Chapter - II
REVIEW OF STUDIES

In the preceding chapter we have observed both similarities and difference between implicit and explicit memory. Thus there is still controversy regarding the process underlying these two kinds of memory. The present study, as mentioned in chapter-1, is undertaken to resolve this controversy, that is to explore whether same or different processes operate in implicit and explicit memory. In this chapter we would review some of the most relevant studies which bears directly or in directly to this problem.

After extensive review of numerous studies, Herman Ebbinghaus (1885) observed that not all effects of memory are expressed in conscious awareness. His saving paradigm, in which memory was measured by saving during relearning, can be viewed as an index of implicit memory in the sense that relearning of a previously studied list does not require explicit reference to a prior learning episode, although the influence of prior episode is revealed by saving during relearning (Slamecka, 1985). However it is not entirely clear what saving studies tells us about implicit memory as little efforts have been made in this direction. The most directly pertinent evidence has been provided by Nelson (1978) who has shown saving for items that were neither recallable nor recognized, and thereby suggest that saving can occur in an entirely implicit manner.
Nelson (1978) conducted three experiments to investigate the relative sensitivity of recognition test and saving test for detecting information about items that were non-recallable. Four weeks after learning a list of number-word pairs, subjects had a test of recall followed by a test of forced choice recognition and relearning(saving). In exp. 1, 24 undergraduate students served as the subject. Each subject learned a list of 20 paired associates. The cues were two digit numbers of low association value from the norms of Batting and Spera (1962). The targets were nouns (four to six letters in length) of AA association value from the Thorndike-Lorge (1944) norms. Crossing 20 cues with 20 targets yielded 400 cue target combinations. From these twenty-four, 20 item lists were randomly constructed with the restriction that each cue and each target were used once in each list, and across all lists, each cue target combination was used approximately equally often. Each of these 24 lists was used once so that the cue-target combination were counterbalanced across subjects.

Prior to study, a practice and warmup task was given to each subject and then the main list of number-noun pairs was presented visually via a Kodak Carousel projector at a rate of 4 seconds per pair. During each test trial, the cues were presented alone at a 8 sec rate, and the subject responded vocally. The list was blocked so that a minimum of 10 items (either being studied or tested) intervened between the study and test of a given item, this procedure minimized short-term memory effect during acquisition of the list. Acquisition continued via this study-test
procedure until attainment of the criterion of one errorless trial on
the entire list. Then the subject was dismissed without being informed
of the subsequent retention test.

Four weeks after acquisition, the subjects returned for the second
session. First the subject had a self-paced forced-response retention
test in which he saw each cue for as long as he wanted before eventually
making a recall response. After all 20 item had been tested for recall,
the subject had a self-paced 20-alternative forced choice (20 AFC) recogni-
tion test. The subject's task during recognition was to select the particular
target that he had acquired to the cue 4 weeks earlier. There was no
feedback to the subject concerning his correctness on either the recall
test or the recognition test. After all 20 items had been tested for
recognition, there was a delay of 10 min during which the subject worked
on a puzzle while the experimenter arranged the slide tray for relearning.

The relearning list was constructed as follows. First, the items were
devided into three pools: (a) incorrectly recalled and incorrectly recognized,
(b) incorrectly recalled but correctly recognised, (c) correctly recalled-
most (89%) of the correctly recalled items were also correctly recognised.
Second, for each of the above pools, half of the items remained the
same as during the acquisition (designated as old items), whereas other
half of the items (designated as new items) were changed by randomly
re-pairing the cue and targets within a given pool. Finally, the cue
and targets were never intermingled across the three pools listed above;
their sigrigation insured that remembered associations would not differentially interfere with the relearning of new associations that came from
the pool of forgotten items. Thus, a relearning advantage of old over new for non-recognized items demonstrated that originally learned information can be detected by a saving test.

The findings of Nelson's major interest came from the analysis of saving score during relearning. Results of the experiment showed a considerable saving during relearning even for items that were neither recalled non-recognized.

The above findings prompted the investigator to replicate and extend the first experiment. Thus the exp. 2 was a replication and extension of the exp. 1.

The method of exp. 2 was the same as for the exp. 1 except. (a) Instead of one recall test of each item, a second recall test occurred after every item had been tested once. This change was made to provide a "purer" pool of non-recalled items, because items are occasionally correct on a second test trial even after they have been incorrect on the first test trial. (b) Instead of a 20-AFC recognition test, a 3-AFC recognition test was employed. The distractors came from the same pool as the target, in term of correct Vs incorrect recall during the retention test (i.e. the distractors for the recognition test of an incorrectly recalled item were the target from other incorrectly recalled items). (c) To produce more forgetting, a weaker criterion of original learning was employed. Once a given item correctly recalled during acquisition, it was deleted from the study and test phase of the list. Thus, rather
than an acquisition criterion of one errorless trial on the entire list, the acquisition criterion was one correct response per items. (d) Because of the dropout procedure, bloking the list (as in exp. 1) to prevent recall from short term memory became impractical. Therefore, the interpolation of 20 sec number shadowing between study and test was employed.

(e) The items were presented on an index card at a 5 sec rate during study (F) subjects were 30 undergraduate students.

Findings of exp 2 were consistant with the results of exp. 1 A considerable saving during relearning after 4 weeks was observed even for the items that were neither recalled non-recognized. However, the magnitude of saving was lower in exp 2 than the magnitude of saving in exp. 1. It was due to change in acquisition criterion which was weaker than the criterion employed in exp. 1.

Experiments 3 was designed to examine the possibility that a recognition test is more sensitive than saving test for measuring the retention.

This experiment was an exact replication of exp 2 except three changes:

1) The second recall test was not followed by a recognition test. Instead, the relearning study test trial occurred, with half of the items being old and half being new.

