Chapter VI

Summary

Verbal learning is one of the most important research areas which has developed both extensively and intensively only in the last two decades, due largely to its widely recognized importance for any account of human learning. In verbal learning an association is formed between a verbal stimulus and a response which may either be verbal or nonverbal.

When an association between two verbal units is formed one acts as a stimulus component and the other as a response component. Thus, 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 it appears to fit the stimulus-response paradigm of behaviour almost exactly.

That verbal conditioning and generalization are instances of more complex variants of primary conditioning and generalization derives directly from certain formulations of Pavlov, who regarded classical conditioning as involving the first signalling while speech as involving the
second signalling system, the latter being the one in which words are assumed to bear the same relationship to the sensory conditioned stimuli, as do sensory conditioned stimuli to unconditioned stimuli.

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 also by 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 only as a part of a larger whole in training. The demonstration of verbal generalization was, therefore, the first objective of the present study.

A comparison between sensory generalization of animals and verbal generalization of human beings indicates 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 generalization cannot be explained in the same way in which sensory generalization is explained. This kind of generalization is technically known as semantic generalization, and is explained in terms of some 'mediating mechanism'.
in which meaning serves as an implicit or mediated response.

Meaning is, in fact, an implicit mediating response playing a significant role in verbal conditioning and generalization by providing a mediating link for stimulus-stimulus, response-response and stimulus-response relationships and, being an outcome of previous conditioning, or past association, it plays its role through what may be termed as 'awareness' which is an important component of intentional as distinguished from incidental learning. The second objective of the study was, therefore, to determine the differential effect of intentional and incidental learning conditions on generalization with different types of verbal material.

The hunch which provided the basis for the present study was that different processes are involved in generalization with materials varying along different dimensions, such as phonemically-similar material as compared to semantically-similar material, synonymous material as compared to antonymous material, concrete conceptual as compared to abstract conceptual material and material involving different types of syntactical structure. The third and the main purpose of the study was, therefore, to put to an experimental test a number of specific hypotheses with a view to seeing whether the same or different principles explain the phenomenon of generalization with verbal materials ranging
from such simple material as nonsense syllables to such complex material as complete sentences varying in grammatical construction.

To attain the above mentioned objectives, four experiments were designed to study generalization with material involving (i) phonemically-similar and semantically-similar items, (ii) synonyms and antonyms, (iii) concrete and abstract concepts and (iv) sentences having different syntactical structures.

These experiments were thus designed, apart from verifying one general hypothesis, in the case of the first three experiments, that the amount of generalization decreases with a decrease in similarity between the test and the original learning material, and another general hypothesis, in the case of all the four experiments, that intentional learning condition is more conducive to generalization than incidental learning condition, to verify six specific hypotheses, the first three experiments verifying one hypothesis each, and the fourth one verifying the remaining three hypotheses.

The material used in the four experiments was prepared in Hindi, the details of which are as follows:

a. Phonemically-Similar Material

A learning list of 10 CCC nonsense trigrams having high association-pronouncibility value was prepared and three
lists were prepared for testing generalization, one in which the first letter of the trigrams were changed, another in which the first two letters of the trigrams were changed, and a third in which all the three letters of the trigrams were changed.

b. **Semantically-Similar Material**

A learning list of 10 meaningful words most frequently chosen by 200 judges was prepared and three lists were worked out for testing generalization, one consisting of the synonyms of the first-order, another, of the synonyms of the second-order, and the third, of the synonym of the third-order similarity.

c. **Synonymous Material**

The material and the data used were the same as those for the semantically-similar material.

d. **Antonymous Material**

A learning list of 10 meaningful words most frequently chosen by 150 judges was prepared and three lists were worked out for testing generalization, one consisting of the first-order, another, of the second-order, and a third, of the third-order antonyms varying in closeness-remoteness.

e. **Concrete Conceptual Material**

A learning list of 10 names of concrete concepts most frequently chosen by 150 judges was prepared and three lists
were worked out for testing generalization, one consisting of the first-order, another, of the second-order, and a third of the third-order instances of the concepts varying in closeness-remoteness.

