Chapter I

Introduction

In recent years a vast body of experimental data has been accumulated on verbal learning and conditioning, but two important parameters of verbal conditioning, namely, verbal generalization and discrimination, have relatively been neglected as fields of promising research. It is true that verbal generalization and discrimination are frequently encountered in discussions of verbal conditioning and theories of verbal learning, yet limited experimental work is available to answer many issues arising out of these two important parameters of verbal conditioning. There is little doubt that verbal generalization is an extremely important and useful phenomenon connected with verbal conditioning, but its utility is in striking contrast to the lack of information which exists regarding the conditions which affect the phenomenon. It is with this realization in mind that an attempt has been made in the present investigation to study generalization in verbal learning in relation to variations in stimulus characteristics, i.e., variations in different types of verbal material, namely, phonemically-similar, semantically-similar, synonymous, antonymous, conceptual and syntactical.

The area of research designated as verbal learning, though its origin may be traced back to the publication of
Herman Ebbinghaus' treatise *Uder das Gedächtnis* (Concerning Memory) in 1885, has developed both extensively and intensively only in the last two decades. It was in 1957 that it acquired the status of an independent area of research in psychology. In that year five psychologists who had developed a special interest in problems of verbal learning and behaviour formed an informal group which subsequently came to be known as 'the Group for the Study of Verbal Behaviour'. The formation of this group thus served as a landmark in the history of verbal learning. The years from 1957 onwards have witnessed an upsurge in research and theory in this newly developing area of psychology with original and significant contributions of the pioneering investigators like Mcgeoch, Underwood, Postman and their associates and students.

The study of verbal learning has come into prominence in recent years due largely to its widely recognized importance for any account of human learning. It requires hardly any documentation or argument to hold that of all the various problems in the study of human learning, none is more important than verbal learning. This is so because there is nothing either more characteristically human or psychologically significant than the use of language. It is not surprising, therefore, to find that the study of verbal learning has become so vitally important for the
understanding of human behaviour.

The study of verbal learning is a study of the kind of behaviour which most clearly differentiates human beings from all other animals. It is not for nothing that the Persians call man haiwan-e-natique, i.e., the animal that speaks. The creature called homo sapiens stands at the highest level of development, characterized especially by a highly developed brain which expresses itself through the medium of speech, homo sapien's speech being the only vehicle of thought, reflection, and meditation. The power of speech lies behind all man's potentialities, for it is the most outstanding characteristic which distinguishes him from all other subhuman species. The behaviour we study under verbal-response system is the kind of behaviour which pervades all human activities, and through which we can delve deepest into these activities. In this sense, then, according to Wickens, "verbal learning stands as the favoured candidate for centrality in human learning." (p.83)

Verbal learning takes us to a field of inquiry dealing with the phenomena and processes which enable the individual to link, through practice, two verbal items together, to learn the sequences in which verbal items occur, to see similarities and differences between verbal items, and to recall a set of such items. Thus, verbal learning deals with the association, acquisition, generalization, discrim-
mination and retention of verbal units, and in verbal learning an association is formed between a verbal stimulus and a response which may either be verbal or nonverbal. When an association is formed between two verbal units, one acts as the stimulus component and the other as the response component. The study of S-R associations has dominated the field of verbal learning to such an extent that verbal learning psychologists have heavily drawn on the principles of conditioning to explain the phenomenon of verbal learning, particularly the verbal learning that involves the procedure of paired-associates. Paired-associate learning represents a straightforward extension of simple conditioning principles, because paired-associate learning appears to fit the stimulus-response paradigm of behaviour almost exactly. This has been clearly borne out by the observations made by Goss, Morgan, and Golin (1959) to the effect that the stimulus component of a single pair in paired-associate learning corresponds to the conditioned stimulus, the presence of the response component (i.e., its physical presentation, visual or aural, to the subject) corresponds to the unconditioned stimulus and the subject's pronunciation (such as overt or covert pronunciation of the response term) corresponds to the unconditioned response, and the pronunciation of the response term as elicited by the stimulus component corresponds to the conditioned response.
This may be diagrammatically presented as follows, employing a pair of stimulus and response words to be learnt by the paired-associate method of learning.

