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# Variation in the Order of Presentation of Cues as One Variable in Concept Organization

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# VARIATION IN THE ORDER OF PRESENTATION OF CUES AS ONE VARIABLE IN CONCEPT ORGANIZATION

by

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ABSTRACT

Variation in the Order of Presentation of Cues as

One Variable in Concept Organization

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In the experiment, with forty-eight students as subjects, a series of nonsense syllables (DAX, MEF, TOV, VIC, YOP, ZIP, and ZIL) were to be associated with four geometric figures. The task was so arranged that Zip applied to all figures, Dax and Vic to subsets of two figures each, and the remaining were individual labels. In each of three experiments there was an experimental group that received pre-response cueing by means of an analogy which involved hierarchic concepts in the same general form, i. e., animal, wild, tame, and individual names.

The results suggest that the order and timing of the presentation of the cues were varied in the three separate experiments. Groups that received prior analogy versus groups not given the analogy were more successful in ordering the random stimuli. Further, the order of presentation of the cues had no significant effect on the ability of the subjects to order the random stimuli.

(38 pages)

# PROBLEM

This study is a partial replication and an expansion of an experiment on concept formation by David R. Stone (Stone, 1966). The original study, "Subsumptive Labeling as a Variable in Concept Organization," was conducted with a sample of 313 college students at Utah State University. Dr. Stone's study led to the conclusion that "students given a representative set of subsumptive labels will order random stimuli more successfully than those with no such system." There was a need to determine what effect the timing of the presentations of the cues would have on the subject's performance, and also to investigate the effect of the order of presentation of the nonsense syllables.

This study was conducted in three separate experiments: Experiment I; conducted to determine the effect of early presentation of second and third level labels in the ordering of random stimuli. Experiment II; a partial replication of Dr. Stone's earlier study, where the second and third level labels were presented lated in the series of cues. Experiment III; an investigation of the effect of all positive cues in the first half of the presentation, followed with all negative cues in the second half of the presentation to the subject's ordering of the labeling cues.

Second level labels in this study refers to the names used to designate the subsets in a hierarchic order. Third level labels are the names used to refer to the presentation of cues depicting the general set in a subsumptive hierarchic ordering of stimuli.

In all three experiments there was an experimental group that was given an analogy prior to the presentation of the cues and a control group that was given no analogy. The purpose of this experiment was to investigate, first, the role that partial cues play in aiding a subject to arrange concepts in a hierarchic or subsumptive fashion, and second, to determine if there was any interaction between the timing and ordering of the presentation of the cues from the prior analogous knowledge and set that subjects possess.

# REVIEW OF LITERATURE

This review considers the effect on concept formation of the variation of timing and order of presentation of labeling cues on concept organization and subsumptive labeling. It also investigated the effect of giving a subject an analogous concept prior to the presentation of the learning task. It was observed in evaluating these studies that there is a controversy concerning the effect of previous presentation of labeling cues and also of the effect of the amount of prior training given to subjects trying to attain a concept.

Concept learning has been of theoretical and practical interest to psychologists and educators for decades and to philosophers for centuries. The first type of concept learning consists of learning attributes (or characteristics of cues) which define a category or class. One area of controversy that has been increasing the interest in finding out how concepts are learned is in the theoretical background of the seemingly opposing views of Bruener's emphasis on self-guided learning and Ausubel's emphasis on didactic learning. It is the controversy between discovery versus "being told in learning." One area of compromise mentioned by Stone appears to be in providing partial guidance information in sequence and partial cues--so that the learner may participate inductively in the process. One such method is analogy cueing to aid the subject in arranging in a hierarchic or subsumptive fashion (Stone 1966).

Ausubel (1962) presented a subsumptive theory of meaningful verbal learning and retention. He aimed to present a comprehensive theory of

how human beings learn and retain large bodies of subject matter in the classroom and similar learning environments. He proposed that the learning and retention of meaningful material assumes the existence of a cognitive structure that is hierarchially organized. The cognitive structure is composed of highly inclusive conceptual traces under which are subsumed traces of less inclusive subconcepts, as well as traces of specific informational data. It is hypothesized that the cognitive structure is arranged in a subsumptive order regardless of how the material within the structure was originally acquired. Existing cognitive structure then is the major factor affecting meaningful learning and retention.

The initial effect of subsumption can be described as facilitating of both learning and retention. Only orienting, relational, and categorizing operations, or more simply, the identification of classes, are involved at first. The efficiency of learning and retention of ideas and information are largely dependent upon the adequacy of cognitive structure. The strategy advocated by Ausubel (1962) to manipulate the cognitive structure so as to enhance proactive facilitation is the use of introductory material (organizers) prior to the presentation of the actual learning task. The function of the organizer is to provide ideational scaffolding for the stable incorporation and retention of the main detail of differentiated materials that follow to be learned.

