Chapter – I

Introduction
INTRODUCTION

It is well known truth that one’s life is influenced greatly by past experiences. The term ‘memory’ refers to the processes that allow us to record experiences and information and to retrieve that information later. This information may be maintained for any length of time. It is memory that gives us the sense of continuity on which every notion of the self depends. While thinking of what it means to be humans, the centrality of memory must be acknowledged. It is this importance of memory, that has made the area so attractive to the psychologists.

For any learning to result in a changed behaviour the learning stimuli will have to be stored somewhere in the brain. The act of demonstrating memory is the retrieval of stored information, which is an important area of research even today.

Ebbinghaus (1885) assumed that learning leaves traces in the brain and these traces are known as neural traces. The trace is considered as the physical representation of learning. These neural traces, as per this viewpoint, may fade away with passage of time. The synaptic resistance approach assumes that due to repeated trials, synaptic resistance in the brain neuron is lowered and learning takes place (Ebbinghaus, 1885).
As it is proved that innate information can be stored chemically, many researchers postulated that learned material might also be stored in chemical composition of brain cells. Since brain cells contain various chemicals such as carbohydrates, lipids, DNA, proteins etc., attempts were made to deduce those molecules which are more likely candidates of memory. It was observed that RNA, proteins have high information content and therefore, later on researches concentrated more on these molecules. Substances like, epinephrine, vasopressin, acetylcholine, dopamine, serotonin, opioid substances like naloxane, endorphins and enkephalins and a variety of other chemical substances have been found to play an important role in memory, including acquisition/storage and retrieval (Hyden and Egyhazi, 1964; Latane and Schachter, 1962; McGaugh and Herz, 1972; Bohus, Van Wimersma and deWied, 1975; Gold and Van Buskirk, 1975; Iversen, 1979; Dunn, 1980; Bohus and deWied, 1981; Izquierdo and Dias, 1983; deWied, 1984; Batra and Muhar, 1987; Martinez, Jensen, Messing, Vasquez, Sournireh-Mouret, Geddes, Liang and McGaugh, 1980a; Batra and Muhar, 1991).

These substances and their derivatives when given exogenously, alter memory performances. One cannot deny that inspite of established biochemical processes in memory there are also a variety of
environmental, situational or internal biological and psychological factors that play a role in memory. For example motivation to learn, mental set, interest in the material, nature of material, personality etc. have been concentrated upon by many a researchers. But whenever we talk of effective learning, one important factor that still demands attention and should be considered is the learning style.

People react to situations in different ways and they learn from situations in different ways. People work and learn better when placed in an environment that matches their way of working and learning. This is true of numerous situations, such as working in teams, choosing a profession, informal learning situations and the formal classroom situations. When the environment is conducive a person's performance is improved whether it is about learning subject matter, about the job or about the team.

Learning Style

The learning styles play a crucial role in how effectively the information is stored. Each learners have different ways of learning that depend upon many personal factors and every one has a distinct, cognitive/learning style (Montgomery, 1996; Mumford and Honey, 1996)
Cognitive style is a hypothetical construct that has been developed to explain the process of mediation between stimuli and responses. The term cognitive style refers to characteristic ways in which individuals conceptually organize the environment. Harvey’s view that cognitive style refers to the way an individual filters and processes stimuli so that the environment takes on psychological meaning is representative of this use of the term (Harvey, 1963). As such cognitive representations modify the one-to-one relationship between stimulus and responses. If it were not for these cognitive representations, Harvey pointed out, stimuli would be irrelevant for the individual or the individual would respond to stimulation in a robot like fashion. Messick (1976) also defined cognitive style in terms of consistent patterns of “organizing and processing information”.

At the same time some psychologists feel that the terms learning and cognitive learning style are often used interchangeably and convey the same meaning. Learning style means the composite of characteristic cognitive, affective and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment (Keefe, 1979). The construct of learning style slightly varies from the term cognitive style and is slightly more specific.
It refers to stable individual preferences for perceptual organization and conceptual categorization of the external environment (Kagan, Moss and Siegel, 1963)

The term "leaning styles" has been used in the literature in two distinct ways.

