CHAPTER - II

REVIEW OF STUDIES - I

Role of phonemic and semantic similarity in retention:

As mentioned in chapter I, there is a considerable body of evidence which shows that short-term memory store possesses acoustic properties, and not the meanings, whereas long-term memory store is sensitive to semantic features of the information but relatively insensitive to acoustic features. However, this dichotomy between STM and LTM has not been accepted by a number of investigators (e.g. Melton, 1963; Bregman, 1968; Murdock, 1972; Craik and Jacoby, 1974). They argue against two-process models and continue to speak in favour of a unitary system. This controversy is high-lightened in the conflicting results obtained by several investigators. In the following paragraphs, we shall review a few studies which bear directly or indirectly on this point.

In 1965, Conard, Freeman and Hull conducted a study to determine the effects of phonemic confusability and sequential redundancy on immediate recall of visually presented six-consonant strings. They found phonemic similarity to be the more powerful variable, indicating the relative unimportance
of a linguistic factor in short-term memory. With aural presentation, and using a list of eight different items, e.g. four letters and four digits under two conditions of experiment, namely (a) recall and (b) copy plus recall, Wickelgren (1965a) discovered that substitution errors were phonemically related to the forgotten item, and that the likelihood of forgetting a letter was an increasing function of the number of other phonemically similar letters in a sequence. In another study comprising of two experiments, Wickelgren (1965c) tested his phonemic-associative theory of short-term memory. The theory states that in a phonemically similar list of letters such as UZGBP in which phoneme 'e' is common among all letters, subjects should show better free recall than in a phonemically different list, since phoneme 'e' is certain to be recalled and direct associations exist from the representative of the 'e' phoneme to the representative of all the consonant phonemes in the list. If competition of response blocks recall of the consonants whose associations to the representative of 'e' phoneme are weakest, then free recall of phonemically similar list might be poorer than free recall of phonemically different list. But if competition of response does not prevent recall of the consonants whose associations to the representatives of the 'e' phoneme are weakest, then one might expect more items to be recalled from phonemically similar lists, though often in wrong positions.
If the phonemic associative theory just described is correct, then the superior ordered recall of phonemically different items should be reflected primarily in better recall of the position of an item. The number of items recalled, irrespective of position, should be less affected by phonemic similarity and might show a reversed effect. In the first experiment, 31 subjects attempted ordered recall of two types of 9 letter lists: phonemically similar lists in which all letters had a common vowel phoneme (a, e, or e) and phonemically different lists whose letters had no common phoneme. Ordered recall was found poorer for phonemically similar lists. Item-recall, by a free recall criterion, was not significantly different for the two types of lists. In the second experiment, 28 subjects attempted ordered recall of the consonants only, from two types of lists of seven consonant-vowel diagrams: phonemically similar lists in which the vowel was identical for all seven diagrams (a, e, i, o, o) and phonemically different lists whose seven vowels were a mixture of the above five vowels. Results of this experiment showed that position-recall was significantly poorer for phonemically similar lists, but item-recall was significantly better for phonemically similar lists.

However, in one of his studies, Wickelgren (1966b) investigated the effect of several degrees of similarity on short-term memory. He used the distractor method to investigate
short-term proactive and retroactive interference as a function of phonemic similarity. Subjects copied a list of PI (proactive interference) letters, then copied a single letter to be recalled later, then copied a list of RI (retroactive interference) letters and then attempted recall of single letter. The length and the phonemic similarity of both lists were varied systematically. Both proactive and retroactive interference were found in short-term memory for single letters. Retroactive interference continued to increase with increasing length of RI list, while proactive interference did not increase appreciably beyond four letters. Both proactive and retroactive interference increased with increasing phonemic similarity of the proactive and retroactive interference lists.

Using a probe technique, Wickelgren (1966c) also studied retroactive interference in short-term recognition memory. The task involved the presentation of single critical letter for retention followed by 12 interference letters, varying in their similarity to the critical letter. The single probe letter was either correct or incorrect and phonemically similar to the critical letter or incorrect and phonemically dissimilar. In some conditions the critical letter was repeated as one of the interference letter, and when this was done, there was a sizeable negative effect of phonemic similarity on correct recognition of the critical letter. There was also an increase in the
false recognition rate for phonemically similar probes.