The model of cognitive organization proposed for the learning and selection of meaningful materials assumes the existence of a cognitive structure that is hierarchially organized. The role of cognitive structure has been studied by Schwartz and Lippman (1962). Their study

hypothesized that mental structures maximize the efficiency with which work is done, and once learning takes place, mental structure is available and can be used to organize future events. In this line of highly inclusive conceptive traces, there are subsumed traces of less inclusive subconcepts as well as tr ces of specific informational data. The major organization principle is that of a progressive channeling of trace systems of a given sphere of knowledge from a region of greater to lesser inclusiveness. Each sphere is linked to the next highest step in the hierarchy through a process of subsumption. As new material enteres the cognitive field, it interacts with and is appropriately placed under a relevant and more inclusive conceptual system. If it were not subsumable it would stand alone and describe an isolated trace.

In Gestalt's Theory what is remembered is believed to be stored in a modified cognitive structure. In the subsumptive theory what is remembered is not because it is changed to fit a Gestalten but because it is subsumed under a more general concept.

Although negative instances appear of little use to the Gestalt approach, negative instances may infirm an incorrect hypothesis for the hypothesis tester. The contribution of each type of item to the learning of concepts has been extensively studied by Smoke (1933). Smoke found that negative instances are of little aid in learning the correct concept. The role of "positive instances" and "negative instances" was further studied by Hovland and Weiss (1953). They did not find the same results as Smoke's eariler study in all respects. Hovland and Weiss hypothesized that the effect of positive instances is to greatly reduce the number of hypotheses which must be considered, while negative instances specify which of the alternatives can be discarded. When positive instances are given first, the subject need

only keep in mind a limited number of possibilities; whereas, when the negative instances come first, only a few possible hypotheses are eliminated and therefore subjects must retain quite a few alternatives until the positive instances finally define the correct choice. The effect of the stimuli was also naturally affected by the availability of the past stimuli presented. Bourne (1964) stated that the major effect of stimulus availability in concept learning was the reduction of memory error. The role of memory was investigated by Gary Miller (1956). He hypothesized that the human mind cannot keep in mind more than seven different concepts at one time, when a person is learning a concept.

Although the effect that memory has on performance has been quite consistent, studies of the effect of negative and positive stimuli have not always been in agreement. For example, Bulgarella (1962) states that the interaction between relevant and irrelevant information was not significant. Whereas Hovland and Weiss (1953) observed that it is easier to define a concept on the basis of a series of instances showing what the concept "is" than what it "is not." In contrast, Joseph Phelan (1965) found that the awareness of difference plays a much more essential role than the awareness of similarities in the solution of a sorting problem when concept attainment is being sought.

The controversy over the difficulty of learning the concepts from the results of the structure of "negative instances" as compared with "positive instances" might lead to the assumption of a difference in the nature of the psychological process, rather than a difference in the amount of information conveyed about the concept in the two types of instances. Concept formation experiments may be regarded as communication

situations in which the examiner transmits the combination of elements he has selected as constituting the concept through a series of messages. There is need to study experimentally the relative difficulty of assimilating material varied in the order of timing of presentation of the positive and negative instances, but equated with the amount of information conveyed.

There is a need to further research the effect of prior training and cueing in concept formation.

Leo Postman (1954), in discussing an experiment, stated that "the nature of preliminary training influences the amount retained and the quality of the reproduction. During the training the subject acquires categorizing habits which pertain both to the individual design and to the relation of the members of the series. These categorizing habits influence (a) the way the members of the series are associated during learning, and (b) the way the stimuli are reconstructed at recall. Progressive memory changes can be built into the subject by subsuming information under a general concept. Meaningful and rote materials are learned and retained in different ways. Meaningful information is linked to more inclusive concepts in the existing cognitive structure. Rote material is retained in isolated descriptions of the data. This difference in learning of meaningful and rote material may to some extent account for the conflicting results in the studies by Hilgard, Irvine, and Whipple (1956) and Katona (1941). Hilgard, Irvine, and Whipple hypothesized that learning by understanding was not superior to memorization in terms of recall. Whereas Katona concluded that learning by understanding is better in retention and recall of concept learned. However, in Katona's experiment the concept presented to the subjects to be learned was more

difficult than in the opposing experiment. This suggests that the superiority of meaningful learning is more apparent when the task involves the learning of more meaningful material.