![Diagram showing paired association process](image)

Here SOJ is the stimulus word which is paired with the number 29, so that when SOJ is visually or aurally presented, the subject has to anticipate the number 29. Here visual presentation of the number 29 is the unconditioned stimulus (UCS) and the pronouncement of the same, the unconditioned response (UCR), the UCS-UCR sequence constituting UCRX, while the visual presentation of SOJ is the conditioned stimulus (CS) and the pronouncement of SOJ which the subject is not required to make is like the orienting response the animal used to make at the appearance of the conditioned stimulus for the first time in the experimental setup of Pavlov's classical conditioning. When a new association is formed (CS-CR' Sequence) between the pronouncement of the number 29 (UCR'), on the one hand - the pronunciation being made not in response to the visual presentation of the number 29 (UCS) but in response to the visual presentation of the nonsense syllable SOJ (CS) - and the visual or aural
presentation of the conditioned stimulus (CS), on the other, the pronunciation of the number 29, which was originally the unconditioned response (UCR) immediately takes the form of conditioned response (CR).

In paired-associate learning what actually happens is that the learner learns a list of arbitrary pairs of verbal items, the first or the left-hand member of which is the stimulus term, and the second or the right-hand member is the response term which is to be anticipated when the stimulus term is presented. The stimulus and response terms may be any type of material - words, digits, syllables, pictures, sounds - and they are typically paired together arbitrarily, and the subject learns a list of, say, 10 to 20 of such pairs.

As in conditioning situations, the essential elements of the paired-associate learning may be described in terms of stimuli and responses, with the associations or connections of the stimuli with their paired responses being what is learnt in the paired-associate learning situation, so that the presentation of any stimulus leads to the occurrence of its paired response. The apparent correspondence to conditioning situations is extended further by designating as 'reinforcement' the presentation of the correct stimulus-response pair that characteristically follows the subject's attempted anticipation of the response under the typical
paired-associate anticipation procedure, indicating thereby whether or not the response of the subject was correct. The theoretical interpretations of paired-associate learning have relied heavily upon the strengthening of correct S-R associations resulting from the reinforcement of these correct associations, combined with the non-reinforcement of all incorrect associations, thereby opening the door also to a host of other S-R concepts, such as generalization, discrimination, extinction, spontaneous recovery, and the like.

It was Gibson (1940) who first studied generalization-discrimination in verbal learning by employing the paired-associate method. She used geometric forms as stimuli and nonsense syllables as responses. The stimulus material used by Gibson has been severely criticized by Underwood as not being completely of a verbal nature. The implication of this criticism is that when an association is formed between two items, one of which can be verbalized while the other cannot, as it was in the case of Gibson's study, the learning cannot strictly be regarded as verbal. However, when an association is formed between two such items, one of which is capable of being verbalized, while the other is not, the outcome squarely belongs to verbal learning. A response once conditioned to a verbal stimulus, regardless of whether it is a verbal or nonverbal, voluntary (i.e., psychomotor) or
nonvoluntary (i.e., physiological) response, it can very well serve as an index of generalization or discrimination for the subsequent verbal stimuli being similar to, or different from the conditioned stimulus, respectively.

Stimulus generalization is an empirical phenomenon which has been widely used as an explanatory construct in a multiplicity of situations involving the after-effects of previous learning. It has been used in theoretical interpretation of the experimental findings in verbal learning and conditioning as well. Verbal learning, as we have already seen, can very well be regarded as a more complex variant of primary conditioning, particularly as it has been exemplified by the acquisition of associations between verbal items by the method of paired-associate learning.