2) After the relearning test trial, the subjects had a self paced 3-AFC recognition test on the relearning items. The items were divided into two pools: correct during relearning versus incorrect during relearning. Thus, for a given cue, the three recognition alternatives consisted of the relearning target along with two distractors drawn randomly from the appropriate pool.
Sample was consisted for 38 undergraduate students.

Results of the experiment disconfirmed the hypothesis that recognition test might be more sensitive, in some cases, than the saving test. Nelsons major interest of the study was to explore which test is more sensitive to the retention. It was found that relearning method is most sensitive measure of memory. Since saving during relearning occurred even for the non-recallable and non-recognizable items while no explicit reference was made to the prior learning episode, it may be concluded that saving occurs entirely in implicit manner.

Although, the saving paradigm used by Nelson makes a reference to implicit memory but he did not discuss about the nature of this phenomenon. Several studies have demonstrated that priming effects in implicit memory measures are independent of explicit recall and recognition. Tulwing, Schacter, & Stark (1982) for instance, observed that priming effects in word fragment completion are independent of recognition memory. They selected a pool of 192 words and corresponding graphemic fragment which allowed only one legitimate completion. One half of the words (96) were presented to the subjects for a single study trial. These words were refered as 'old' words and remaining (96) words served as 'new' test items in subsequent test. Each test item whether old or new appeared in both Yes/No recognition test and the word fragment completion test. In addition to the type of test items (old Vs new) two other variables were also manipulated in the design: (i) retention interval 1 hr. to 7 days and (ii) order of test recognition followed by fragment completion.
(Rn-FC) or fragment completion followed by recognition (FC-Rn). Thus, the design of the experiment was 2 X 2 X 2 factorial design.

In all eight conditions, subjects were tested individually in two successive test phases separated by 7 days. Half of the old test items (48) with another set of (48) new items were tested in one session and remaining 48 old and 48 new items were tested in the second session. Thus, the item tested once in one session was not retested in the second session. In each session the test items were subdivided into two subsets of 24 old and 24 new words. For one of the subset, the test was given in Rn-FC order and for the other subset the order of test was FC-Rn. The sequence of the test was same for all subjects in both test sessions.

Results of the experiment demonstrated a dissociation between recognition memory and word fragment completion. Performance on recognition test was found impaired on a 7 days retention interval whereas the performance on fragment completion test was found unaffected. Priming occurred in both Yes/No recognition and fragment completion. The proportion of yes responses in the recognition test was higher in Fc-Rn order than in the Rn-Fc order. It was due to additional opportunity to study the successfully completed words.

Graf, Mandler, and Haddon (1982) also observed a dissociable performance on recall and word-completion tests. They tested two groups of subjects, one group was required to process the word elaboratively, and the other group was given a task that allowed construction of an integrated representation but was prevented elaborative processing. The
elaborative processing task required subjects to rate their liking for each word on a seven point scale (liking group). The other group was prevented from elaborative processing by requiring them to decide whether a word shared any of its vowels with the preceding word (Vowel group).

Each subject studied a list of 20 words which was preceded by 8 filler words to acquaint the subject with the task and followed by 4 filler words to prevent from extensive rehearsal of last few words of the list. After studying the list, each subject first received the completion test and then the recall test. In completion test, the subjects had to complete the initial three letter stem of the studied words with the first word that came to mind. The free recall test was given with the instructions to write down the words from the study list in any order.

On the completion test, the liking and vowel group produced a similar proportion of the study list word in response to the three letter stems whereas, on the other side, performance of liking group on free recall test was substantially higher than the performance of vowel group. This pattern of findings is evident that different and separate processes are responsible for the completion and recall performance.

Following Graf et. al (1982), Graf, Squire and Mandler (1984) conducted a series of three experiments to compare the performance of amnesic patients with alchohalic control subjects on both priming tests and standard memory measure under two orienting conditions, namely elaborative and non-elaborative.
In experiment 1, the performance of two groups, patients with alcoholic Korsakoff syndrome and alcoholic control subjects, was compared on word-wompletion and free-recall test. Each subject studied a list of words twice in succession in either the elaborative or non-elaborative orienting condition. Under elaborative orientation, subjects were required to rate each word on a 5 point liking scale. In non-elaborative orientation, subjects were required to underline common vowel in two successive word pairs. Vowel comparison task prevented elaborative processing of the study material so that the test performance was mainly determined by activation process.

Immediately following the list presentation, subjects were asked to recall the list words in any order and then they were given a word completion test.

The results of free recall and completion test were examined in separate ANOVAS. For the free recall data, there was a significant effect of orienting task (elaborative/non-elaborative) and patient group (amnesic/control). The performance was higher in elaborative condition than in the non-elaborative condition. Amnesic patients were found impaired in recall performance than the control subjects. There was also a significant interaction of orienting task x patient group. Analysis of simple main effect showed a significant difference in the liking (elaborative) condition but not in the vowel (non-elaborative) condition.

Analysis of completion test data showed a significant main effect of orienting task and no other significant effect. The overall higher completion performance was observed in the liking condition than in the vowel condition.
In experiment 2, an additional variable of retention interval was also manipulated. Findings of experiment 1, that amnesic patients performed equal to the normal subjects on completion test, suggested that activation is spared in amnesia. However, it was assumed that the information that determines performance on the completion test may decay more slowly in normal subjects than in amnesic patients. Under this condition amnesic patients were supposed to be impaired on completion test at long retention interval even though their performance may appear normal at short retention interval. To test this hypothesis, the performance of amnesic patients on completion test was compared with normal subjects, at different retention intervals. In addition, a recognition memory test was also administered at each retention interval. Since recognition performance according to Mandler (1980), depends on both activation process and available paths of retrievability, it was expected that amnesic patients will be impaired on recognition test.

The entire experiment was divided into three different sessions, scheduled on three different days. After the study of list of words, subjects were tested by a delay of 0,15,120 min. on each day. The sequence was (a) study list 1, than (b) study list 2, then (c) study list both again in the same order. Each list was studied either in vowel or in liking orienting condition and then subjects were given completion and recognition tests at scheduled retention intervals.