1. It has been used to indicate a broad description of relatively consistent behavior related to ways of going about learning, it is treated as an individual difference of generality comparable to intelligence or personality, but describing consistency in the ways people tackle learning tasks.

2. The definition has been narrowed considerably to parallel the idea of cognitive style, with the use of bipolar traits, but described in relation to the learning tasks commonly found in educational contexts as opposed to scores on psychological tests.

Both uses of the term imply that learning style is related to both cognitive processes and to personality, but in broader definition the emphasis is more on cognition while the narrower definition is closer to personality. In both senses, the term has been used to cover a wide range of concepts which have emerged from attempts to describe various aspects of student learning.
Cognitive processes are basic cognitive activities taking place with in the memory, involving coding or thinking processes. When these processes are described in terms of the ability of individuals consistently to carry out certain types of task, such as certain psychological tests, they are referred to as "cognitive skills". In everyday life, skills are brought into play in order to solve particular problems or to deal effectively with certain situations. Here a decision is required to select particular skills, or to apply processes in succession, within some overall plan. This can be seen as adopting "tactics". And if an organized services of tactics is required perhaps depending also on a person’s attitudes and motives, than these may be called "strategies". Finally, if a person tends to adopt a similar set of strategies consistently across different tasks and settings this can be taken to indicate the existence of "learning style".

Learning Style Models

There are four major types of models of learning styles. The different learning style models are based on different psychological theories.

1. Extroverted-Introverted

Models that are based on personality include Witkin’s (1954) and Myers-Briggs Type Indicator (Myer, 1978). In these models, it is
assumed that basic personality influences the approach to acquiring and
integrating information that means the person is extroverted or
introverted. The extroverts are oriented primarily toward the outer world,
thus they tend to focus their perception and judgment on people and
objects. Introverts are oriented primarily toward the inner world, thus
they tend to focus their perception and judgment upon concepts and ideas.

2. **Thinking-Feeling**

A second type of model assumes that the method of information
processing decides the individual's preferred intellectual approach to
learning. It means a person may rely primarily on thinking to decide
impersonally on the basis of logical consequences, or a person may rely
primarily on feeling to decide primarily on the basis of personal or social
values.

3. **Judgment-Perception**

In the third type, the distinction is based on social interaction. It
describes the process a person uses primarily in dealing with the outer
world, that is, with the extraverted part of life. A person who prefers
judgment has reported a preference for using a judgment process (either
thinking or feeling) for dealing with the outer world. A person who
prefers perception has reported a preference for using a perceptive
process for dealing with the outer world. Reichmann and Grasha (1974) are examples of such models. Reichmann and Grasha (1974) developed a set of student learner types that indicate the likely attitudes, habits and strategies students will take toward their work. By becoming aware of these categories, Grasha has indicated ways in which teachers can adjust their teaching styles to create better connections with various types of students.

4. Information Processing

The fourth type considers multi-dimensional factors within a human information processing framework. Many times it is used in teams building, self-understanding and development, and organizational development as well as many other ways. Examples are Keefe (1989) and Dunn and Dunn (1978) models. Dunn's theory includes 18 different styles environmental (sound, light, temperature, design); emotional (motivational, persistence, responsibility, structure) sociological (peers, self, pair, team, adult, varied) and physical (perceptual, intake, time, mobility). The theory of Kolb and Dunn and Dunn have been primarily used in the educational world. All these models stress the importance of identifying and addressing individual differences in the learning process.
Besides this some other distinct learning styles have also been referred to in the related literature by the researchers.

**Hudson Learning Style**

In 1966 Hudson identified two different cognitive styles, based on an analysis of the approach which school boys took in their academic work. One of these styles was convergent thinking. Convergent thinkers tend to focus tightly on particular problems and look for the answers within well established frameworks. The other style was referred to by Hudson as divergent thinking. Divergent thinkers would range widely in their search for a solution to a problem, often moving far outside the usual accepted framework. Hudson believed that divergent thinking also had its spin offs in terms of personality: that divergent thinkers were more likely to be perceived as witty or unusual by their friends than were convergent thinkers.