It is possible to see a continuity between Pavlov's sensory conditioning experiments and the type of verbal conditioning experiments that have been carried out during the last three decades. For Pavlov, the adaptation of man to his environment rests on three mechanisms. The first and the foremost mechanism of adaptation is provided by unconditioned responses. The second and more broadly adaptive mechanism is provided by conditioned responses, because these conditioned responses are elicited by sensory stimuli signalling the occurrence of biologically significant events. Pavlov regarded classical conditioning as involving the first
signalling system. Recognizing the significant role played by speech, Pavlov proposed an additional adaptive mechanism, the third one, namely, speech. According to him it provides a signalling system, in which words are assumed to bear the same relationship to sensory conditioned stimuli, as do sensory conditioned stimuli to unconditioned stimuli. It is important to note here that although Pavlov used the term higher-order conditioning to explain more complex forms of conditioning, including the establishment of the second signalling system, he regarded the latter not as a simple higher-order conditioning, but rather as the basis of abstraction. Pavlov, however, saw a direct relationship between the first and the second mechanism of adaptation, and also between the second and the third adaptive mechanism. Consequently, the disciples of Pavlov devoted themselves to developmental studies in children of the transfer of the CR from sensory stimuli to their verbal symbols, i.e., object-word transfer. Subsequently, they extended their efforts to include the word-object transfer. However, the study of word-word CR transfer and of transfer of CR between larger verbal units originated with the studies of Razran, who, for the first time, introduced the term semantic conditioning to refer to conditioning studies in which verbal stimuli are employed as conditioned stimuli.

What is to be emphasized here is that Pavlov was the first investigator to interpret verbal behaviour within the
framework of the principles of conditioning. His brilliant formulation regarding the second signalling system filled the gap of understanding between perceptual and symbolic stimuli.

The phenomenon of generalization or, in the words of Pavlov, 'irradiation of conditioned response' refers to the empirically determined fact that if a conditioned response is established to a given stimulus ($S_1$), other stimuli ($S_2$,...,$S_n$) of the same dimension will also elicit the response without reinforcement, the magnitude of the generalized response varying inversely with the distance of $S_2$,...,$S_n$ from $S_1$ along that dimension. Such stimulus equivalence has been experimentally demonstrated in the case of various stimulus dimensions such as pitch, tone etc., and can also be demonstrated in the case of verbal material, this being precisely one of the objectives of the present investigation.

That nonsense syllables and words can function as conditioned stimuli is an experimentally well established fact. Pavlov could just as well have used a nonsense syllable, or a word as a bell when he conditioned the salivary response of a dog. Nonsense syllables and words like physical stimuli generalize. The term verbal generalization is used when any response physiological, motor, or verbal conditioned to a given verbal item, or a combination of such items, is elicited by some other verbal items bearing some
relationship with the original item or a combination of items, although the other verbal item or combination of items have not been used, or have been used as a part of a larger whole in training.

A comparison between sensory generalization of animals and verbal generalization of human beings would indicate that in the case of the former similar stimuli of a visual nature tend to generalize to each other, mainly because of their being alike in some respect representationally, whereas in the case of words, and also sentences, which are perceptually different but have some meaningful relationships, the phenomenon of verbal generalization cannot be explained in the same way in which sensory generalization is explained. The generalization of a response from one word to another, or from a sentence to one of its components, calls for a different principle according to which it can be explained. And the principle, as Osgood and others have experimentally demonstrated, is the meaningful relationship between the word or the sentence to which the response was originally conditioned and the word or the component of the sentence to which it has now been generalized. In an attempt to explain this kind of generalization, which is technically termed as semantic generalization, it has been hypothesized that meaning is actually an implicit or mediated response which serves, in turn, as a cue. The GSR is, for example, first conditioned to the written word *won*. The subject is then exposed to the word
beat which already has the tendency to evoke the response won because of previous learning, which established them as synonyms. The response won then serves as a stimulus cue to evoke the GSR. To put it differently, beat is not directly linked to GSR; rather, its capacity to evoke such a response is mediated by its capacity to elicit won. This example of semantic or mediated generalization may be represented in the form of the following diagram:

\[
\begin{array}{ccc}
S & r & s \\
\text{BEAT} & \text{won} & \text{won} \\
& & GSR
\end{array}
\]

The response won and its resultant cue are represented by small letters to indicate that they are implicit, i.e., the relationship of the response won to beat, and the relationship of the stimulus won to GSR are determined by the previously established association between beat and won. The relationship of won to beat, as a response, and its relationship to GSR, as a stimulus, are not observable by the experimenter but can only be inferred as a mediating mechanism.

To put the whole thing in simpler words, sensory generalization is based on physical, perceptual or representational similarity of the stimuli, which tend to get generalized to each other, but semantic generalization, viz., the generalization which occurs in the case of words having different appearance but having some meaningful relationships is determined by implicit relationship of meaning among these words, or between a sentence and one of its components, which has
been acquired as a result of previous learning.