In concept formation experiments, the items presented in learning a series may be of two different types: "positive instances," which are examples of the concept and include the essential characteristics, or "negative instances," which lack one or more of the necessary characteristics, and are therefore examples of what the concept "is not." There are several strategies that subjects may employ in learning concepts: (Bruener, Austin, and Goodnow, (1956), (Bourne, 1963). (a) wholist's strategy, where the subject considers all of the information in the positive instances (the focus) and eliminates the irrelevatn information when subsequent positive instances are encountered again (b) hypothesis testing, where the subject selects some aspect of the stimuli (usually a positive instance) as his hypothesis of the concept and proceeds to gather information concerning the nature of the stimulus; by teaching him rules for organizing the stimulus. The subject uses this information and applies these rules.

The effect of the internal structure is discussed by Whitman and Garner (1963). They comment that concept learning involves both internal and external structure, since the subject is such an experiment is required to learn which stimulus belongs in a specific subset of the total number of possible stimuli. He is also required to differentiate the subset from the other stimuli which do not contribute to the concept. They further state that good form of internal structure strongly facilitates concept attainment. This was discussed in a somewhat similar fashion by Archer (1962), who hypothesized that any verbal

pretraining which modifies inner speech will thereby affect performances in problem solving tasks like concept formation.

It can be seen that there are many variables that affect concept attainment that need to be further identified. The present paper is devoted to analyzing the difficulty in assimilating material presented in different orders and with different timing. The study will also be concerned with the effect that the presentation of an analogy of test concept will have on an experimental group matched with a control group and given the above-mentioned different presentation in order and time of the labeling cues.

## HYPOTHESES

It was hypothesized that:

1. Students who are given a representative set of subsumptive labels will order random stimuli more successfully than those who have no such system.

2. Presenting the second and third level labels earlier will aid both students given a representative set of subsumptive labels, and also those students serving as a control group who receive no such system.

3. The presentation of all positive cues in the first half of the experiment and all negative cues in the second half will aid both groups. However, the presentation will aid the non-analogous group more than the analogous group. This will reduce the difference as compared to the other experimental group situations between the means of the analogous versus non-analogous groups.

## PROCEDURE

### Selection of subjects

The subjects were 48 undergraduate students, male and female, in an introductory psychology class at Utah State University. The students were divided at random by the use of a table of random numbers, into six equal groups of eight members each. The groups were numbered from one to six. Having been randomly selected into six groups of eight members each, groups one and two were matched and designated to perform experiment number one, groups three and four were matched and designated to perform experiment number two, and groups five and six were matched and designated to perform experiment number three. One experimenter was placed in charge of each of the three separate experiments. In the separate experiments groups one, three, and five were designated as Red groups and were given an analogy prior to the presentation of the matched pairs of nonsense syllables and the geometric figures. For the experiment, groups two, four, and six were designated as the Blue groups and were asked to leave the room for several minutes prior to the presentation of the nonsense syllables and the geometric figures. The Blue groups served as control groups and the Red groups became the experimental groups. The graph in Figure 1 illustrates the composition of the groups in the three experiments.

### Definition of experimental and control groups

For the experiment, the control groups designated as the Blue groups were asked to leave the rooms for several minutes prior to the

| Group | Experiment I | Experiment II | Experiment III |
|---|---|---|---|
| Red, experimental, given analogy | Eight members second and third level labels presented earlier (group one) | Eight members second and third level labels presented later (group three) | Eight members all positive cues presented in first half, all negative cues in second half of presentation (group five) |
| Blue, control, not given analogy | Eight members second and third level labels presented earlier (group two) | Eight members second and third level labels presented later (group four) | Eight members all positive cues presented in first half, all negative cues in second half of presentation (group six) |

Figure 1. Chart showing composition of groups in each experiment.

presentation of the matched pairs of nonsense syllables and geometric figures. While the Blue groups were out of the rooms the experimental, or Red groups that remained in each room were given seven terms that illustrated by analogy the general principle of subsumption. The seven terms were placed on the blackboard and the subjects were told by the experimenter that the seven terms could be used to classify the four animals that were in the list of seven terms. The seven terms are illustrated in Figure 2 in the manner that they were placed on the board in front of the Red groups. The seven terms were "animal," which covers all cases and subcategories; "wild" and "tame," with "lion" and "tiger" under "wild;" and "cat" and "dog" under "tame."