f. **Abstract Conceptual Material**

A learning list of 10 abstract concepts most frequently chosen by 150 judges was prepared and three lists were worked out for testing generalization, one consisting of the first-order, another, of the second-order and a third of the third-order definitions of the concepts varying, again, in closeness-remoteness.

g. **Syntactical Material**

Five syntactical variations of a list of 10 simple sentences, consisting of a subject, a verb and an object were prepared, one each for the five types of grammatical construction, namely, assertive, interrogative, optative, exclamatory and imperative, and three lists were prepared for testing generalization, one consisting of the subject components, another, of the object components and a third of the verb components.

The material was presented on a memory drum to intentional and incidental learners. Those who were told to serve as subjects were designated as intentional learners, and those who were told to help the investigator by acting as 'experi-
menters', were designated as incidental learners.

Standard paired-associate learning instructions were given to the subjects (intentional learners) in the presence of the 'experimenters' (incidental learners).

Verbal generalization was measured in terms of total number of conditioned responses, that is, responses learnt in relation to the associated syllables/words/sentences of the original learning lists, elicited by the syllables/words/word component of the sentences of the corresponding generalization test lists.

The four experiments involving different types of verbal material were as follows:

Experiment I : Generalization with Phonemically-Similar and Semantically-Similar Material

Following a lead from an earlier study it was hypothesized that since similar semantic items are more distinct from one another and, consequently, hold a separate identity of their own as compared to similar phonemic items, the former are less amenable to generalization than the latter.

Apart from that, the two types of material differ also on another important dimension, namely, familiarity. Similar semantic items are meaningful and, therefore, familiar whereas similar phonemic items are nonsense and, therefore, unfamiliar: the former evoking a different set of
lawful associations stand out as distinct from one another, whereas the latter not being capable of evoking lawful associations tend to be mixed up with one another.

To verify the hypothesis, the experiment was performed with a 2x2x3 between-group factorial design under two learning conditions (INT and INC), using two types of material (P and S) and three generalization tests ($T_1$, $T_2$ and $T_3$) of each type of material. A sample of 120 subjects was divided in 12 experimental groups of 10 subjects each, and these subjects were assigned to different experimental treatments according to the design of the experiment.

The results obtained by applying the analysis of variance with a 2x2x3 design and the t-test, and the graphic representation of generalization gradients confirmed the two general hypotheses and also, by and large, confirmed the specific hypothesis, namely, that similar phonemic items are more amenable to generalization than similar semantic items.

Experiment II: Generalization with Synonymous and Antonymous Material

Both synonyms and antonyms are meaningful and familiar but the difference between the two is that antonyms are more discriminable than synonyms and this difference was assumed to be due mainly to the fact that synonyms have a large number of features in common whereas the features which
antonyms have in common are extremely limited, so that the synonyms tend to be equivocal and overlapping while the antonyms tend to be different and distinct.

On the basis of this distinction it was hypothesized that since antonyms convey opposite meanings and are, as such, different and distinct from each other, whereas synonyms convey the 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.

To verify the hypothesis, a second experiment was performed with a 2x2x3 between-group factorial design under two learning conditions (INT and INC), using two types of material (SYN and ANT) and three generalization tests (T₁, T₂ and T₃) of each type of material. A sample of 120 subjects was divided in 12 experimental groups of 10 subjects each, and these subjects were assigned to different experimental treatments according to the design of the experiment.

The results obtained by applying the analysis of variance with a 2x2x3 design and the t-test, and the graphic representation of generalization gradients confirmed the two general hypotheses. As for the specific hypothesis, namely, that antonyms are more discriminable and, therefore, less amenable to generalization than synonyms, it was
confirmed in two out of six cases, and in the remaining four cases also the trend was in the expected direction.

Experiment III: Generalization with Concrete and Abstract Conceptual Material

Verbal learning and conceptual learning are inextricably bound together. In fact, verbal learning and learning of concepts develop side by side because conceptual rules provide a cognitive control over both verbal and nonverbal behaviour, and so a knowledge of conceptual processes has important implications for complex problems of verbal learning and behaviour.