Analysis of obtained data showed that overall performance on the completion test was similar for amnesic and control subjects while the recognition performance was found severely impaired in amnesic patients,
particularly in the liking condition. The tendency to complete three letter cues to form recently presented list words was well above chance at zero and 15 min. delay but it declined to chance level after 120 min delay. An ANOVA of the completion test results involving the factor of patient type (amnesic/control), orienting task (vowel/liking), and test delay intervals, 0, 15, 120 min., revealed significant effect of test delay and orienting task. No other effects approached significance.

Recognition performance was also evaluated by an ANOVA. The results revealed significant effect of patient type and test delay. Retention performance on test of recognition was markedly impaired in amnesic group, it was higher in liking condition than in vowel condition and it decreased with increasing delay. There was also a significant interaction of patient type and task, orientation which reveals that the difference between amnesic patients and control subjects occurred in the liking (elaborative) condition but not in vowel (non-elaborative) condition. This pattern of findings suggests that only elaborative process is impaired in amnesia but the process of activation (non-elaborative) is remain intact.

Experiment 3, was designed to compare the word-completion performance of amnesic patients and control subjects with the closely related cued-recall test under both liking (elaborative) and vowel (non-elaborative) orienting condition. In the completion test, three letter cues were given with instructions to write the first word that comes to mind. In the related cued-recall test, the three letter cues were given with the instructions to recall the words from the learning list. Since the completion
performance, according to Graf and Mandler (1984), is mainly determined by activation process, a process that appears to be intact in amnesic, but the cued-recall involves additional process like elaboration that is impaired. Thus it was assumed that amnesic patients would be impaired on test of cued-recall but not on word completion and findings confirmed their hypothesis.

In general, the main findings of the study were:

(a) amnesic patients performed equally to the normal subjects on word-completion test but their performance was found impaired on standard tests of memory like recall and recognition. This difference in their performance was found under only elaborative processing condition. Under non-elaborative processing condition of the study material, amnesic patients were equal to the normal subjects in recall and recognition performance as they were equal to normals in completion performance.

(b) Retention interval had detrimental effect on both word-completion and recognition performance. Thus, the study reveals both similarity and difference between implicit and explicit memory.

In a subsequent study, Graf and Mandler (1984) conducted another series of three experiments to compare different memory tests for word, that were studied under either semantic or non-semantic processing condition. Duration of retention interval was also manipulated in the experiments to observe its effects on various kinds of memory tests.
In exp. 1, a word completion, a free recall and a recognition test was given to the subjects under three semantic and three non-semantic processing conditions of the task in each test. Since performance on word completion test reflects primarily the increased accessibility of the words as a consequence of an automatic activation process. Thus the word completion performance was expected not to be influenced by semantic and non-semantic processing of the task. Retrievability, on the other hand, is a function of elaboration which is independent of automatic activation and recall and recognition tests are sensitive to retrievability, therefore, a higher recall and recognition performance was expected under semantic processing condition of the task than under non-semantic processing condition.

Six groups of the subjects participated in the experiment. 3 groups studied the word under semantic processing condition. They had to rate the words on a 5 point scale in either of three following ways: like/dislike, meaningful/not meaningful, and concrete/abstract. Remaining 3 groups were prevented from semantic processing of the task in following three ways. One group of subjects required to report whether the preceding word had a vowel in common with the subsequent word. The second group was required to count T junctions (i.e. two intersecting lines) in each word and the third group had to count both enclosures (i.e. totally enclosed spaces) and T junctions. After studying the words, subjects were tested for word completion, word recognition and free recall.
Findings of exp. revealed that semantic and non-semantic processing of the task has a pronounced effect on recall and recognition performance but has little effect on completion performance. Different kinds of semantic and non-semantic processing conditions had no effect on any type of the test.

Exp 2 was designed to study the time course of completion and recognition performance. Each subject received a recognition and completion test immediately after the presentation of study list, after 20 min delay, and after a 90 min delay. Since different semantic and non-semantic processing conditions showed no difference in exp 1, only one semantic processing condition i.e. liking rating and one non-semantic processing condition (i.e. counting of enclosures and T junctions) was given to the subject. Exp 2 also examined the effect of word frequency on recognition and completion performance. Half of the words in study list were of low frequency (5.1 occurrence per million) and the remaining half of the words were of high frequency (95.6 occurrence per million). Six alternative completion tests and three recognition tests were given to the subjects at different retention intervals after the practice and study phase.

Recognition performance was affected severely in semantic Vs non-semantic processing condition while there was little influence of task processing on completion performance. Duration of retention interval had the same effect on both kinds of test. No effect of word frequency on any test was found.
Exp. 3 was designed to compare the completion performance with the closely related cued-recall test. First three letters of words were presented as cue in each test. The completion test was given with the instructions to complete each cue with the first word that comes to the mind whereas the cued-recall test was given with instruction to use the cues to help the recall of the words from the study list. Subjects studied the words in condition that required either semantic or non-semantic processing. Hypothesis was the same as in exp. 1 and 2, that elaboration in semantic processing of the task would increase retrievability and would raise cued-recall performance above completion performance by providing additional retrieval paths for finding the words. In contrast, the lack of elaborative information produced by non-semantic processing of the task was expected to result in reduced retrievability and thus cued recall performance was expected to be poorer.