Behaviouristically-oriented psychologists regard meaning as an implicit mediating response, so that when both stimuli and responses are verbal in nature, as they are in human communication, the nature of a verbal response to a verbal stimulus will understandably depend upon the relationship between the two as defined in terms of the mediating mechanism of past association. It is evident, therefore, that in verbal conditioning and generalization meaning plays a vital role by providing a mediating link for stimulus-stimulus, response-response, and stimulus-response relationships.

Awareness, whether it is defined in terms of methodological behaviourism as an intervening construct with its antecedent conditions lying in certain stimulus contingencies and its consequent conditions taking the form of certain verbal report, or, according to cognitive psychologists, who believe that it means something more than its defined usage, it is defined as a characteristic of phenomenological experience, it seems to be inextricably bound up with what we mean by 'meaning' or the implicit mediating response, and hence the significant role that it plays in verbal learning and generalization, which are also designated as mediated conditioning and generalization, is beyond any doubt. There is a substantial body of experimental evidence consistent with
the above observation, which shows that verbal conditioning and generalization with awareness is decidedly more effective than without awareness.

One possibility of studying the effect of awareness on verbal generalization is to conduct the experiments under intentional and incidental learning conditions, on the assumption that awareness is predominantly a characteristic of the former, but not of the latter. The second objective of the present investigation will, therefore, be to study the differential effect on verbal generalization of intentional and incidental learning conditions.

The basis of verbal learning and behaviour lies in the syllables and words, which ultimately combine into sentences, and which, in turn, serve as a medium of communication among the individuals. Taking into consideration the importance of the various types of verbal stimuli that are employed in verbal communication, it is proposed to study generalization with different types of verbal material, ranging from simple to complex type, namely, material involving three-letter nonsense syllables (phonemically-similar material), meaningful words (semantically-similar material), synonyms and antonyms (synonymous and antonymous material), concrete and abstract concepts (conceptual material), and the five forms of sentence construction (syntactical material) with a view to verifying different hypotheses pertain-
ing to different types of verbal material. And this will be the third and the main objective of the present study.

Keeping the main objectives of the proposed study in view, the experiments may be designed to demonstrate (i) the phenomenon of generalization, (ii) the differential effect of intentional and incidental learning conditions on the phenomenon of generalization, and (iii) the fact that different principles apply to the phenomenon of generalization in different types of verbal material.

In view of the above-stated objectives, the present study is planned to verify two general and six specific hypotheses. These hypotheses are stated below:

a. General Hypotheses

Hypothesis I: Generalization decreases with a decrease in similarity between the test items and the original learning items in different types of verbal material, except for syntactical material to which this hypothesis does not apply, because in this type of material the items in the generalization test are one or another component of the original material and not just the variations of the latter.

Hypothesis II: Generalization under condition of intentional learning (i.e., learning with awareness) which involves a conscious effort on the part of the learner, is greater as compared to generalization under condition of
incidental learning (i.e. learning without awareness), which is casual and, therefore, does not involve any conscious effort on the part of the learner.

b. Specific Hypotheses

Hypothesis I: As semantically-similar items are dissimilar physically and are familiar in terms of specific lawful associations evoked by them as compared to phonemically-similar items, generalization for the former will be less than for the latter.

Hypothesis II: Since antonyms convey opposite meanings and are, as such, different and distinct from each other, whereas synonyms convey same meanings and, hence, are equivocal and overlapping with each other, the former are more discriminable and, therefore, less amenable to generalization than the latter.

Hypothesis III: Variations of an abstract concept in terms of its defining properties are more amenable to generalization than variations of a concrete concept in terms of its specific and discrete instances.

The three hypotheses pertaining to the different types of syntactical structure are as follows:

Hypothesis IV: In the assertive and interrogative forms of syntactical structure the generalizability of the whole sentence to the verb component will be greater than
Hypothesis V: In the optative and exclamatory forms of syntactical structure the generalizability of the whole sentence to the subject component will be greater than to the other two word components.

Hypothesis VI: In the imperative form of syntactical structure the generalizability of the whole sentence to the object component will be greater than to the other two word components.