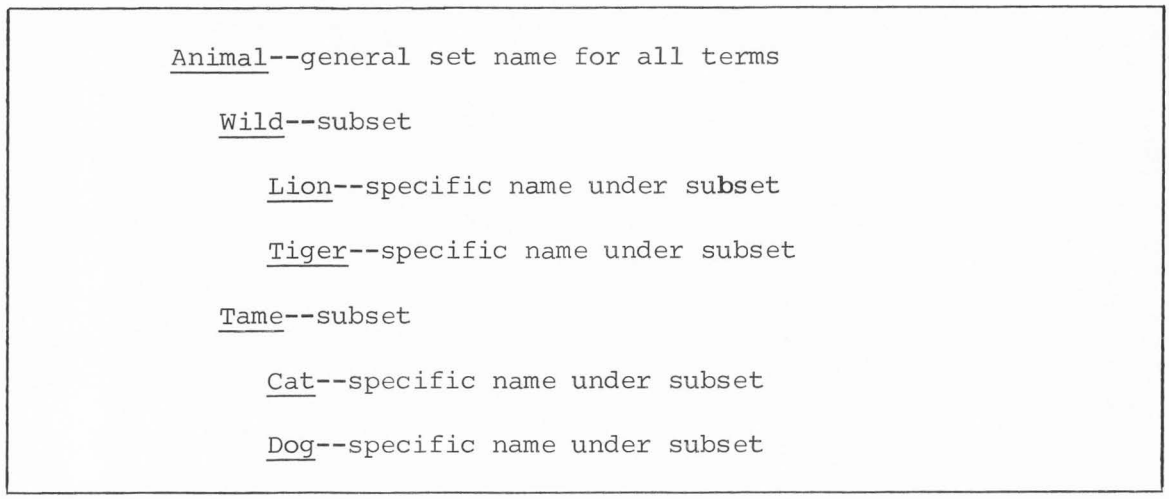


Figure 2. Seven terms used to illustrate by analogy the general principle of subsumption. These terms were placed on the board during the time that the experimental group was receiving the analogy.

To the degree that the subjects realized the seven terms could be used to categorize the four particular animals, it was hypothesized that they would be able to see the relationship between the four geometric figures and the seven nonsense terms.

The control group, formerly designated as the Blue group, that was out of the room during the presentation of the analogy, was returned to the room after the Red group had received the analogy. There were then three experiments, with each experiment composed of two groups of eight members each. One group in each experiment was a control group and one group an experimental group.

## Presentation of cue schedule

Once the experimental group had been given the analogy, then the control group was brought back into the room. The subject's task was to identify the nonsense syllables for the general set, the subset, and the specific names of the four geometric figures, and the relationship

of the geometric figures to the nonsense syllables. The following instructions were given in all three experiments to both groups:

> In a moment we are going to present a group of four black geometric figures marked on white cardboard. The object is for you to figure out the naming or labeling relationship between the seven nonsense words and the four figures. All are used. With each presentation we will give one "bit" of information. For example, the first bit (holding up the first figure on the present schedule) is: This is a _____ naming the symbol. We will give you six bits, then pause two minutes while you write down on the record sheet any conclusions you have made. Then we will allow six more bits, and then five more minutes. This will be repeated once more until 24 bits have been presented, and then you will have five minutes to write the observations you can about the relationship of the words to the figures. Write the words on the upper left side of the data sheet for reference. Show the figures across the top of the page, and also for reference keep notes on each bit of information as it is given.

In order that all experiments would have the same instructions, and also in order to make the instructions clearer, the instructions were repeated again to the subjects. Prior to the instructions, each subject was handed a data sheet which consisted of a space for the subject's name or initial, his group color, and his experiment number. The group color and experiment number was furnished to the group by the experimenter in charge of the particular experiment. On the data sheet were the numbers from 1 to 24 listed on the left side of the sheet in order that the subjects might be able to take notes following each of the 24 presentations of matched nonsense syllables and geometric figures.

The first matched group, referred to as experiment one, was given the paired associates in the order of presentation illustrated in Table 1. The second matched group was given the second and third level words earlier than in experiment I. The order of presentation for this group is illustrated in Table 2. The third experiment was given all of the

Table 1. Order of presentation of geometric figures and paired nonsense syllables given in experiment I to both analogy and non-analogy groups

| Sequence | Figure | First Order | Second Order | Third Order |
|---|---|---|---|---|
| 1 | | | | + Zip * |
| 2 | | | - Vic | |
| 3 | | | | + Zip |
| 4 | | | - Dax | |
| 5 | | + Yop | | |
| 6 | | | | + Zip |
| 7 | | - Zil | | |
| 8 | | - Yop | | |
| 9 | | | - Vic | |
| 10 | | - Tov | | |
| 11 | | | - Dix | |
| 12 | | | | |
| 13 | | | | |
| 14 | | + Zil | | |
| 15 | | + Tov | | |
| 16 | | | | + Zip |
| 17 | | - Mef | | |
| 18 | | | + Dax | |
| 19 | | - Yop | | |
| 20 | | + Mef | | |
| 21 | | - Tov | | |
| 22 | | - Mef | | |
| 23 | | | + Vic | |
| 24 | | - Zil | | |

*A plus before a nonsense syllable denotes that the syllable represented the geometric figure in some way, and the statement "This is a _____," was made by the examiner. A minus denotes that the syllable does not represent the geometric figure.

positive cues in the first half of the experiment, and then all of the negative cues in the second half. Their order is shown in Table 3.