One of the ways in which Hudson explored **convergent** and **divergent** thinking was to look at the kinds of original solutions which the school boys gave for problems. e.g. one of these tests asked them to state how many uses they could think of for a brick. **Convergent thinkers** would tend to give conventional solutions, such as building a wall or ‘holding’ something up they showed quite a high level of
functional fixedness. This also meant that they did not think of very many answers. Divergent thinkers, however would think of many more uses. Some of which would be quite unexpected. This was mainly because they would focus on the physical characteristics of the brick itself, and ignore its usual function. A divergent thinker might describe a brick as a possible tray for paper clips, because of the dip in the centre, or doorstop because of its weight and shape. Wallach and Kogan (1965) and Hudson (1966) drew attention to the existence of two distinct groups of children. Those with much higher score on intelligence than creativity were labeled “convergers”, while those with the reverse pattern of scores were called “divergers”. Hudson reported that these two groups showed markedly different patterns of thinking contrasting subjects choices in schools, and even varying personality configuration. The divergers were seen as being more impulsive, emotional, expressive, and humorous, while the convergers were more logical, rational, consistent, restrained, and conventional. Wallach and Kogan (1965) argued that the existing educational system appeared to favour the convergers and to penalize the divergers. Such arguments had a considerable impact on education at the time, encouraging the movement toward informal or open education, and also introduced researchers to the idea of individual differences in which
cognitive differences were paralleled with personality differences. This pattern became the hallmark of learning style.

Another prevalent classification of Learning style was given by Butler (1989). He gave three distinctions.

(1) **Psychological/affective styles**

Student’s inner strength, sense of individuality and personality traits (e.g. social and emotional traits) also influence how they learn. How the students feel about him/herself and how self esteem is developed are linked to learning.

(2) **Physiological styles**

There are consistent ways of facilitating learning through the use of the sense or environmental stimuli specializations (i.e. right or left brain) auditory, visual, kinesthetic olfactory preferences or preferences for environmental conditions e.g. light, noise are examples of physiological styles.

(3) **Cognitive styles**

There are consistent ways of responding and using stimuli in the environment, how things are perceived and make sense of the most comfortable expedient and pleasurable way to process information, for example, students may utilize field dependence, impulsive or reflective
cognitive style. The more students grow the more sophisticated they become, but each has preferred styles or ways that influence their achievement.

**Field Independence v/s Field Dependence**

As per the above concepts some students will follow field independence. Field independent learners perceive items as more or less separate from the surrounding field. They are interested in concepts for their own sakes. They have self-defined goals and function successfully in self structured situations and impersonal learning environments. Other students may be field dependent processors. Their mode of learning is strongly influenced by the prevailing context settings. They are more aware of their surroundings as they learn. These learners value practical information.

Pask (1967a) argues that the holist and serialist strategies are manifestations of important underlying differences in the way people think and tackle problems. He argues that some students are disposed to act 'like holists' whenever they are given that opportunity, whereas others behave "like serialists". The holist like style is called comprehension learning which involves building descriptions of what is known. The
serialist like style is called operational learning which is the ‘facet of the learning process concerned with mastering procedural details’.

Students who shows sufficient consistent bias in their learning strategies to be described as ‘comprehension learners’ or ‘operation learners’ are likely to show equally consistent pathologies of learning. But there are other students who are readily able to adapt their learning strategy to the requirements of the particular task, emphasizing either comprehension learning or operation learning as appropriate and using both in tandem wherever possible.

Another common way of distinguishing learning style could be on the basis of sense modality being used e.g. visual, auditory, kinesthetic.

**Visual learners**

Visual learners relate most effectively to written information, notes, diagram and pictures. Typically they will be unhappy with a presentation where they are unable to take detailed notes to the extent that information does not exist for a visual learner unless it has been seen written down. This is why some visual learner will take notes even when they have printed course notes on the desk in front of them. Visual learner will tend to be most effective in written communication symbol manipulation etc. To aid recall such people make use of ‘colour coding’
when studying new information in your textbook or notes. Using highlighter pens, highlight different kinds of information in contrasting colours.