Wickens and Eckler (1968) have also demonstrated that short-term recall decreases as a function of phonemic similarity. 36 Undergraduates were given triads of consonants or words in the Peterson and Peterson paradigm. After PI had developed for the CCCs, the experimental group was given a word trigram such as pea, kay, bee, and the control group received the homophonic triad, P, K, B. A significant improvement in performance was found for the experimental group and none for the control group. The investigators concluded that semantic factors over-ride any acoustic factors which might operate in this type of STM situation.

Dale and Gregory (1966) on the other hand, studied the effect of semantic similarity in short-term memory and compared it with the effect of acoustic similarity. In free recall, using RI paradigm, semantic similarity between original list and interpolated list increased intrusions from interpolated list but decreased omissions. By contrast, acoustic similarity caused both interpolated list intrusions and omissions to increase.

Baddeley (1970) studied the effects of acoustic and semantic similarity on short-term paired associate learning. He made use of six types of paired-associate lists: (a) Both acoustically and semantically similar words, (b) Both acoustically and semantically dissimilar words, (c) semantically similar
adjectives and (d) semantically dissimilar adjectives, (e) acoustically similar words, (f) acoustically dissimilar words. Baddeley found that performance was affected by acoustic similarity while semantic similarity had no reliable effect. Serial position curves, however, suggested that the primary and secondary memory components of the task were equally affected by acoustic similarity.

Shulman (1970) has argued that the differential effectiveness of the two types of similarity (phonemic and semantic) on short-term memory can also be accounted for by the hypothesis that the encoding of an item takes place over time, and that features most closely related to the sensory input, e.g., phonemic features, are encoded more rapidly than semantic features. In order to maximise the time available for rehearsal and under the pressure of relatively fast presentation rates, subject may tend to encode incoming information as quickly as possible, which implies that encoding will be based primarily on sensory attributes of input. Thus Shulman hypothesised that semantic encoding is possible in short-term storage when required by task demand or when slow presentation rates are used. In order to test these hypotheses, Shulman (1970) undertook a study in which subjects were forced to encode items both semantically and phonemically. A probe recognition task was used to evaluate the relative effectiveness of semantic and phonemic coding in short-term
memory. On each trial, a list of ten words was presented at a rate of either 350, 700 or 1400 msec. per word. Recognition was tested with a probe word which could be a homonym, a synonym or identical to one of the words in the list. The retention functions for all three probe types were found similar in shape, supporting the hypothesis that semantic encoding occurs in short-term memory. Furthermore, an interaction between type of encoding and rate of presentation was observed, which indicated that encoding is a time-dependent serial process. In another study, Shulman (1972) investigated further the hypothesis that semantic encoding is possible in short-term memory, through the collection of error data. On each trial, the sequence of events was as follows: a visual ready signal of 1-sec. duration was presented; followed by the successive visual presentation of 10 words at a 500 msec. rate. The tenth word was followed by the visual presentation of either I (identical) or M (same meaning) for 1-sec. and then the probe word appeared. The probe word remained visible until subject pressed either of two buttons signifying a positive or negative response; and then a 3-sec. interval began. The letters I and M were cues signifying to S that he was to base his recognition response on either identity or meaning. Each cue was presented on 60 trials and within each cue condition "yes" and "No" were the correct responses on 30 trials each. The results supported the hypothesis that semantic information may be stored
in short-term memory where such storage is a task demand. But
Baddeley (1972) has argued that Shulman's results are question­
able on the ground that semantic coding in primary memory
reflects the subject's use of semantically coded retrieval rules
which, though themselves stored in secondary memory, are used to
interpret phonemically coded primary memory traces.

