > p > .02$). A slight increase in the recall of completed tasks under the ego-oriented, as compared to the task-oriented, condition was not statistically reliable ($F = 1.03$, $df = 1,56$, $p < .20$). These results are similar to those reported by Glaxman (13) and suggest that differential recall of I and C tasks under ego and task conditions was primarily a function of the decremental effects of anxiety arousal on the recall of interrupted tasks. The findings are graphically illustrated in Figure 1.

The second prediction was that tasks involving complex stimuli presumed to have anxiety arousing properties would be less frequently recalled than neutral tasks. The mean frequency of recall for the critical picture-puzzles was 3.28 and for the control puzzles 3.82. The analysis based on the data in Table 1 yielded a statistically significant F -ratio for the test of the difference between these means ($F = 6.88$, $df = 1,56$, $.02 > p > .01$).

The differences in recall of the critical and the neutral puzzles is consistent with the assumption that anxiety selectively influences memory content. However, two alternative explanations for these data should be considered. A number of recent studies have indicated the importance of voluntary inhibition of verbalizations in social-experimental situations. In this experiment two precautions

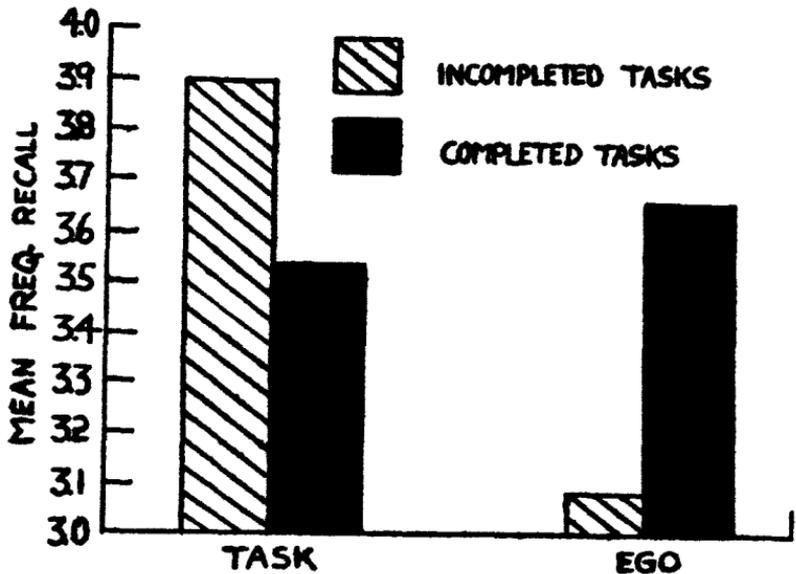


FIG 1 Frequency of Recall of Completed and Incompleted Tasks as a Function of Instructional Conditions

were taken in an attempt to avoid this particular problem. First, *Ss* were actively encouraged to recall as many of the pictures as possible. Secondly, only a description of the physical properties of the stimuli were required from the *Ss*. There is no way of knowing, of course, the extent to which these precautions were successful in reducing voluntary inhibition of verbal reports of the critical stimuli.

Another possible explanation is suggested by the fact that the differential recall of critical and neutral tasks was primarily a function of recall differences in the ego-oriented group. Although in the over-all analysis, the interaction between the two instructional conditions and type of puzzles did not reach a high level of significance ($F = 2.91$, $df = 1,56$, $p = .10$), comparison of the frequency of recall of critical and control puzzles for each of the conditions separately was made. Analysis of these effects yielded an F -ratio of 6.13 ($df = 1,56$; $0.02 > p > 0.01$) for the difference between the ego- and task-oriented groups in the frequency of recall of critical tasks, the same comparison for the control tasks was clearly nonsignificant ($F = 1.68$, $df = 1,56$, $p > .20$).

The decrement in recall of the critical tasks under the ego-oriented conditions might be attributed to increased generalization

tendencies arising from anxiety and the relatively greater physical similarity among the critical task stimuli rather than to their motivational properties. However, since the interaction between type of stimuli and instructions was not highly reliable, and the stimuli were not pre-selected for their relevance to areas of conflict for individual subjects, the question cannot be resolved with these data.

In addition to the recall test, the *Ss* were also asked to indicate whether each of the recalled puzzles had been finished or unfinished. A similar recognition test for all 12 puzzles was then administered to each *S*. An accuracy score based on the percentage of correct recall was computed for each individual for each recognition test. The mean recall scores for both measures tended to be lower for the ego conditions and for the interrupted tasks. However, none of these differences was statistically reliable.

DISCUSSION

The results of the present experiment give general support to previous findings that recall of incompleting tasks is superior under task-oriented conditions, whereas completed tasks are more frequently recalled under ego-oriented conditions (1, 10, 13, 20). These findings, then, are consistent with the assumption that "failure" experiences arouse characteristic anxiety reactions that mediate the "forgetting" of stimulus material associated with that experience. Further, tasks composed of stimuli assumed to have anxiety-arousing properties were less frequently recalled than control puzzles. Similar effects have been obtained in a variety of experimental situations (10, 17, 22) and have been generally considered to lend support to the hypothesis that needs, or anxiety, exert a selective influence on memory and perception.