**Auditory Learners**

Auditory Learners relate most effectively to the spoken word. They will tend to listen to a lecture and then take notes afterwards or rely on printed notes. Often information written down will have little meaning until it has been heard. It may help and learn to read written information out loud. Auditory learners may be sophisticated speakers and may specialize effectively in subjects like law or politics.

**Kinaesthetic Learners**

Kinaesthetic learners learn effectively through touch and movement and space and learn skill by imitation and practice. Predominately Kinaesthetic learners can appear slow in that information is normally not presented in a style that suits their learning methods. These learners learn best when physically engaged in a “hands on” activity.

**Honey and Mumford’s Four Learning Style Preferences**

Honey and Mumford (1982) created a learning style theory for organizational management. Instead of using learning style theory solely
Fig.1.1: Honey and Mumford Learning styles
for style identification, Honey and Mumford have strived to identify and modify style. The four learning styles identified by Honey and Mumford are the activist, theorist, reflector, and the pragmatist. These learning styles consist of two pairs of opposites (Fig. 1.1). The activist is defined as the counterpart of the theorist and the reflector is the inverse of the pragmatist. Unique strengths and weaknesses of each style have been highlighted. The final phase in the model involves recommendations to instill flexibility and awareness of other styles. Activists are geared toward self-development and are used primarily for managers and advisors. This model is actually based on Kolb’s (1984) model which is the most popular one and is described below.

Kolb’s Learning Style Model

Kolb is known for his influence on learning style theory and organizational psychology through the use of his model formulation (McCarthy, 1987). The cornerstone of Kolb’s model relied on experience-based learning. Kolb reviewed the work of John Dewey, and Jean Piaget to create his theory of experiential learning. Although Kolb noted differences in their theories, he felt the similarities were too strong to be ignored. All three models involved a circular approach to learning and started with the experience of the learner (Kolb, 1984). Kolb’s
Fig. 1.2: A depiction of Kolb’s Model
research demonstrates a clear link between learning style research and the underlying theories of learning and instruction.

Kolb defined experiential learning as "the process whereby knowledge is created through the transformation of experience". He used this working definition to create his model of the experiential learning process.

Kolb believed that humans "grasp experience" immediately in a concrete manner or abstractly in an indirect manner. Once an individual understands an experience, it can be added to other experience through reflective observation or active experimentation. The two methods used to grasp experience and the two ways this experience is transformed create four unique types of knowledge (Fig. 1.2). Kolb (1984) also used the term convergers and divergers but with a rather different meaning. The convergers prefer abstract material and process it actively, while the divergers look for concrete information and process it reflectively. Kolb depicts the individual learning styles two dimensionally to illustrate the opposite nature of these learning abilities. Concrete experience (CE)/abstract conceptualization (AC) and active experimentation (AE)/reflective observation (RO) define the two dimensional plane CE, AC,
AE, & RO have been considered to be four important stages involved in experiential learning.

**Concrete Experience (CE)**

This is a slow process, emphasizing accuracy. Any subject using this ability needs time to digest information and also tangible “hand on” approaches. Such subject should do a lot of reading to build the background knowledge that can facilitate understanding. These learners generally find theoretical approaches to be unhelpful and prefer to treat each situations as a unique case. They learn best from specific examples in which they can be involved. These learners tend to relate to peers, not authority (they are people oriented persons – they want to get along with others, not be bossed around). Theoretical meanings are not always helpful while group work and peer feedback often leads to success. Planned activities should apply learned skills.

**Abstract Conceptualization (AC)**

The subjects with this ability collect a lot of related information that’s already learnt. Now they link the present new knowledge with previous knowledge experience. They do not look at any items as an individual item but in the background of a big picture, having a related information. Therefore, they may have difficulty with organizing
information and finding focus or attending to details. These Ss may sometime lose the track and are over the place, missing the minute details.

**Reflective Observation (RO)**

The Ss using this ability try to link every pinch of information personally with themselves. They usually need to know on how to understand material without feeling compelled to agree with it. These are similar to feeling type of learners.