Results of the experiment showed a significant main effect of task processing. The overall performance was higher in semantic processing condition than in the non-semantic processing condition. There was also a significant interaction of task processing and test type. This interaction was due to overall lower cued-recall than completion performance with non-semantic processing but higher cued-recall than the completion performance with semantic processing. The test order affected completion performance but not cued-recall. Completion performance was significantly higher when it followed rather then preceded cued-recall testing, but only with semantic processing task which suggests that when cued-recall test was given first, the recall of studied words may have increased their accessibility due to additional activation.
Results of these studies are consistent with the findings obtained by Shimamura and Squire (1984). They examined paired associate learning and priming effect in amnesic patients and in normal subjects. In their experiment subjects studied unrelated word pairs and then they were asked to complete three letters word stem to form a word. The word stem could be completed by using stimulus word from the study list. Just after the word completion test, paired associate memory was assessed on cued-recall test. Results of the study showed that the performance of amnesic patients on word completion test was as good as the performance of control subjects whereas, on the other hand, the performance of amnesic patient on cued-recall test was impaired. Control subjects performed better on the test when they were given explicit instructions. All these results support the views, espoused by Jacoby (1983); Mandler (1979), and others that different memory tests are sensitive to different aspects of the underlying memorial representations.

Studies of amnesic patients have suggested a distinction between two memory systems. One system is damaged in amnesia and depends on the integrity of the damaged brain region and the other is intact in amnesia and is independent of these regions. Keeping in view the above facts, Squaire, Shimamura, and Graf (1985) examined the relation between recognition memory and priming effects in patients receiving electroconvulsive therapy (ECT). ECT is known to cause anterograde and retrograde amnesia as a prominent side effect of treatment.
Three groups of subjects were used in the experiment. One group consisted of the patients receiving bilateral ECT, the second was receiving unilateral ECT, and the third group consisted of normal subjects. Subjects were tested on three different days during the course of bilateral or unilateral treatment when patients were receiving their third, fourth, fifth, or sixth ECT treatment. On the first and third day patients studied and were tested on word completion test after 45 min., 65 min., and 85 min. of bilateral or unilateral ECT treatment. On the second day patients studied and were tested for recognition memory after 45 min., 65 min., 85 min., and 9 hours ± 1 hour of ECT. Thus there were 10 study and test conditions in all: 6 for assessing word-completion and 4 for assessing recognition memory. The 10 learning lists were counterbalanced across these 10 test conditions. For the control subjects there were four test conditions. Three for assessing word-completion on one day, and one for assessing the recognition memory on the following day.

The word-completion ability was found intact in both groups of patients after 45 min. of ECT. Word completion performance did not differ significantly at different delays after ECT with the normal subjects. Recognition memory of the patients was found impaired at 45 min. after ECT. It was just near to the chance level. After 65 min. of ECT, the anterograde amnesia had diminished to some degree, and after 85 min. of the treatment the recognition score of these patients was significantly higher than chance level. These findings supported the view that recognition memory and priming test performance are independent of each other and there by suggested that the process that support priming
makes little, if any, contribution to recognition memory.

Graf, Shimamura, and Squire (1985) further reported similar findings that support the view of multiple memory system. In their study they conducted two experiments to examine the priming across modality and priming across category levels that extends the domain of preserved functions in amnesia. In experiment 1, the priming effect measured by word-completion, and deliberate recollection, measured by free recall, was examined across modalities and within modalities. Four groups of subjects, two amnesic and two control, were presented the words visually in one condition and auditorily in another condition and then they were tested alternatively for completion and free recall in a counterbalancing order.

Priming was observed in both visual-visual and auditory-visual modalities but the magnitude of priming was significantly larger under within the modality than in across the modalities whereas the change in modality did not affected free-recall. Amnesic patients performed as better as the control subjects on word completion test whereas the performance of amnesic patients was found impaired on free-recall.

In experiment 2, subjects were presented a random list of words belonging to different conceptual categories, and then they were given a priming test. Subjects were presented a category lable as cue, and they were required to generate the first eight exemplers that came to mind. A free recall test followed the priming task. In this way two
groups of amnesic patients and two control groups, studied and were tested.

Analysis of the performance of amnesic patients, healthy controls and alchohalic control group on word-production and free-recall showed that the average level of recall was similar for healthy control group and alchohalic control group but the performance of amnesic patients was significantly lower. In word production by category cue, each group showed a significant tendency to generate target words from the study list more often than expected without a study list presentation. Findings of similar amount of priming in amnesic patients and control groups is inconsistent with the view that subject accomplish priming by using a recall strategy, because amnesic patients were severly impaired on free-recall test while they showed normal performance on word production test. Thus the study reveals a dissociation between recall and priming tests.

Graf and Schacter (1985) may be regarded as poineer in using the terms implicit and explicit memory. According to them, implicit memory refer to the performance on priming test like word-completion whereas explicit memory refers to the performance on traditional memory tests such as recall and recognition. To explore whether the same or different processes operate in implicit and explicit memory, Graf and Schacter conducted two experiment to examine whether either newly acquired associations or preexisting associations affect completion test performance. In experiment 1, 64 subjects equally divided into four groups, studied related and unrelated words pairs in elaborative and non-elaborative study
conditions. In the related pairs, the target words were linked by an familiier association and in unrelated pairs, the target words had no preexisting relation. Subjects learned either under elaborative or under non-elaborative condition. Under elaborative condition, subjects used a 5-point scale that had the labels "Easy to relate" and "Difficult to relate" at its ends. Under non-elaborative condition, subjects had to report a common vowel between the two words of the pair. The design of their experiment included two between subject factors: type of study list pairs (related Vs unrelated) and study task (elaborative Vs non-elaborative). The design also included completion test context (same Vs different) as a within subject factor. Under same context, the initial three letter stems of the response word were paired with the same word as in study list and under different context these stems were paired with the words different from the study list, at the time of test. Retention performance of the subjects was assessed on a word-completion test. A cued-recall test, in addition, was also given to assess the explicit memory.

The experiment yielded three main findings. First, following an elaborative study task, there was a higher level of completion performance when the study context was reinstated at testing than when study and test context were different, for both related and unrelated study list word pairs. In contrast, following vowel comparison task, there was not same different effect on either type of word pairs. Second, across all type of different-context test items, there were similar and significant increase above the chance level of completion performance under both elaborative and vowel comparison task condition. Third, there was a higher level of recall for related pairs than for unrelated pairs as well
as a higher level of recall under elaborative than vowel comparison task condition.