A concrete concept refers to a characteristic, or characteristics, which a number of different physical objects have in common. An abstract concept, on the other hand, refers to common features which different definitions have in common.

On the basis of this differentiation between the two types of concept it was, therefore, hypothesized that 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.

To verify the hypothesis, a third experiment was performed with a 2x2x3 between-group factorial design under
two conditions of learning (INT and INC), using two types of material (C and A) and three generalization tests (T₁, T₂ and T₃) of each type of material. A sample of 120 subjects was divided in 12 experimental groups of 10 subjects each, and these subjects were assigned to different experimental treatments according to the design of the experiment.

The results obtained by applying the analysis of variance with a 2x2x3 design, and the t-test, and the graphic representation of generalization gradients confirmed the two general hypotheses and also, on the whole, confirmed the specific hypothesis.

Experiment IV: Generalization with Syntactical Material

In some earlier experiments, the term 'meaning load' was used to explain why a particular word component, the subject, the verb or the object, stands out in a sentence and plays a vital role in conveying the meaning of the whole sentence. Since sentences themselves differ with regard to their grammatical constructions, or syntactical structures, it was assumed that different word components would stand out by virtue of their being loaded with the greatest amount of meaning in sentences having different syntactical structures, namely, assertive, interrogative, optative, exclamatory and imperative, and that, consequently, the whole sentence would be more generalizable to that parti-
cular component than to the other two word components.

Since the emphasis in assertive and interrogative type of sentences appeared to be on the action expressed by the verb component, it was hypothesized that in these two types of sentences the 'meaning load' of the verb component would be greater and, consequently, the whole sentence would be more generalizable to this component than to the other two word components.

In the optative and exclamatory type of sentences, on the other hand, the emphasis appeared to be on the subject component rather than either on the verb or the object component, due mainly to the fact that in the former some wish is expressed for the subject to be or to do something, while in the latter an exclamation, by way of praise, wonder, etc., is expressed on the current state or action, again, of the subject. It was, therefore, hypothesized that in these two types of sentences the 'meaning load' of the subject component would be greater than that of the other two word components and, consequently, the whole sentence would be more generalizable to this component.

The only type of sentence in which the emphasis appeared to be on the object component was the imperative type, because here the most important thing is the object to which a command is directed. On the basis of this observation it was hypothesized that the 'meaning load' of the
object component would be greater than that of the other
two word components and that, therefore, the whole sentence
would be more generalizable to this than to the other
components in this type of sentence construction.

To verify the hypotheses, a fourth experiment was
performed with a 2x5x3 between-group factorial design under
two learning conditions (INT and INC), using five types of
syntactical material (AS, IN, OP, EX and IM) and three
generalization tests, one consisting of the subject compo­
ents, another of the object components and the third the
verb components. A sample of 300 subjects was divided in
30 experimental groups of 10 subjects each, and these sub­
jects were assigned to different experimental treatments
according to the design of the experiment.

The results obtained by applying the analysis of
variance with a 2x5x3 design and the t-test, and the
graphic representations confirmed the second general hypo­
thesis, namely, that the INT learning condition is more
conducive to generalization than INC learning condition, and
also the three specific hypotheses, namely, that in the
assertive and interrogative types of syntactical structure
it is the verb component, in the optative and exclamatory
types of syntactical structure it is the subject component,
while in the imperative type of syntactical structure it is
the object component which stands out and, consequently, is
more susceptible to the generalization of the whole sentence than the remaining two word components, respectively.

The first three experiments demonstrated that as similarity between the test material and the original learning material decreases, generalization also decreases, regardless of the learning conditions and the types of material. One important point that emerged out of this finding is that generalization is a phenomenon which is not confined to sensory-perceptual learning, but occurs in verbal learning as well in varying degrees and along different dimensions. Another point that was clearly brought out by the findings is that semantically-similar material as compared to phonemically-similar material, antonymous material as compared to synonymous material and concrete conceptual material involving variations of concrete concepts in terms of their specific and discrete instances as compared to abstract conceptual material involving variations of abstract concepts in terms of their defining properties are more discriminable and, therefore, less amenable to generalization for different reasons.