**Active Experimentation (AE)**

The subjects having this capability are compelled by a need for immediate feedback. They may face anxiety. They learn best by asking questions. Jump ahead of anyone they are talking or discussing with, thus interrupting very often by asking questions. They are also often academic rebels and like to “buck the system” or look for exceptions to the rules. However, they work well with group study.

On the basis of the score obtained by an individual in these dimensions he/she can be placed in either of the following four categories.
The Divergers/Imaginative are those who are concrete experimenters and reflective observers. Their strength lies in imaginative ability and the awareness of meaning and values. They perform well in situations that call for the generation of alternative ideas and implications. They tend to have broad cultural interests, are interested in people, and are feeling-oriented.

The Accommodators/Dynamic score high on concrete experience and abstract conceptualisation. Their strength lies in carrying out plans and tasks and getting involved in new experience. They tend to be adaptive and risk-taking. They are at ease with people, but sometimes impatient.

The Convergers/Precision are active experimenters and abstract conceptualisers. Their strength lies in problem solving, decision making and the practical application of ideas. Their expression of emotion is controlled, and they prefer dealing with technical tasks and problems rather than social and interpersonal issues.

The Assimilators/Analytical are reflective observers and abstract conceptualizers. Their strength lies in inductive reasoning and the ability to create theoretical knowledge. They tend to be less interested in people
and practical applications and more concerned with ideas and abstract concepts.

Kolb’s two methods of grasping information, two methods for transforming information and four types of knowledge helped him create an instrument that could be used to identify learning style preferences. Educators and organizational managers use the Learning Style Inventory to assess individual learning style. Kolb’s depth of research, use of models and creation of the Learning Style Inventory make him one of the pioneers in learning style research.

Kolb’s model is based on Piaget’s and Jung’s model. Piaget discovered that children think and reason differently at different periods in their lives. Every normal child passes four stages – sensorimotor - birth to 2 years; preoperational- 2 years to 7 years; concrete operational- 7 years to 11 years; and formal operational (abstract thinking) – 11 years and up. Each stage has major cognitive tasks which must be accomplished. In the sensorimotor stage, the mental structures are mainly concerned with the mastery of concrete objects. The mastery of symbols takes place in the preoperational stage. In the concrete stage, children learn mastery of classes, relations, and numbers and how to reason. The last stage deals with the mastery of thought (Evans, 1973).
The ability to learn any cognitive content is always related to their stage of intellectual development. Intellectual growth involves three fundamental processes: assimilation, accommodation, and equilibration. Assimilation involves the incorporation of new events into preexisting cognitive structures. Accommodation means existing structures change to accommodate to the new information. This dual process, assimilation-accommodation, enables the child to form schema. Equilibration involves the person striking a balance between himself and the environment, between assimilation and accommodation. When a child experiences a new event, disequilibrium sets in until he is able to assimilate and accommodate the new information and thus attain equilibrium. There are many types of equilibrium between assimilation and accommodation that vary with the levels of development and the problems to be solved. For Piaget, equilibration is the major factor in explaining why some children advance more quickly in the development of logical intelligence than do others (Lavatelli, 1973). Actually, the final learning style adopted by any individual depends upon the learning of the various cognitive tasks and experiences at various stages.

Dangwal and Mitra (2000) have compared the models of Kolb with Piaget’s theory of learning and cognitive development.
Piaget's Model on learning and Cognitive Development

<table>
<thead>
<tr>
<th>Piaget's Model</th>
<th>Kolb’ Model</th>
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<tbody>
<tr>
<td><strong>Concrete Phenomenalism</strong>: The child is predominantly concrete and active in his learning style. Learning is actively enactive through feeling, touch and handling. Representation is based on action- for example ‘dig a hole’</td>
<td><strong>Concrete Experience</strong>: Learners are able to involve themselves fully, openly, and without bias in new experiences</td>
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<tr>
<td><strong>Internalized Reflection</strong>: The child begins to internalize action, converting them to images. He is captivated with his ability to collect images and to view the world from different perspectives.</td>
<td><strong>Reflective Observation</strong>: Learners are able to reflect on and observe their experiences from many perspectives.</td>
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<tr>
<td><strong>Abstract Constructionism</strong>: Learning in this stage is governed by the logic of class and relations. He relies on concepts and theories to select and give shape to his experiences.</td>
<td><strong>Abstract Conceptualization</strong>: Learners are able to create concepts that integrate their observations into logically sound theories.</td>
</tr>
<tr>
<td><strong>Active Egocentricism</strong>: The child focuses on the symbolic processes of representational logic.</td>
<td><strong>Active Experimentation</strong>: Learners are able to use these theories to make decision and solve problems.</td>
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Source: Adapted from Dangwal and Mitra, 2000
Sensing

