CHAPTER IV

METHOD AND PROCEDURE

The present research was undertaken to study the effect of stimulus similarity (i.e., phonemic and semantic similarity), anxiety (as measured by Sinha Anxiety Scale) and imagery type (i.e., individual differences in imagery) on short- and long-term memory. More specifically, the study was designed to answer the following questions:

(a) Does phonemic similarity affect short- and long-term memory differentially?

(b) Does semantic similarity affect short- and long-term memory differentially?

(c) Does anxiety affect short- and long-term memory differentially?

(d) Is there any interactional effect of anxiety and stimulus similarity on short- and long-term memory?

(e) Does imagery type affect short- and long-term memory differentially?
(f) Is there any interactional effect of imagery type and stimulus similarity on short- and long-term memory?

(g) Is there any interactional effect of imagery type and anxiety on short- and long-term memory?

(h) Is there any interactional effect of stimulus similarity, anxiety and imagery type on short- and long-term memory?

Experimental Design:

A factorial design of experiment was used in which four groups of subjects learned and recalled a mixed list consisting of paired-associates, having phonemically and semantically similar stimuli. The design of the experiment may be stated diagramatically as follows:

<table>
<thead>
<tr>
<th>I</th>
<th>High-anxious Visiles</th>
<th>Receive one trial on a mixed list consisting of 16 paired-associates.</th>
<th>Recall (STM) after 6 sec. interval filled with counting backward activity.</th>
<th>Receive 30 min. interval (LTM) filled with trials on the same read light material.</th>
<th>additional which unrelated material.</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>in the first half of the list, stimuli of the two successive pairs were phonemically similar and responses were unrelated adjectives, while in the other half of the list, stimuli of the two successive pairs were semantically similar with unrelated adjectives as response members.</td>
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<table>
<thead>
<tr>
<th>Group</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>II</strong>&lt;br&gt;High-anxious-audiles</td>
<td>Receive one trial on the same mixed list, used for group I.</td>
</tr>
<tr>
<td><strong>III</strong>&lt;br&gt;Low-anxious-visiles</td>
<td>Receive one trial on the same mixed list, used for groups I and II.</td>
</tr>
<tr>
<td><strong>Low-anxious-audiles</strong></td>
<td>Receive one trial on the same mixed list, used for groups I, II, and III.</td>
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</table>

In order to form four groups of subjects mentioned above, Sinha Anxiety Scale was administered on four hundred postgraduate students of Aligarh Muslim University randomly selected from the faculties of Arts, Social Sciences, Science and Commerce. On the basis of the scores obtained by them, two groups were formed, one having scores above 75 percent and another having below
25 percent. There were 80 subjects in the former group and 101 in the latter. An adapted form of Brewer's (1947) imagery test and Kraepelin's imagery test were given to both of these groups in order to measure individual differences in imagery, i.e., to select visiles and audiles. In the adapted form of Brewer's imagery test, subjects were presented a series of stimulus words relevant to two imagery modalities (i.e., visual: red rose, green loaf, yellow ribbon etc., and auditory: thundering of clouds, ringing of bell etc.). For each stimulus, subject rated his imagery experience on a 5-point scale ranging from "No imagery experience" to "very intense imagery experience". In the Kraepelin's imagery test, subjects were asked to write down within three minutes as many words as possible which are characterised by their colour. Subjects, then, were asked to write down within three minutes as many words as possible which are characterised by their sounds. The subjects who wrote relatively more words which may be characterised by their colour rather than by their sounds, were considered as visiles (or visualizers). Similarly, subjects who wrote relatively more words which may be characterised by their sounds rather than by their colour, were regarded as audiles (or verbalizers). On the basis of the scores obtained by them on the two tests, 15 visiles (or visualizers) and 15 audiles (or verbalizers) were selected from 80 high anxious subjects and 15 visiles
(or visualizers) and 15 audiles (or verbalizers) were selected from 101 low anxious subjects. In this way four groups of subjects — high anxious visiles, high anxious audiles, low anxious visiles and low anxious audiles — were formed.