The data reported in this study, as well as those reported by Glixman (13), indicate that interruption of a task tends to facilitate recall under task conditions (Zeigarnik effect) and has a decremental effect on recall under ego-oriented or stress conditions whereas the frequency of recall of completed tasks is relatively unaffected by the two instructional sets. While consistent with the notion of selective recall arising from the effects of anxiety on memory, some form of "repression" for example, this finding has been the subject of some controversy (3, 12, 20). Alper (3) has correctly pointed

out that the selective recall hypothesis requires only that recall tendencies are in the direction of relatively fewer "failures" recalled under task as compared to ego-oriented conditions. However, according to the ego-defense interpretation, differential recall under ego as compared to task oriented instructions is attributable to the *differential motivational properties of interruption* under the two conditions. The relative susceptibility of the recall strength associated with incompleting tasks to either facilitation or interference by external instructional conditions suggests a plausible alternative explanation of selective recall of interrupted and non-interrupted tasks. That is, differential recall of I and C tasks under ego- as compared to task-oriented conditions might be due to *differential familiarity* arising from the effect of varying levels of motivation on learning, rather than to the motivational properties of interruption per se.

Bruner, Matter and Papanek (9) have recently re-emphasized the relationship between motivation and the range and variety of environmental cues to which the individual responds. Interruption under task oriented conditions would appear more likely to produce some increase in the motivational level ("goal-striving tendencies," 5, 6) to some optimal point and thus increase the number of cues which mediate the recall of tasks, for example, increased tendencies toward psychological completion and "rehearsal." On the other hand, "conditions requiring increased speed and efficiency of goal attainment may have the effect of narrowing the range of environmental cues to which the individual responds" (9, p. 9). Thus, under the ego-oriented conditions, Ss would be expected to respond to fewer relevant cues (i.e., details of the picture on the puzzle) that would facilitate recall.

Two sources of evidence from the present investigation lend some support to this hypothesis. First of all, Ss in the ego-oriented group tended to require less time to complete the series of tasks ($t = 1.37$, $df = 58$, $.20 > p > .10$). Secondly, a more direct test was possible by comparing the "approach," or sequence of placement of the pieces of the puzzle, of Ss in the ego and task oriented groups. As indicated in the procedures, each puzzle had a distinctive colored border; in addition, the puzzles were so constructed that the major details of the picture were on the three

center pieces of each puzzle. According to the assumption stated above, it would be expected that individuals in the ego-oriented group would respond to the more dominant cues of color and straight edges rather than to the details of the picture. In fact, one might argue that "good" performance, i.e., fast solution, was incompatible with attention to the "relevant" details of the picture. In any case, individuals who tended to follow this approach may not have been exposed to the relevant cues during the task period. A crude test of this hypothesis was possible by comparing the two groups on the total number of relevant cues put into the 12 puzzles prior to the point of interruption. The obtained mean for the ego group was 28.83 and the task group 33.23, analysis of variance of these data indicated this difference to be statistically significant beyond the .05 level of confidence ($F = 5.27$, $df = 1,56$, $.05 > p > .02$).

One might say, therefore, that when individuals in the task group were interrupted, they were "looking" at and responding to an *incompleted picture*, whereas, individuals in the ego-oriented group were responding to the unfinished border details. Some Ss in the ego-oriented group probably were not re-exposed to the stimulus picture prior to interruption, i.e., details of the picture had not yet been placed in the puzzle. Further, it would be expected that "selective attention" to "irrelevant" cues would have central-cognitive consequences that disrupted the previously formed associations to the task stimuli. Thus, differential familiarity, arising from the effects of varying levels of motivation on learning during the task series, would appear to be an important factor underlying the observed decrement in recall of interrupted tasks under ego-oriented conditions. Since this interpretation is based only on the limited data obtained in the present study it must be viewed with considerable caution. Further systematic investigation will be required to determine if similar effects are associated with differential recall under different experimental conditions (e.g., with other types of tasks, stimulus materials, and/or recall delay periods). Certainly, whether or not anxiety exerts selective effects on memory per se, as the ego-defense interpretation implies, will remain a debatable hypothesis (12) until the role of differential familiarity in recall can be more fully specified.

SUMMARY

The purpose of this experiment was to test the hypotheses that (a) differential recall of interrupted and non-interrupted tasks would vary as a function of the degree of experimentally aroused anxiety, and (b) tasks composed of stimuli assumed to have anxiety arousing properties would be less frequently recalled than tasks involving stimulus materials of presumable neutral connotation. Thirty-three female and twenty-seven male subjects from a fourth and fifth grade were randomly assigned to an ego or task oriented group, and to one of two groups varying with respect to the degree of completion of tasks to be interrupted. Each *S* was administered a total of 12 jig-saw puzzles (six critical and six control), half of which were interrupted prior to successful solution. Immediately following administration of these tasks, *Ss* were asked to name or describe as many of the tasks as they could remember.

Analysis of the data indicated that proportionally more incomplete tasks, as compared to completed tasks, were recalled under the task conditions than under the ego-oriented conditions. A significant difference also was obtained between the frequency of recall of critical and control puzzles. The results are discussed in terms of the effects of anxiety and defensive processes on selective recall. An alternative explanation for recall of interrupted and non-interrupted tasks in terms of the effects of motivational level on performance was suggested.

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