Thinking ← ← Feeling

Intuition

Fig.1.3: Jung’s Dimensions of Perception (Vertical and Judgement (Horizontal))
The model by Kolb also borrows something from Jung, being quite similar to Jung’s theory of psychological types.

**Jung’s Psychological Types**

In 1921, Jung developed a theory called Psychological type which stated that there are three dimensions of personality structure. The first dimension involves the mental process of perception and is categorized as either sensing or intuiting (Fig. 1.3). Jung believed that generally one method of perception was preferred or favored over the other by every individual. Yet he also firmly believed that everyone used both mental processes to some degree (Jung, 1971).

The second dimension of personality deals with how people judge information once it is in consciousness. Judgment was also sub-divided into two categories by Jung i.e. thinking and feeling (Fig. 1.3). Both of these are used to differing degrees. As already described thinking is used to define a logical decision-making process or reasoning. Feeling, on the other hand is a term for making judgments on a personal and may be at emotional level. Jung classified the mental processes of the perception dimension, sensing and intuition, as polar opposites and mental processes of the judgment dimension, thinking and feeling, as polar opposites. Jung stated that the four functions are somewhat like the four points on a
compass: they are just as arbitrary and just as indispensable” (Jung, 1971).

Introversion-Extroversion is the third dimension in Jung’s model. These have been defined as subjective preferences. Lawrence (1982) credited Jung for inventing these terms, which relate to how we act in the world and how we reflect. According to Lawrence, “extraverts often say ‘when in doubt, act’ Introverts are more likely to say ‘when in doubt, reflect on the matter more deeply.” Jung felt that these two “general attitudes” were manifested through dominance of one of the four basic functions. Jung developed eight distinguishable” types” based on his two preferences and four basic functions. Based on his own reflections, however, Jung admitted that there were possibly more combinations of psychological types (Jung, 1971).

There is substantial evidence that people do show strong and relatively consistent preferences for tackling learning tasks in distinctive ways. Cognitive learning theorist focuses on the human minds’ active attempts to make sense of the world. The way we think about situations along with our beliefs, expectations and feelings- influence what and how we learn. Cognitivists view knowledge as the outcome of learning and the power of knowledge as the driving element in learning. Knowledge can
be general or domain specific and can be classified as declarative, procedural and conditional. Different kinds of knowledge require different learning approaches.

One widely used cognitive model of the structure and processes of learning is the established, and well-known model i.e., the information processing model. This model is based on the analogy between the mind and the computer. Information processing involves encoding, retention, retrieval and other processes. This model also includes storage systems such as the sensory register, short-term memory and the long-term memory.

Encoding is the process by which an external stimulus is eventually a neural representation or code within the brain; storage refers to the maintenance of these codes in long-term memory and retrieval refers to recall of these memories. For the present study, one variable taken up is retrieval facilitation. Therefore, the following section deals with retrieval and its facilitation.

Retrieval

One key factor is how well we organize material while we are learning it. If books are properly catalogued as they arrive at a warehouse, it will be much easier to find them later. Similarly, we are more likely to
remember experiences if we think about them and try to relate them to material already in memory.