The learning and test sequence for each group of subjects was as follows: First a ready signal was given to the subject, then, two paired-associates were projected on the screen successively, each for two seconds. As soon as the second paired-associate disappeared, the subject started counting backward from 629 to fill up a retention interval of 6 seconds. Immediately after the counting backward activity, the stimulus member of the first pair appeared alone on the screen for a period of two seconds, during which the subject was required to recall the response associated with it. In this way the whole list of eight blocks of sixteen pairs was projected on the screen. For immediate recall test, subject was 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. Subjects, then, received five more study trials in the same way except that counting backward activity was dropped. At the end of these five additional trials, a retention interval of 30 minutes was given to the subject during which the subject remained engaged in reading unrelated light material. Immediately after 30 minutes' retention interval, the stimulus
member of every first pair of the eight blocks of sixteen pairs was projected on the screen one by one except in the case of the 3rd and 7th blocks of the pairs where stimulus members of the second pairs were projected. Each stimulus member appeared for two seconds, during which subject was requested to recall the response associated with it. In this way the subject was tested for delayed recall (LTM). For half of the subjects of each group, the first four blocks of eight pairs were arranged in such a way that the stimulus member of the two successive pairs were semantically similar and remaining four blocks of eight pairs were arranged in such a way that the stimulus members of the two successive pairs were phonemically similar. For other half of the subjects, the arrangement of these eight blocks of sixteen pairs was in reversed order, i.e. the stimuli of two successive pairs of the first four blocks of eight pairs were phonemically similar and the stimuli of two successive pairs of the last four blocks of eight pairs were semantically similar. This was done to counterbalance the possible effect of practice and fatigue on learning and recall of either type of material.

In short, a 2 x 2 x 2 factorial design in which one task variable and two personality variable (i.e. anxiety and imagery type) each variable varying in two ways, was used in this experiment. The two values of task variable were (a) phonemic similarity and (b) semantic similarity. The two degrees of anxiety were (a) high and (b) low anxiety, and imagery was varied by selecting those having visile type of imagery and those having
audile type of imagery. Thus each of the four groups of subjects, namely, high-anxious visualizers, high-anxious verbalizers, low-anxious visualizer and low-anxious verbalizers, was presented with lists of material, half of which consisted of phonemically similar stimulus members of the paired-associates and the other half consisted of semantically similar stimulus members of the paired-associates, the types of items being counterbalanced. Thus, it yielded eight observations on four groups of subjects for each of the two measures of the dependent variable. In other words, the recall scores obtained for phonemically similar items and those for semantically similar items, though correlated observations, were treated as separate observations of the two sets of items presented in the mixed list to each of the four groups of subjects. The two measures of the dependent variable (i.e. retention) employed in the present experiment were short- and long-term recall.

**Stimulus material and apparatus:**

The stimulus material and the apparatus employed in the experiment were: (a) list of paired-associates, (b) Will-Wetzlar projector and (c) bell-metronome.

The list of paired-associates consisted of eight blocks of sixteen pairs. In the four blocks of eight pairs, the stimuli of the two successive pairs were semantically similar, paired with unrelated adjectives and in the other four blocks
of eight pairs, the stimulus members of the two successive pairs were phonemically similar and responses were unrelated adjectives. To prepare the first type of four blocks of eight pairs, a preliminary study was conducted. First 50 nouns were given to 50 undergraduate students with the following instructions:

"I will show you a list of stimulus words one by one. You are required to write down within one minute the synonym of each stimulus word presented to you. For example, if I pronounce the word 'HAPPY', then you may write 'GLAD', 'CHEERFUL' etc. as its synonyms".

In this way responses of 50 subjects to each of the 50 nouns were obtained and tabulated to determine the most suitable synonym for each stimulus word. Out of 50 stimulus words only four nouns and their four corresponding synonyms were selected on the following criteria: (a) that each stimulus word has more or less equal number of letters, (b) that the synonym of each stimulus word is the nearest possible one and (c) that neither stimulus word nor its synonym evokes any emotion, i.e., stimulus word and its synonym are neutral words. Each of the eight stimulus words (i.e. four nouns and their four corresponding synonyms) was paired with unrelated adjectives taken from Haagen's (1949) table. The pairs were arranged in such a way that the stimulus members of the two successive pairs were semantically similar. If, for example, the first pair of a
block of two pairs was 'WEATHER-VACANT', then the second pair of the block was 'CLIMATE-CUNNING'. In this way four blocks of eight pairs were arranged.

In order to prepare remaining four blocks of eight pairs another preliminary study was conducted. Another set of 50 nouns were given to a group of 50 undergraduate students with the following instructions:

"I will present to you some stimulus words one by one and you are required to write down within one minute the homonym of each stimulus word presented to you. For example, if I pronounce the stimulus word 'COUNCIL', then you may write 'COUNSEL' as its homonym, i.e. you may write all those words as a homonym whose sound is like the sound of the stimulus word presented to you".