A conclusion common to many of the studies is that acoustic
similarity has much larger effect than semantic similarity on
short-term memory, while semantic similarity is more effective
in long-term memory. The effect of phonemic similarity on long­
term memory has not been investigated extensively, but the results
available are internally consistent with the above conclusion.
Dallet (1966) reported four experiments in which he investigated
the effect of phonemic similarity on acquisition and retention
of paired-associate lists. Two sets of paired-associate lists
were used; they differed only in pairing of stimuli and responses.
The stimuli were homophone pairs (e.g., REIGN-MAIN). The
responses were twelve pairs of words obtained from articulation
testing materials prepared by Black and Haagen. The responses
were not homophones, but sounded alike— one of them being the
word most frequently given by subjects mishearing the other
word in an articulation test. The examples of these pairs
(stimuli and responses) are: BOAR - CONVAS, BORL - CAMPUS,
MUSSEL - OPAL, MUSCLE - OVAL. In the first session of the
experiment, subjects learned original and interpolated lists successively. In the second session that started one week after the first session, subjects were asked either to relearn the second of the two lists they had practiced the week before or to write down all the items they could think of, that is, stimuli as well as responses. When they had done this, they were asked to (a) indicate which had been the responses and (b) indicate which had been on the first and which on the second of his two lists. Dallet (1966) found that between-list phonemic similarity had little effect, while within-list similarity retarded acquisition and depressed retention at the 1-week interval.

Bruce and Murdock (1968, exp. II) examined long-term memory for paired-associates in a retroactive interference design. They found that the phonemic similarity of list I and list II stimuli affected neither acquisition nor retention. In a series of four experiments on serial learning, Baddeley (1966a) also found little effect of phonemic similarity on long-term memory. Bregman (1968) obtained forgetting curves by using four different sort of cues (contiguity cue, phonetic attribute, graphic attribute and semantic attribute) to retrieve nouns which had been presented earlier. He varied the interval between the original presentation and the test to obtain forgetting curves. Each subject received a booklet containing a long series of nouns (one per page) which were exposed at a fixed rate of one item
every 3 sec with an auditory signal. Some pages in the booklet, instead of having a noun printed on them, had a test which provided a cue for the recall of one of the prior nouns in the series and a space to write the answer. The delays between the presentation of a target item and its test were 1, 2, 3, 6, 12, 24, 48, 96, where a delay of 1 means that the test appeared on the first page of booklet following the noun. Bregman conducted two experiments, which were exactly the same except that in the first experiment all cues in a given booklet were of the same type so that subjects could predict in advance what type of cue would be given and would perhaps use homogeneous encoding strategy in each booklet. In the second experiment, on the other hand, all four types of cues were used in each booklet. The subject therefore, could not predict in advance what type of attribute would be used to cue any specific noun and was expected to use a neutral or mixed strategy. Bregman found that semantic, phonemic and graphic informations tend to be equally salient and forgotten at the same rate. However, Kintsch and Buschke (1969) have clearly demonstrated that phonemic similarity affects short-term memory and not long-term memory, and semantic similarity has detrimental effect on long-term memory but has no effect on short-term memory. Their learning material consisted of strings of 16 words. After the 16 words were presented, one of them was repeated and subjects were asked to respond with the word that
had followed the repeated words in the strings of words. There were three types of strings in the experiment. Some consisted of 8 pairs of synonyms in random order (POLITE - COURTEOUS), others consisted of randomly ordered homophone pairs (NIGHT - KNIGHT) and third type were strings of unrelated words which served as controls. The results were broken down into separate primary and secondary components and were consistent with the hypothesis that primary memory is sensitive to phonemic similarity and insensitive to semantic similarity, while reverse is true for secondary memory.