The first finding of the study i.e. a higher level of completion performance on same-context test items versus different-context test items under elaborative study condition, but not under vowel comparison condition was used to argue that implicit memory is mediated by automatic processes. In contrast, explicit recall and recognition were assumed to be mediated by strategic or controlled processes because of their dependence on study task manipulation. On this view, the observation that the same-different effect depends on elaborative processing suggested that the completion test measures explicit rather than implicit memory. Thus, the same-different context effect may not provide evidence of implicit memory.

Keeping in view the above facts, Experiment II was designed to compare the cued-recall and completion performance of amnesic patients with the control subjects. Since amnesia is a such type of disease that deteriorate the explicit memory but has no effect on implicit memory. It was assumed: (a) If amnesic patients and control subject show a comparable performance superiority on the completion test in the same-context condition over the different-context condition, there would strong support for the view that the same different effect is medicated by implicit memory for newly aquired associations. (b) If
amnesic showed a similar level of completion performance on same and
different context test items, it would suggest that the same different
effect found in experiment 1, was mediated by explicit remembering.

Experiment 2, was similar to experiment 1, except the three changes: First, materials were presented under elaborative processing
test condition because same different effect was observed only under elaborative
study condition in experiment 1, second, the type of study material
(related and unrelated word pairs) was included as within subject factor;
third, a simplified word completion test was used, with fewer items,
for assessing performance in different-context condition. Each subject
saw both related and unrelated word pairs and then received word-
completion test followed by a cued-recall test.

Results of the experiment II revealed that there was a higher
level of completion performance when the study context was reinstated
at testing (same-context) then when study and test contexts were different,
for both related and unrelated word pairs. This pattern of finding supported
the view that the same-different effect on the word completion test is
mediated by implicit memory for new associations. In spite of their
severely impaired recall, the amnesic patients showed entirely normal
level of completion test performance after studying unrelated and related
word pairs. These findings lent support to the view that implicit and
explicit memory for new associations are mediated by different underlying
process.
Studies of amnesic patients strongly support the view of performance dissociation on implicit and explicit memory tests. Several studies, using other experimental variables, have also demonstrated a dissociation between implicit and explicit memory.

Thus Lewicki (1985) observed non-conscious biasing effects of single instance on subsequent judgement. He presented adjective noun pairs (e.g. old tree) through a cathod ray tube for a period of 30 ms. A computer was used to register subjects responses and response time. Immediately after the presentation of the material, it was marked by a string of Xs having the same length as that of words which remained on the screen for 50 ms. Responses were measured by presenting two adjectives (e.g. is a tree old or big) with the instructions to select one of them which, according to his judgement, would fit better with the noun. Lewicki found that subjects tend to choose the previous exposed adjective in response to question concerning how they felt about the noun (e.g. is a tree big or old). The findings clearly indicated the existence of implicit memory. As 30 ms exposure of a stimulus can not elicit an explicit memory response which was, however, sufficient to measure implicit memory.

Schecter and Graf (1986) examined the effect of elaborative processing on implicit and explicit memory for new associations. Experiment 1, was designed to examine whether the variation in degree and type of elaborative processing of the study material have the same or differential
effect on implicit and explicit memory for newly acquired associations. One group of subjects was required to perform a sentence generation task and the second group was instructed to generate only a word to link the member of each pair. It was hypothesized that the word generation task would require less associative elaboration than the sentence generation task, and hence, explicit memory for new associations would be lower after word generation than after sentence generation, since explicit memory is dependent on elaborative process. No assumption was made about the influence of degree and type of elaborative processing on implicit memory. The design of the experiment included two between subject factors, type of study task (sentence generation Vs word generation), and type of test (word completion Vs letter cued recall), and one within subject factor, type of test context (same Vs different).

The rate of word completion was found higher in same context than in different context condition following word generation, thereby demonstrating that this task, too, can produce an associative effect on completion performance. Moreover, performance in the same context condition which reflects this associative influence, did not differ in the word generation and sentence generation task. An ANOVA revealed a significant main effect of test context on word completion performance. No other effects approached significance.

Analysis of cued-recall performance revealed that recall performance in the same context condition was significantly higher following sentence generation than word generation task.
The overall pattern of results suggests that implicit and explicit memory for new association may depend on different consequences of elaborative processing. Explicit memory relatively benefits more from sentence generation than from word generation, whereas implicit memory does not.

Experiment 2, compared word completion and recall performance following two types of study conditions. In one condition, the sentence generation task from experiment 1, was used to induce active elaboration of unrelated word pairs. In a second condition, subjects were shown sentences that included the same target pairs and they were required to rate how well these sentences related the targets. An additional variable of retention interval was also manipulated in the experiment.

Results of the experiment showed that the completion performance was higher in the same context condition than in the different context. This difference was present in both sentence generation and sentence rating condition and was evident on both the immediate and delayed tests. An ANOVA revealed a significant main effect of test context. In contrast, there was no effect of study task. The interaction between delay and test context, delay x study task, and delay x study task x test context, was not significant. There was some evidence of main effect of retention interval on word completion performance. Performance declined across the retention interval in both the sentence generation and sentence rating task and in both the same and different context condition. At the 24 hr delay, completion performance remained significantly above baseline level in the same context condition following
both sentence generation and sentence rating. In the different context condition, however, delayed performance did not exceed base line level following either word or sentence generation.

Analysis of cued-recall data showed significant main effect of test context. Type of elaborative processing also had a large effect on explicit remembering of new associations. Recall in the same context condition was substantially higher following sentence generation versus sentence rating at both test delays. ANOVA also revealed a significant test type x Study Task interaction and also a marginally significant Test Type Study Task x Test context interaction.

Overall pattern of results demonstrated that active generation of elaboration is not necessary to observe implicit memory of new associations and suggested that encoding of even a small amount of information that relates or unites two randomly paired word is sufficient to produce implicit memory for new associations. However, it is not clear whether it is necessary to encode only meaningful relations between two words in order to observe implicit memory for new associations. Experiment 3, was addressed to this issue.