The responses of 50 subjects to each of the 50 nouns were obtained and tabulated to determine the most suitable homonym of each stimulus word. Out of the 50 stimulus words, only four stimulus words and their four corresponding homonyms were selected on the criteria: (a) that each stimulus word has more or less equal number of letters, (b) that the homonym of each stimulus word is the nearest possible one and (c) that all four stimulus words and their four corresponding homonyms are neutral words. Each of the eight stimulus items (i.e., four stimulus words and
their four corresponding homonyms) was paired with the unrelated adjectives taken from Haagen's (1949) table. The eight pairs were arranged in such a way that the stimuli of the two successive pairs were phonemically similar. For example, if the first pair of a block of two pairs was 'WHOLE-DISTANT', then the second pair of the block was 'HOLE-HASTY'. In this way all the eight pairs were arranged in four blocks. Each block consisted of two pairs, with stimulus terms of two successive pairs being phonemically similar.

The two set of paired-associates so prepared were combined to obtain a mixed-list of eight blocks of sixteen pairs. As mentioned earlier, two orders of arrangement of these pairs were used. The mixed-list and its two orders of arrangement are given in the following Table I.

<table>
<thead>
<tr>
<th>One order of presentation</th>
<th>Second order of presentation</th>
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</thead>
<tbody>
<tr>
<td>WEATHER-VACANT</td>
<td>WHOLE-DISTANT</td>
</tr>
<tr>
<td>CLIMATE-CUNNING</td>
<td>HOLE-HASTY</td>
</tr>
<tr>
<td>BUNDLE-GENIAL</td>
<td>SEEN-SOLID</td>
</tr>
<tr>
<td>PACKET-MATURE</td>
<td>SCENE-HEAVY</td>
</tr>
<tr>
<td>BAGGAGE-AFRAID</td>
<td>REIGN-MIXED</td>
</tr>
<tr>
<td>LUGGAGE-UP-HILL</td>
<td>RAIN-RESTING</td>
</tr>
<tr>
<td>MARGIN-BARREN</td>
<td>CATTLE-PRESSING</td>
</tr>
</tbody>
</table>
The film-slides of these sixteen paired-associates and those of eight stimulus members (i.e. those stimulus members which were presented as cue for recall) were prepared. Thus in all 24-film slides were prepared.

The apparatus used in this experiment was a Will-Wetzlar Projector of 1:28/85 m.m. The projector consists of a slide-carrier in which film-slides of the stimulus material may be arranged in accordance with the specific order of presentation. By means of an operating switch, the film-slide may be projected on the screen one by one. The timing device was set by means of a bell-metronome which was so adjusted as to sound at a regular interval of 2 seconds. Thus each paired-associate or the stimulus member alone, as the case may be, was projected on the screen for 2 seconds at a regular interval of 2 seconds in between two projections.
Subjects and Procedure:

In all, sixty subjects were used in this experiment. There were four groups, each consisting of fifteen subjects selected according to the specific requirement of the experimental conditions mentioned under the heading 'Experimental Design'.

All the subjects were tested individually and all the four groups were run simultaneously i.e. first subject was tested from the first group, second subject was tested from group II, third was tested from group III, fourth subject was tested from group IV, fifth subject was tested from group I and so on.

As the subject entered the laboratory, he was seated on a chair facing the screen and the following instructions were given to him:

"I am going to project on the screen few film-slides of paired-associates by means of a projector. Firstly, I will project two paired-associates one by one for 2 seconds per pair and at a fixed regular interval of 2 seconds in between two projections. You are required to learn the response associated with the corresponding stimulus member of each pair. I will, then, project on the screen either of the two stimuli alone for 2 seconds, and during this period you have to recall response
associated with it. For example, if I project two paired-associates such as 'APPLE-SKILLFUL', 'MONEY-RIGID' successively, and then stimulus 'APPLE' alone is projected, your task will be to recall its appropriate response, i.e. 'SKILLFUL'. If stimulus 'MONEY' is shown to you, then you have to recall its response 'RIGID'. Have you followed? 

According to the instructions given above each subject was tested for short- as well as for long-term recall irrespective of his group assignment.

The data obtained were tabulated groupwise and statistically treated to draw necessary inferences as given in Chapter V.