Gruneberg, Colwill, Winfrow and Woods (1970), on the other hand, demonstrated the existence of acoustic confusion in long-term memory. In their study, 20 CVC trigrams were presented at a rate of 1 every 4 sec to 25 undergraduates. After two successive presentations of this list, there was a 10-12 hour gap. Subjects were then given a test list which consisted of items acoustically related, acoustically unrelated, and identical to items on the presentation list. The subjects were asked to indicate which items appeared on the original presentation list. The results showed that false positive intrusion errors occurred to a significantly greater degree among items acoustically related to items on the presentation list. These results led Gruneberg et al. (1970) to conclude that long-term memory is also sensitive to phonemic similarity. Glanzer and Schwartz (1971) studied the
effect of associative structures on short-term and long-term store. 104 Undergraduates were given a series of lists, each containing associated and unassociated items. Subjects were asked to recall the items in any order. The effects on short-term store and long-term store were separated by the use of post list delay tasks. It was found that the effect of associative structure was solely on long-term store and short-term store remained unaffected by the associative structure.

Philip (1972) assessed the differential effects of acoustic similarity and meaningfulness at short (2.7 sec) and long (10.8 sec) retention intervals. Four lists of 18 consonant trigrams (CCCs) were used. These lists of CCCs varied in acoustic confusability and level of meaningfulness (M). Thus four lists were (a) acoustically similar and low in M (BGO, CPJ, DZH, MOX, SJF), (b) acoustically similar and high in M (BGR, CPS, DZN, MRX, SKF), (c) acoustically distinct and low in M (JNL, OJK, JNW, ZRX, LOB), and (d) acoustically distinct and high in M (CRL, THK, JNG, MRX, LOD). After the presentation of each trigram, subjects were tested at one of the two retention intervals (2.7 sec or 10.8 sec). The retention intervals was filled by the presentation of digit pairs at a rate of 0.9 sec. per pair. Three question marks appeared after the last digit pair was removed from the screen. These remained on the screen for 10 sec while subject attempted to recall the trigram. The findings
revealed that the main effects of level of meaningfulness, degree of acoustic confusability, and retention interval were all significant. Recall performance for all groups decreased as a function of retention interval. Recall for high M trigrams was consistently higher than for low-M trigrams, while acoustically distinct trigrams were recalled better than acoustically similar trigrams. Meaningfulness clearly has its major effect at the long retention interval. Similarly, the detrimental effect of acoustic similarity is found only at the short retention interval.

Recently Saeeduzzafar (1975) conducted two experiments. In one experiment, two lists of sixteen pairs were used. The experimental list was divided into eight blocks, each block consisting of two pairs whose stimulus items were semantically similar and responses were unrelated adjectives (e.g., WEATHER - GENIAL, CLIMATE - MATURE). The second list or control list was constructed by rearranging the pairs of the first list in such a way that the stimulus items of the two pairs of each block become semantically dissimilar. Four conditions were used. These were: (a) Semantic similarity with no induced anxiety, (b) Semantic dissimilarity with no induced anxiety, (c) Semantic similarity with induced anxiety and (d) Semantic dissimilarity with induced anxiety. Thus four groups of subjects were employed, one in each condition. Each group received two paired associates successively each for two seconds. Subjects then counted
backward from 629 to fill up a retention interval of 6 sec. Immediately after counting backward activity, the stimulus member of the first pair was presented alone for a period of 2 sec. during which subjects were required to recall the response associate with it. In this way the whole list of eight blocks of sixteen pairs was presented and for short-term recall test, subjects were shown stimulus member of every first pair except in the case of 3rd and 7th blocks where stimulus member of the second pair was shown. Five more trials were given to the subjects in the same way except that counting backward activity was dropped followed by a retention interval of 30 minutes during which subject was engaged in an unrelated light reading task. After retention interval of 30 sec, the subjects were tested for long-term recall. The experiment II was identical to first except that experimental list of 16 pairs were divided into eight blocks, each block consisting of two pairs whose stimulus items were phonemically similar and responses were the same as used in experiment I. Except this difference the two experiments were exactly the same. The purpose of these experiments was to see the differential effects of semantic and phonemic similarity on short- and long-term recall in relation to anxiety. The findings showed that both semantic and phonemic similarity have detrimental effect on short- as well as on long-term recall. Anxiety was found to have no effect on short- and long-term
recall when semantically similar material was used but had facilitative effect on short-term recall when material was phonemically similar. With phonemically similar material induced anxiety had no effect on long-term recall.