In summary, retrieval is seen as a process in which the encoded trace is matched with the presently active encoding. The present encoding in turn, is partly driven by the stimulus and partially reflects the results of more elaborate reconstructive operations. Thus retrieval operations vary in their extensiveness; habitual encodings are evoked spontaneously and automatically by the stimulus whereas further elaborate processing is evoked if directed by task demands or by feelings of partial recognition. It is assumed that retrieval processes mirror initial encoding processes and may thus also be described as varying in depth elaboration, and distinctiveness. This point of view suggests studies of incidental retrieval in which retrieval processes are controlled by orienting tasks in the same way that encoding processes have been controlled in many recent studies. Also, for the distinctiveness of an encoded trace to be effectively utilized at retrieval, it is considered necessary to reinstate the original encoding dimensions.

A stimulus may be recognized on the basis of its general familiarity; in this case, recognition is ‘context free’. If a more specific retrieval question is asked, however, retrieval operations must be
expanded by more active reconstructive activities in an attempt to reconstruction the original episodic context, in this case, recognition is the original episodic context, in this case, recognition is ‘context dependent’. The past experiences may interact with present processing in two major ways. In the first attention is focused on the current pattern of stimulation and past learning serves as a context for interpretation of presented stimuli (that is past learning and present comprehension). In the second case, attention is focused on specific episodic details of the past experience, and the present stimulus is used to specify the type of information required (that is present stimuli act as cues to evoke memories of past events). Whether the interaction between the past learning and present stimulation results in ‘comprehension’ or remembering will depend in turn on the Ss set, goals and motives.

Bransford (1977) has stressed the ‘stage setting’ role of past learning in allowing degree of differentiation of present stimuli; this role corresponds to the ‘comprehension’ mode described above. This is one way in which the system can also operate in the more traditionally accepted manner of the stimulus functioning as a retrieval to evoke contextual details of an event’s past occurrences.
Tulving (1967) has distinguished between failures to remember which are due to the absence of the required information in memory, and those which occur because information which is present in memory storage cannot be retrieved. In Tulving's terms it is necessary to distinguish between the availability of information in memory and its accessibility. The basis of Tulving's distinction is a body of research which demonstrates that items which can't be recalled at one time may be recalled at a later time either unaided or with the help of cues, even though no new opportunity for learning has occurred.

The unaided recovery of previously unrecallable items was demonstrated by Tulving (1967) in an experiment in which he gave Ss a single presentation of a word list and required three successive recall attempts. Although about half of the list words were recalled on each trial they were not all the same words. Thus some words which were not recalled on one trial were recalled later, while others recalled on an early trial were not recalled in a subsequent one. The earlier failure to recall items which were later recalled cannot of course be attributed to storage loss because it would not then be possible to recover them at all. These items therefore, must have been available in memory but not accessible. An important aspect of Tulving's results is that although the actual words
changed the number of words recalled on each trial was rarely constant. This implies that in some circumstances at least, there is a limit on the capacity of the retrieval process, i.e. only a certain number of items can be accessed on a particular trial.

Tulving and Osler (1968) took up the study of retrieval cueing from where Tulving and Pearlson (1966) left off by investigating some of the circumstances in which cues are or are not effective. In the conditions which form the core of their experiment they presented 24 to be remembered words, either alone (e.g. MUTTON) or paired with a weak associate (e.g. fat, MUTTON), telling the Ss that the accompanying words might be helpful in remembering the TBR words. The results showed that recall was relatively good, when the same cues or no cues, was present both during encoding and at the retrieval, but performance was poor in those conditions where the encoding and test situations differed with effectiveness of a cue. These results show that the effectiveness of a cue supplied at retrieval depends critically on the circumstances of encoding. Tulving and Osler concluded that specific retrieval cues facilitate recall if and only if the information about them and about their relation to the to be remembered word is stirred at the
same time as the information about the membership of the to be remembered word in a given list (Tulving and Osler, 1968).

In addition to organizing material during original learning two other factors seem to be particularly important in determining later retrieval; retrieval cues and cue overload.

**Retrieval cues**

One determinant of retrieval is the similarity of the contextual cues present during retrieval and coding. In order to establish permanent memories, associations are formed between the word to be remembered and contextual cues present at the time. If one of these cues is again present during retrieval, activation will spread from its node to all the others linked to it (Collins & Loftus, 1975). The more such cues are present that is the greater the similarly of training and test conditions the more excitation will spread to the target node from the contextual node, and the greater the likelihood of the words being recalled.