All the four experiments showed that a significantly greater amount of generalization occurs under INT than under INC learning condition. This, it was thought, is due to the fact that three factors, namely, heightened state of motivation, an orientation to the task and a deliberate effort to perform
the task are inherent in the former condition while only one factor, i.e., orientation to the task is inherent in the latter.

The main purpose of the study was to see whether the same or different principles explained the phenomenon of generalization with different types of verbal material, ranging from simple material like nonsense syllables to such complex material as complete sentences varying in grammatical construction.

In the first experiment greater amount of generalization was found for phonemically-similar items than for semantically-similar items. As the phonemic items were similar only on a physical dimension their similarity was like the similarity of sensory stimuli. It was, therefore, considered appropriate to explain generalization for this type of material by the same principle by which primary stimulus generalization is explained, namely, the principle of transfer, while generalization for semantic material which is based on similarity of meaning was considered to be plausibly explainable in terms of 'equivalence of meaning' brought about by the process of mediation.

In the second experiment generalization for synonymous material was compared to that for antonymous material and it was found that synonyms are more amenable to generalization than antonyms. That antonyms are also amenable to generaliza-
tion, though to a much lesser degree than synonyms, was considered to be somewhat unexpected because antonyms, unlike synonyms, convey meanings which are diametrically opposite to each other and, hence, should not be amenable to any amount of generalization. This unexpected finding was explained by accepting the view that synonyms and antonyms are different not in kind but only in degree, and that antonyms also, like synonyms, share certain common features, though the range of these features being much smaller than those shared by the latter. This led to the view that words may be regarded as complexes of features or attributes, each word being uniquely characterized by a particular set of these features or attributes, on the basis of which it can be distinguished from all other words in the vocabulary system. Such a view was considered to be parsimonious in that it analyzes words - both synonyms and antonyms - in terms of certain elementary meaning processes, out of which the meaning of a particular word is constructed, and reduces large number of different words into smaller number of feature complexes which a set of words have in common.

The findings of the third experiment that verbal material involving concrete concepts is less amenable to generalization than material involving abstract concepts was explained in terms of the distinctive characteristics of the two types of concept. Variations of concrete concepts in
terms of their specific instances are essentially sensory-perceptual, discrete and divergent, whereas variations of abstract concepts in terms of their defining properties are ideational, amorphous, overlapping and convergent. Concrete concepts, it was further elaborated, are formed by a process of categorization and classification, in which observations of particular instances of concrete concepts lead to the formation of generalized concepts, whereas abstract concepts are derived through reasoning from general definitions, axioms, universally recognised principles and widely accepted propositions and postulates.

The purpose of the fourth experiment was entirely different from that of the first three experiments. It was to see which of the three word components in a sentence of a particular grammatical or syntactical structure, the subject, the verb or the object, has greater 'meaning load' so that the whole sentence tends to generalize to that component than to the other two word components, and to see whether the component having the greatest 'meaning load' remains constant for sentences with different syntactical structures, or it varies from a sentence with one syntactical structure to that with another. The results have clearly demonstrated that the word component to which the whole sentence is more generalizable than to the remaining word components varies from one syntactical structure to another.
As the results have shown, in the assertive and interrogative types of syntactical structure it is the verb component, in the optative and exclamatory types it is the subject component, while in the imperative type it is the object component which is more susceptible to the generalization of the whole sentence than the remaining word components. This was explained in terms of the 'meaning load' and the 'functional position' of different word components in different types of syntactical structures.

Thus, the overall findings of this experiment led one to conclude that the word component having greater susceptibility to the generalization of the whole sentence is not the same for sentences with different syntactical construction; it varies from one form of sentence construction to another. Whichever of the three word components fulfills the main purpose of a given form of sentence construction comes to occupy the central position in that form, and thereby acquires the characteristics of what Chomsky calls the deep structure of the sentence.