Experiment 3, was similar to experiment 2, except some changes in type of elaboration. In one condition subjects rated the meaningful sentences as in experiment 2, and were tested with both completion and recall tests. In the other condition, however, they rated and were tested on anomalous sentences that resembled the filler sentences that were used in experiment 2. These sentences, though grammatically
correct, did not provide a meaningful relation between the two critical words.

The main finding of the experiment 3, was that studying word pairs in anomalous sentences did not produce a significant associative effect on word completion test performance, whereas studying the pairs in meaningful sentences did. Thus the finding suggests that encoding of a meaningful relation between two words is necessary to produce implicit memory of new associations. Encoding the meaning of individual words without a meaningful relation between them, as was done in the anomalous sentences, does not produce implicit memory of new associations.

Experiment 4, was designed to examine whether rating the pleasantness of each word in an unrelated pair is sufficient to produce an associative influence on word completion test. For the comparative purpose, the sentence generation task from experiment 1, and 2 was also used.

The results of the experiment 4, were consistent with results of preceding experiment. Following the sentence generation task, an associative effect on completion performance was found. The completion performance was higher in the same context condition than in the different context condition. In contrast, there was much weaker evidence of an associative effect following pleasantness rating. This pattern of the result indicates that encoding the meanings of individual words in a pair is not sufficient to produce implicit memory of new associations.

Thus, the results of the study have revealed both similarities and differences between implicit and explicit memory. Degree and
type of elaboration have a large effect on explicit memory but little or no effect on implicit memory. However, these two kinds of memory are similar in the sense that both are dependent on elaborative processing of study list, since implicit memory was not observed without a meaningful relation between the two words of a pair.

In a subsequent study, Graf and Schacter (1987) conducted two experiments to examine the effect of interference manipulation on implicit and explicit memory for new associations. Historically, interference researches have focused on associative memory and have firmly established that explicit remembering is impaired by interference manipulation. In view of pervasive findings of associative interference on explicit memory tests, it was expected that studies of the effect of interference on implicit memory should have significant theoretical implications. The main purpose of their study was to examine whether interference manipulation have the same or differential effect on implicit and explicit memory. The general strategy for the experiment was that the subject was required to study unrelated word pairs and then received either an explicit or an implicit memory test. The critical manipulation involved an AB, AC interference paradigm. Under interference condition subjects were required to study a list of target word pairs (e.g. Shirt-Window) that had same stimuli or A word as the interference list pairs (e.g. shirt-finger). Under control condition, the target and interference list had no word in common. The design of the experiment included two between subject factors (RI & PI as type of interference and recall and completion as type of test) and one within subject factor (experimental and control as study condition) under retroactive interference condition,
subjects studied the interference list preceded by target list and it was followed by target list under proactive interference condition. Implicit memory was measured by word completion test and a letter cued recall test was given to assess the explicit remembering. Half of the words, in each type of test, were tested in same context (i.e. paired with the same words) as in the study list, and remaining half of the test items were tested in different context (i.e. paired with different word) than in the study list.

Results of the experiment showed that overall performance was higher on same versus different context test items on both word completion and latter cued recall tests. The critical new findings were that interference manipulation had no effect on word completion performance, whereas, it produced a significant impairment on latter cued recall test. The finding that interference effects were considerably larger on same than different context test items, emphasized that interference manipulation had selective effect on explicit memory for new associations.

Experiment 2, was designed to examine the effect of interference manipulation for two reasons. First, the interference manipulation in exp 1, was too weak and secondly, interference might fail to affect the recognition memory.

Second experiment was similar to the first experiment except two changes: first only one interference manipulation -R1- was used because both R1 and PI showed similar effect in experiment 1, and
and secondly an item recognition test - pair matching was used to assess the explicit memory, since it has been consistently found that interference has no effect on explicit recognition test.

The design of the experiment 2, included study condition (experiment and control) and test type (word completion and pair matching) as between subject factors. In experimental condition, each subject learned two interference lists AC and AD that had the same A word as the target list, whereas in the control condition, subjects studied and were tested on two interference lists EC and ED that had different stimulus words than the target list. The interference lists were always studied after the target list.

The overall completion performance was substantially higher in same than in different context condition. An ANOVA showed a significant main effect of test context (same Vs different) with no other effect approaching significance which suggests that interference manipulation did not affect implicit memory. In sharp contrast, recognition performance was found severely impaired after interference manipulation. Recognition performance was considerably higher in control than in experimental condition.

The other experimental variable that has been, frequently used to demonstrate whether the same or different processes underly implicit and explicit memory is age. Thus, Light and Singh (1987) conducted a series of three experiments, to examine the effect of age difference on implicit and explicit memory. Two age groups, young and older
adults, were used in all the three experiments. The average age of young adults was 23.5 years (range = 19-32 years) and the average age of older adults was 67.7 years (range = 60-76 years). All the subjects studied under two conditions in each experiment. In one condition, subjects had to rate the words on a 7 point pleasantness scale, whereas the second condition required the subjects to report a common vowel in two successive words in the study list. In experiment 1, subjects were tested for implicit memory on a word completion test, and free recall and item recognition tests were given to assess the explicit memory. The experiment 2, was same as experiment 1, with one exception that is a cued recall test was given to the subjects instead of free recall. In experiments 3, the implicit memory was assessed by perceptual identification and the explicit measures were cued recall and item recognition tests.

Overall, pattern of results, showed a significant main effect of age and encoding task. There was very little effect of either age or encoding condition on completion performance. In sharp contrast, recall and recognition performance was affected reliably by these two variables i.e. age and encoding conditions. A 2 X 2 ANOVA yielded main effect of age, encoding task, and age x encoding interaction. It was found that the young adults recalled more than the older adults and that pleasant rating task produced better recall and recognition. These results suggested that explicit memory declines across the age but implicit memory remain unaffected. It is important to note that implicit and explicit memory was assessed by using the study list consisting of unitized words and
attempt was made to examine the effect of age on implicit and explicit memory using new associations.