Some of the contextual cues that form part of the coding of experience are surprisingly subtle. In a study by Smith (1979) for e.g. Ss memorized a word list and were then asked to recall it 20 minute later. Ss tested in the room where they had originally studied the list recalled 33% more words than did Ss tested in a different room. Other seemingly
unimportant cues. Such as your mood and physical condition can also form part of the stored memory traces, and the presence of these irrelevant cues at recall can substantially improve memory.

**Cue overload**

A second factor that influences retrieval is the number of different memories associated with a retrieval cue. When a node is activated, activation spreads to all the other nodes connected to it. The greater the number of these connections, however the less excitation will flow to any one of them and thus the less likely it will be that a particular memory will be retrieved. If someone has eaten in a restaurant only once, for example, returning to it may evoke vivid memories of one's earlier meal there. But the more often one eats there the more memories will become associated with the contextual cues of the restaurant and the more difficult it will be for the individual to remember any particular meal; they all blur together. This phenomenon has been termed cue overload and seems to cause proactive and retroactive interference (Watkins & Watkins, 1976; Anderson, 1975). Retrieval is greatly facilitated if contextual cues associated with the word during encoding are again present. The more of these cues that are present, the more activation will spread from their nodes of the target node, and the greater the likelihood of its reactivation.
The effectiveness of a retrieval cue is diminished, however if it is also associated with other memories. The more connections radiating out form a node, the less activation seems to flow through any one of them.

Adults have at their disposal a number of abilities that allow rapid and efficient processing of information. One of these skills involves the use of prior information to facilitate the processing of subsequent information. For example, many studies have shown that the item necessary to recognize a word decreases if the word is presented in a context with which it is consistent. (Meyer and Schvaneveldt, 1971; Stanovich and West, 1979). Children appear to benefit from presentation of a stimulus in context at least as such as adults do. Mccaulley, Weil and Sperber (1976) showed that children would identify a picture more rapidly when it was preceded by an associated picture than when it followed a picture of an unrelated object. Schvaneveldt, Ackerman and Semlear (1977) found similarly that second and fourth graders were well able to identify a visually presented letter string as a word faster when it followed a word which it was related than when it followed an unrelated word. (Posner and Snyder, 1975b) have described two processes by which one stimulus may facilitate the processing of another. The first process involves the automatic activation of psychological pathways or
representation in memory. This activation may spread to the representation of related stimuli (Collins and Loftus, 1975), partially activating them and reducing the amount of additional information (and time) needed for their recognition. The automatic process is believed to operate very rapidly and not to consume attention. Therefore, the activation of one pathways memory location does not interfere with the activation of others. The second process is based on the conscious allocation of limited capacity attention. Attention may be focused on one of the automatically activated pathways, maintaining the increased recognizability of the information that represents.

Recent research concerning the process underlying the pictorial elaboration effect indicates that the facilitation occurs in the associative phase of paired associated learning as opposed to the response learning phase (Kee and Rohwar, 1974) and availability of the to be remembered pairs is enhanced as opposed to the accessibility (Kee, 1976).

Brown (1981) speculated that an initial access to a category activates the members of that concept and that the resultant retrieval facilitation dissipates rapidly with time. The conception of retrieval blockage generated by prior retrievals from the same conceptual category is similar to cue, dependent inhibition effects and output interference. The
existence of both inhibition and facilitation of target retrieval following semantically related primes has been found using a number of different semantic and episodic memory task (Roediger and Neely, 1982). Neely Schmidt and Roediger (1983) stated that the task for researchers in this area is to help specify the manner in which these two forces combine with each other in routine retrieval operations.

The hard work of various earlier such researches have helped and provided the researchers with already identified tasks graded with different degrees of retrieval facilitation. For example recognition is a task easy to retrieve with the visual cues than recall. These different tasks have been discussed in chapter IV. It is expected that whatever be the learning style, the degree of retention could depend upon the degree of inbuilt retrieval facilitation in the task.

With this background now we may pass on to the second chapter elaborating the related past researches.