In all experiments, presentation of the information was given a cue at a time. For example, in Experiment I, the first cue was (holding up the square for twenty seconds): This is a DAX. All groups were given six cues in the orders illustrated in Tables 1, 2, and 3. There was

Table 2. Order of presentation of geometric figures and paired nonsense syllables given in Experiment II to both analogy and non-analogy groups

| Sequence | Figure | First Order | Second Order | Third Order |
|---|---|---|---|---|
| 1 | | | + Dax * | |
| 2 | | | | + Zip |
| 3 | | | + Vic | |
| 4 | | | | + Zip |
| 5 | | - Tov | | |
| 6 | | | - Vic | |
| 7 | | - Zil | | |
| 8 | | | - Dax | |
| 9 | | + Yop | | |
| 10 | | - Mef | | |
| 11 | | + Tov | | |
| 12 | | - Yop | | |
| 13 | | - Mef | | |
| 14 | | + Zil | | |
| 15 | | - Yop | | |
| 16 | | + Mef | | |
| 17 | | | - Vic | |
| 18 | | - Tov | | |
| 19 | | | - Dax | |
| 20 | | - Zil | | |
| 21 | | | | + Zip |
| 22 | | | + Dax | |
| 23 | | | | + Zip |
| 24 | | | + Vic | |

*A plus before a nonsense syllable denotes that the syllable represented the geometric figure in some way, and the statement, "This is a _____," was made by the examiner. A minus denotes that the syllable does not represent the geometric figure.

a pause for two minutes following the presentation of the first six cues while each person individually wrote down on the data sheet any conclusions he had formed. The cues were given in a series of six. After the first six cues were presented there was a two minute pause in the presentation of cues. Then continuing with six more cues and a five minute pause, and six more cues and a two minute pause, and finally

Table 3. Order of presentation of geometric figures and paired nonsense syllables given in Experiment III to both analogy and non-analogy groups

| Sequence | Figure | First Order | Second Order | Third Order |
|---|---|---|---|---|
| 1 | | | + Dax * | |
| 2 | | | | + Zip |
| 3 | | | + Vic | |
| 4 | | | | + Zip |
| 5 | | + Yop | | |
| 6 | | + Zil | | |
| 7 | | + Tov | | |
| 8 | | + Mef | | |
| 9 | | | | + Zip |
| 10 | | | + Dax | |
| 11 | | | | + Zip |
| 12 | | | + Vic | |
| 13 | | - Tov | | |
| 14 | | | - Vic | |
| 15 | | - Zil | | |
| 16 | | - Yop | | |
| 17 | | | - Vic | |
| 18 | | - Mef | | |
| 19 | | - Yop | | |
| 20 | | | - Dax | |
| 21 | | - Mef | | |
| 22 | | - Tov | | |
| 23 | | | - Dax | |
| 24 | | - Zil | | |

*A plus before a nonsense syllable denotes that the syllable represents the geometric figure in some way, and the statement, "This is a _____," was made by the experimenter. A minus denotes that the syllable does not represent the geometric figure.

six cues and a five minute pause. During the pauses the subjects were able to write down the observations they had made about the relationship of the words to the figures.

Subjects were encouraged to place the geometric figures shown to them during the experiment on the top of the data sheet and to place the nonsense syllables presented down the sides of the sheet. The

subjects were told to keep notes on each cue of information as it was presented.

In order to solve the task, the subjects had to discover that Zip applied to all figures, Dax to right angle figures, and Vic to the triangles. The remaining nonsense syllables were specific names of each geometric fugure, Yop being the square, Zil the rectangle, Mef the right triangle, and Tov the obtuse triangle (see Figure 3). The order of presentation of the nonsense syllables and the geometric figures was in the present order in each experiment. The order of presentation for the three experiments is shown in Tables 1, 2, and 3. The words were in different order in each of the three experiments. However, the order of the geometric figures was the same in all experiments with the square presented first, followed by the rectangle, the obtuse triangle, and the right triangle. The subject's task was to identify the nonsense syllables for the general set, the subset, and the four geometric figures, and to find the relationship of the figures to the nonsense words. As shown in Tables 1, 2, and 3, the geometric figures were held up one at a time. Positive signs indicate figures held up with the statement, "This is a _____." Negative signs in Tables 1, 2, and 3 indicate geometric figures held up with the statement, "This is not a _____."