Khan (1990) examined the effect of age and task similarity on implicit and explicit memory using new associations. In all 80 male subjects participated in the experiment. 40 were young subjects with the average age of 22.7 years and the remaining 40 were old subjects with the average age of 63 years. These two groups were matched with respect to formal education, having a mean of 16.8 years of schooling.

A 2 X 2 factorial design in which one task variable (i.e. similarity) and one personality variable (i.e. age) was used. The two values of task variable were (a) semantic and (b) phonemic similarity and the two values of age were (a) young and (b) old age. Thus two groups of subjects namely young subjects and old subjects were presented a list of paired associates. In half of the pairs, the stimulus members of two successive pairs were phonemically similar and in other half of the pairs, the stimulus members of two successive pairs were semantically similar attached with unrelated meaningful common words. The types of items were counter balanced. The retention scores obtained for semantically similar items and those for phonemically similar items, though correlated observations, were treated as separate observations of the two sets of the items presented in a mixed list to each of the two groups of subjects. Thus, it yielded four observations on two groups for each of the two measures of the dependent variable i.e. implicit and explicit memory.

Implicit memory was assessed by a word completion test and a cued recall test was used to measure explicit memory. Separate
test forms were used for word completion and cued recall test each consisted of a single page. The test form used to measure the implicit memory showed a random arrangement of 24 test items. Each item consisted of a stimulus word attached with initial three letter stem of response word. Out of 24 test items, 6 were the members of phonemically similar word pairs, 6 were the members of semantically similar word pairs of the target list and the remaining 12 test items were distractor items which were not given in the study list and the responses of these items were not included in retention score. The purpose of distractor items in word completion test was to disguise its memory testing aspects, for once memory testing aspects of word completion become apparent to the subject, a completion test can be transformed into a cued recall test.

The test form used for cued recall test showed 12 test items, out of which 6 were from semantically similar word pairs and remaining 6 were from phonemically similar word pairs of the target list. These test items were not used in the completion test but they were constructed in the same manner as for completion test.

All the 80 subjects were tested individually and alternatively. After the necessary instructions, the study list was presented to subject at the rate of 4 second per pair for four trials. Immediately after the last trial, a word completion test followed by a cued recall test was given to the subject. In this way each subject was tested for implicit as well as for explicit memory.
The findings of the study revealed a dissociable performance on implicit and explicit memory measures. The mean cued recall score obtained by young subjects was significantly higher than the mean cued recall score obtained by old subjects whereas no significant effect of age was observed on implicit memory. Moreover, mean cued recall score under phonemically similar condition was markedly higher than the mean cued recall score under semantically similar condition, whereas task similarity affected implicit memory in entirely reverse direction. The mean word completion score under phonemically similar condition was found significantly lower than the mean word completion score under semantically similar condition. The interactional effect between age and task similarity on implicit as well as explicit memory was not significant.

The above review of relevant studies reveals that variables such as type of study processing (Jacoby & Dallas, 1981), Modality change (Graf, Shimamura, & Squire, 1985; Roediger & Blaxton, 1987), retention interval (Komatsu & Ohta, 1984) and retroactive and proactive interference have differential effect on implicit and explicit memory. These studies have provided impressive evidence in favour of dissociation between implicit and explicit memory. Other studies, however, have revealed several similarities between implicit and explicit memory (Jacoby, 1983a; Schacter & Graf, 1986a; Sloman, Hayman, Ohta and Tulving, 1988; Graf & Schacter, 1985; 1987; Schacter & Graf, 1986b; Mackoon & Ratcliff, 1979; 1986; Moscovitch, Winocur, Mc Lachalan, 1986; Johnston, Dark, & Jacoby, 1985). These conflicting results lead us to conclude that there
is still controversy regarding the processes underlying implicit and explicit memory. The present study is an attempt to resolve this controversy.

Another important consideration that influenced the thinking of the present investigator is substantial body of evidence to suggest that the deprivation of various kinds such as sensory, muscular, social, parental cultural, and economic etc., results into the deficient cognitive functioning and thereby impairs learning and memory processes. For instance Saeeduzzafar and Alam (1985) examined the effect of prolonged deprivation on retention. Sample of their study consisted of 30 undergraduate male students of Aligarh Muslim University. They were assigned to two groups on the basis of their scores on prolonged deprivation scale (Misra & Tripathi, 1977). Each group consisted of 15 subjects.

The learning and test sequence for each subject was as follows using anticipation method of learning, subject was presented a list of ten non-sense syllables one by one, each for two seconds. In this way the whole list was presented to the subject. At the end of the last learning trial a retention interval of 20 minutes was given to the subject during which he was engaged in reading some unrelated light material. At the end of the retention interval the subject was asked to recall the non-sense syllables one by one in any order within 20 seconds. The number of non-sense syllable recalled correctly determined the retention score.

Results of the study showed a significant effect of prolonged deprivation on retention. The mean recall performance of the deprived
group was found markedly poorer than the mean recall performance of non-deprived group.

In a subsequent study Saeeduzzafar and Alam (1986) studied the effect of different facets of prolonged deprivation on retention. The main objective of the study was to find out which area of deprivation has relatively more inhibitory effect on retention and which area of deprivation has relatively less inhibitory effect on retention.

80 undergraduate male students of Aligarh Muslim University served as the subjects whose deprivation had been tested with the help of prolonged deprivation (PDS) scale developed and standarized by Misra and Tripathi (1977). They were equally divided into four groups, namely economically deprived, deprived of parental interaction, socioculturally deprived, and non-deprived on the basis of their scores on PDS.