Figure 4 shows what each subject could know by the end of the experiment. What could be known was the same for all three experiments. The same material was presented to all three experiments, with a variation in the timing and order of the presentation of the nonsense syllables. Three experimental groups were given a prior analogy. Four bits of information were withheld (see 0, Figure 4) in all experiments, so that some inferential thinking would have to be done at the specific object

Zip--general set name for all the geometric figures

Vic--subset name for triangles

Mef--right triangle specific name under subset

Tov--obtuse triangle specific name under subset

Dax--subset name for right angle figures

Yop--square specific name under subset

Zil--rectangle specific name under subset

Figure 3. The correct order in which the seven nonsense syllables and the geometric figures were expected to be arranged.

| | Square | Rectangle | Obtuse Triangle | Right Triangle |
|---|---|---|---|---|
| Dax | + | + | 0 | - |
| Mef | - | - | - | + |
| Tov | - | - | + | 0 |
| Vic | - | - | + | + |
| Yop | + | 0 | - | - |
| Zil | 0 | + | - | - |
| Zip | + | + | + | + |

*Plus signs signify that geometrical figure was shown with the statement, "This is a _____." (Naming the nonsense syllable listed to the left of the sign above.)

Minuses denote geometrical figures shown with the statement that "This is not a _____." (Naming the nonsense syllable listed to the left of the sign above.)

Circles denote that this cue was not given to the subjects, and that they must infer this relationship.

Figure 4. Showing what each subject could know by the end of the experiment in all groups.

level. For example, the subjects would have available that a square was a Zip, a Dax, and a Yop. He would also know that a rectangle was a Zip, a Dax, and a Zil. By cross reference he could see that both the square and the rectangle were a Dax and a Zip, and that the square was a Yop and the rectangle a Zil. Subjects would have to infer that a rectangle is not a Yop and that a square is not a Zil.

At the completion of the final presentation and after the subjects had been allowed five minutes to make any inferences they had about the relationship of the figures to the nonsense words, all papers were collected and scored. The only items scored on the subject's answer sheet were those in the subject's written conclusions that indicated attainment of one of the expected concepts. One point was awarded each correctly identified concept. Scores ranged from zero, for no concept identified correctly, to seven, for all of the concepts identified.

The subject's data sheet was scored upon the number of correct conclusions achieved in relation to the placing of the seven labels in the hierarchy. A two way classification analysis of variance was applied to the mean scores for each experimental and control group.

## RESULTS AND DISCUSSION OF DATA

The findings of this study are presented as follows: (1) discussion of statistical results, and (2) implications of the results of the study, and (3) the implications in terms of the current research literature.

There were no significant differences between the analogy versus non-analogy conditions, early versus late presentation of cues, or presentation of all negative and then all positive cues in succession. The hypotheses of the study were tested in terms of the Null Hypothesis procedure, with difference between groups being evaluated at the .05 and .01 levels of significance.

The data produced in the three experiments are shown in Tables 4, 5, and 6. The data in Table 4 presents the statistical comparison of the analogous versus the non-analogous group of students. While the differences between the means are not statistically significant, the mean scores favor the groups which did receive the prior analogy. This would appear to contribute evidence to support the assumption that random ordering of stimuli favors subjects who are given a prior analogy and lends support to the assumption that the extent of the cognitive structure that the subject possesses will facilitate his ability to order random stimuli subsumptively.

The data in Table 5 presents the distribution of the experimental groups according to time of presentation of cues for the analogy versus non-analogy sets. The differences between the means are not statistically significant. The implications here are found to be contradictory to

Table 4. Number of correctly identified concept names for groups varying in time of presentation of cues and given or not given an analogous concept, by Ns of eight in each group

| | Analogy | | Non-Analogy | |
|---|---|---|---|---|
| Experiment I | 0 | | 0 | |
| Second and third | 1 | | 1 | |
| level labels | 2 | | 1 | |
| presented early | 3 | 3.63 mean | 3 | 2.88 mean |
| | 3 | | 3 | |
| | 6 | | 4 | |
| | 7 | | 5 | |
| | 7 | | 6 | |
| | 29 | | 23 | |
| Experiment II | 0 | | 0 | |
| Second and third | 1 | | 0 | |
| level labels | 3 | | 1 | |
| presented later | 4 | 4.38 mean | 2 | 3.25 mean |
| | 6 | | 4 | |
| | 7 | | 5 | |
| | 7 | | 7 | |
| | 7 | | 7 | |
| | 35 | | 26 | |
| TOTALS and mean of Totals | 64 | 4.00 mean | 49 | 3.06 mean |