The learning and test sequence for each subject was as follows. Using anticipation method of learning, each subject was presented a list of ten nonsense syllables one by one, each for two seconds. Than a cue was presented for two seconds during which the subject was asked to anticipate and to report the nonsense syllable that followed the cue. Irrespective of his correct or incorrect answer, the first nonsense syllable appeared on the memory drum for two seconds and the subject was required to anticipate the second nonsense syllable that followed the first. The second nonsense syllable, then was exposed for two seconds and the subject was asked to anticipate the third nonsense syllable that followed the second. In this way the whole list was presented to the
the subject until he anticipated all the nonsense syllable correctly.
At the end of last learning trial a retention interval of 30 minutes
was given to the subject during which he remained engaged in reading
some light material. At the end of retention interval, the subject was
asked to recall the nonsense syllable one by one within 20 seconds.
The retention score was determined by the number of nonsense syllables
correctly recalled.

Data thus obtained were statistically treated by means of 't' test. The mean recall performance of economically deprived group
(deprived in housing conditions, home environment, economic sufficiency
and clothing practices) was found lowest among all the four groups;
Socioculturally deprived group (deprived in motivational experiences,
religious experiences, travel and recreational experience, emotional
experiences, and miscellaneous quasi-cultural experiences) obtained second
lowest mean recall scores and the group which was deprived of parental
interactions (deprived in formal experiences, childhood experiences, parental
characteristics, interaction with parents) obtained third lowest mean
recall scores. The non-deprived group on the other hand, obtained the
highest mean recall scores among all the four groups of subjects. The
mean recall performance of these four groups was also compared with
each other and 't' test was employed to see the level of significance.
It was found that economic deprivation and socio-cultural deprivation
have significant detrimental effect on retention while no reliable difference
was observed between the recall performance of non-deprived group
and group with parental deprivation. The mean recall scores of economically
deprived subjects was also compared with the mean recall performance of the socio-culturally subjects. The difference between the retention performance of these two groups was not found significant. Thus the study revealed that economic deprivation and socio-cultural deprivation equally deteriorate the retention performance whereas deprivation of parental interaction has no effect on learning and memory processes.

More or less similar study was conducted by Alam (1986) to see the effect of prolonged socio-cultural and economic deprivation on retention. In his study 45 undergraduate students of Aligarh Muslim University participated in the experiment. They were assigned to three groups of 15 each, on the basis of their scores on Misra and Tripathi's (1977) prolonged deprivation scale. The three groups of the subjects were economically deprived, socio-culturally deprived, and non-deprived. All the subjects were tested individually. Anticipation method of learning was used. A list of ten nonsense syllable was learnt by the subject to a criteria of one perfect anticipation. At the end of last learning trial, a retention interval of 20 minutes was given to the subject during which he was engaged in reading some unrelated light material. At the end of retention interval, the subject was required to recall the nonsense syllables one by one in any order within 20 seconds. The number of nonsense syllable recalled correctly, determined the retention score of the subjects.

Results of the study revealed a significant effect of both areas of prolonged deprivation, i.e. economic deprivation and socio-cultural
deprivation, on retention. The mean recall score of economically and socio-culturally deprived group was found reliably poorer than the mean recall score of non-deprived group. The mean retention score of economically was also compared with the mean retention score obtained by socio-culturally deprived group, by means of 't' test. It was found that economic deprivation has more pronounced deteriorative effect on retention than socio-cultural deprivation. The mean recall score obtained by economically deprived group was found to be markedly poorer than the mean recall score obtained socio-culturally deprived group. The finding leads one to conclude that economic deprivation as compared to socio-cultural deprivation has stronger inhibitory effect on cognitive processes such as memory.

In another study Alam (1988) examined the effect of social deprivation and observer presence on retention. The presence of an observing audience was taken into consideration because it acts as social cue or incentive to intensify the enactment of those cognitive processes necessary for successful recall performance. If the presence of an observing audience constitute such a social cue then it should have a facilitative effect on memory performance. Thus it was hypothesized that retention would be better under 'observer presence' condition than under observer absence' condition. Since it has been found that an incentive stimulus facilitates learning and retention of deprived subjects, it was further predicted that the presence of an observing audience would have more facilitative effect on memory performance of deprived subject than those of the non-deprived subjects.
Forty undergraduate male students of Aligarh Muslim University participated as subjects in the experiment. They were equally divided into two groups on the basis of their scores on modified version of prolonged deprivation scale (Misra & Tripathi, 1977). These groups were: (a) socially deprived and (b) socially non-deprived. There were 20 subjects in each group. Half of the subjects of each group were assigned to 'observer presence' condition and other, half to observer absence condition in a 2 x 2 factorial design experiment. Thus four groups of subjects were formed each group consisted of 10 subjects.

All the subjects were tested individually. A list of 16 meaningful words was presented to each subject for four trials. Immediately after the fourth trial, the subject was allotted two minutes recall time during which he was asked to write down as many words as possible in any order.

In the "observer-present" condition, a student other than experimenter was watching the learning and recall performance of the subject. The subject was not informed before the start of the experiment that any strange person would observe his performance in this way. In the "observer-absent" condition, no one was observing the learning and recall performance of the subject.

All the main effects were found significant. The mean word recall score of deprived subjects was markedly lower than the mean word recall score of the non-deprived subjects. Consistent with the hypothesis the results revealed that subjects in the 'observer-presence' condition showed higher average recall than subjects in the 'observer-
absence' conditions. The interaction effect of social deprivation and observer manipulation was also found significant, indicating a larger effect of an observing audience for deprived subjects than for non-deprived subjects.

A thorough review of literature reveals that few studies have been undertaken to demonstrate the influence of prolonged deprivation on explicit memory but no attempt has been made so far to examine the effect of prolonged deprivation on implicit memory. In order to resolve the existing controversy regarding processes underlying implicit-explicit memory, it is highly significant to explore whether or not prolonged deprivation has differential effect on implicit and explicit memory. The present study, a pioneer one, is a step in this direction.