the hypothesis that presenting the second and third level labels earlier will aid students in both the analogous and non-analogous groups. Apparently, in this study presentation of second and third level labels earlier in the series was of no advantage and perhaps detrimental to the subject's ability to order the concepts. Perhaps flexibility in ordering of further cues becomes inhibited with earlier presentation of second and third level labels. Further, earlier presentation of second and third level cues may interfere with the subject's ability to rule out possible hypotheses as further cues are given. Also, the effect of

Table 5. Number of correctly identified concept names for groups varying in order of presentation of cues and given or not given an analogous concept

| | Analogy | | Non-Analogy | |
|---|---|---|---|---|
| Experiment I | 0 | | 0 | |
| Second and third | 1 | | 1 | |
| level labels | 2 | | 1 | |
| presented early | 3 | 3.63 mean | 3 | 2.88 mean |
| | 6 | | 3 | |
| | 7 | | 4 | |
| | 7 | | 5 | |
| | 29 | | 6 | |
| | | | 23 | |
| Experiment III | 0 | | 0 | |
| All positive cues | 1 | | 1 | |
| presented in first | 3 | | 3 | |
| half and negative | 3 | 4.00 mean | 3 | 3.75 mean |
| cues in second | 5 | | 4 | |
| half of presentation | 6 | | 5 | |
| | 7 | | 7 | |
| | 7 | | 7 | |
| | 32 | | 30 | |
| TOTALS and mean of Totals | 61 | 3.81 mean | 53 | 3.31 mean |

slight differences in manner of presentation of information to the groups within different studies by the various experimenters may have contributed to lack of significant statistical differences in the groups.

The data representing results from variation of presentation of cues in analogous versus non-analogous groups are presented in Table 6. Although these differences were not statistically significant, the results were in the expected direction as stated in the third hypothesis. Under these conditions--presentation of all positive cues, then all negative cues--the extent of the difference between means of groups

Table 6. Number of correctly identified concept names for groups varying in order and timing of presentation of cues, and given or not given an analogous concept

| | Analogy | | Non-Analogy | |
|---|---|---|---|---|
| Experiment I | 0 | | 0 | |
| Second and third | 1 | | 1 | |
| level labels | 2 | | 1 | |
| presented early | 3 | 3.63 mean | 3 | 2.88 mean |
| | 3 | | 3 | |
| | 6 | | 4 | |
| | 7 | | 5 | |
| | 7 | | 6 | |
| | 29 | | 23 | |
| Experiment II | 0 | | 0 | |
| Second and third | 1 | | 0 | |
| level labels | 3 | | 1 | |
| presented later | 4 | 4.38 mean | 2 | 3.25 mean |
| | 6 | | 4 | |
| | 7 | | 5 | |
| | 7 | | 7 | |
| | 7 | | 7 | |
| | 35 | | 26 | |
| Experiment III | 0 | | 0 | |
| All positive cues | 1 | | 1 | |
| presented in first | 3 | | 3 | |
| half and negative | 3 | 4.00 mean | 3 | 3.75 mean |
| cues in second half | 5 | | 4 | |
| with second and | 6 | | 5 | |
| third level labels | 7 | | 7 | |
| presented early | 7 | | 7 | |
| | 32 | | 30 | |
| TOTALS and mean of Totals | 96 | 4.00 mean | 79 | 3.29 mean |

given the analogy versus groups not given the analogy was numerically less. This would indicate that the presentation of all positive cues followed by all negative cues would allow the non-analogy group to make greater use of the material given. Giving the subjects and analogous

set and giving them first all positive cues and then all negative cues would appear to add most to their ability to identify and order concepts.

Discussion of results in terms of reported research

Although the results of this study were not of statistical significance, the observed differences are as expected in terms of the hypotheses. The data supports the studies by Stone (1966) that students given a representative set of subsumptive labels will order random stimuli more successfully than those who have not been given such a system. It is of interest that the only experimental group which was more successful than an analogy group was the group first presented with all positive cues, and then all negative cues indicating, as found in a study by Hovland and Weiss, (1953) that positive cues greatly reduce the number of hypotheses which must be considered by the subject. These results suggest that when subjects are only given positive cues, fewer possibilities need to be kept in mind, and as negative cues are presented they aid in specifying which alternative can be discarded. This is noted in Table 5 where one control group had mean scores surpassing an experimental group.

In summary, the hypotheses to be tested were: (1) Prior analogy will help the students in ordering random stimuli and (2) presentation of all positive cues followed by all negative cues will aid both analogous and non-analogous groups and the mean difference between scores in this experiment will be less in these conditions. These hypotheses were not supported at the .05 level of significance. However, the results did show indications in the directions expected in the hypotheses.

The third hypothesis that early presentation of second and third level cues would aid the students in ordering stimuli, was not substantiated statistically; nor were there differences between means to support these assumptions.

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

## Summary

The purpose of this experiment was to investigate, first, the role that partial cues play in aiding a subject to arrange concepts in a hierarchic or subsumptive fashion; and, second, to determine if there is any interaction between the timing and ordering of the presentation of the cues from the prior analogous knowledge and set that the subject possesses.

This study involved three separate experiments to determine (1) the effect of early presentation of second and third level labels in the ordering of random stimuli, (2) the effect of presentation of all positive cues in the first half of the experiment followed by all negative labeling cues in the second half, and (3) the effect of giving or not giving an analogy prior to the presentation of the cues. The latter purpose was to determine the effect the prior analogy would have on the subject's ability to hierarchically order the random stimuli presented.

The experimental groups were composed of 48 university students as subjects. A series of nonsense syllables (Dax, Mef, Tov, Vic, Yop, Zip, Zil) were to be associated with four geometric figures (Square, Rectangle, Right Triangle, and Obtuse Triangle). The task was so arranged that Zip applied to all figures, Dax to the right angle figures, Vic to the triangles, and the remaining nonsense syllables were used to designate specific geometric figures. Three separate experiments were

conducted. One group in each experiment received preresponse cues by means of an analogy in a hierarchic order of concepts in the same general form: animals; wild, tame; and individual names. The label cueing was presented in a preset manner so that in Experiment I the second and third level labels were presented early. In Experiment II the second and third level labels were presented later than in Experiment I. In Experiment III all of the positive instances of the labeling cues were presented in the first half of the experiment, followed by all the negative instances in the last half.

In all experiments, at the completion of the presentation of the 24 labeling cues the subjects were allowed five minutes to make any inferences they could make about the relationship of the figures to the nonsense words. Then all data sheets were collected and scored. The subject's individual data sheet was scored upon the number of correct conclusions achieved in relation to the placing of the seven labels in the hierarchy. A two-way classification analysis of variance was applied to the mean scores for each experimental and control group.

Results and conclusions

The experimental groups as compared to the control groups in terms of the hypotheses stated were not significantly different at the .05 or .01 levels. However, the groups which did receive prior analogy versus the group not given an analogy were more successful in ordering of the random stimuli. The following conclusions were made based upon the data in Tables 4, 5, and 6. (1) Random ordering of stimuli is favored if subjects are given a prior analogy. (2) Presentation of all positive cues, followed by all negative cues tended to help the non-analogy group and reduce the amount of difference between the means of

the analogy and non-analogy groups as compared to the other matched experimental and control groups. (3) The results indicate that experimental groups given the general set and subset early in the series of labeling cues have no advantage. As discussed earlier, this may have been detrimental to the ordering of the concepts. The experimental group did better than the matched control group in each study. However, it was interesting to note that the one group not given an analogy that was superior to any of the groups given the analogy was the group not given the analogy but given all positive cues in the first half, followed by all negative cues in the second half. The positive and negative instances of the labeling cues were mixed up in Experiment II, but 80 percent of the second and third level cues were presented by the sixteenth cue.

Recommendations

Differences between the means for the different conditions were not statistically significant. However, descriptive differences did exist between the means of groups and warrant further study and investigation. The groups which were given a prior analogy did earn better mean scores. An investigation involving variations of difficulty of the object concepts to be achieved would be important, particularly in terms of the effect and the amount of benefit gained from the presentation of a prior analogy. By graduating the difficulty of the object concepts, a better understanding of the contributions of prior analogy versus non-analogy in concept attainment would be available.

Further, investigations of all hypotheses might produce more meaningful results if a larger number of subjects could be used. Also utilization of a single experimenter may help control the variability

resulting from the use of more than one experimenter. Although groups receiving all positive cues followed by all negative cues were more successful, but not significantly so, further research designed for presentation of all positive instances throughout the experiment versus an experiment of all negative cues should be conducted for the understanding of the effect on the processes of ordering of stimuli.

A most interesting and worthwhile study would be to determine the situations involving order of concepts in group versus individual subjects. Also, research should be done where responses are made verbally at intervals, in order to understand actual process involved in the attempts of ordering of stimuli into hierarchic fashion and to understand the role of verbalization in forming concepts.

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