1968

The Effect of Dominance Level When Using Mediated Generalization to Facilitate Concept Formation

Delbert Smith McHenry
Central Washington University

THE EFFECT OF DOMINANCE LEVEL WHEN USING MEDIATED GENERALIZATION TO FACILITATE CONCEPT FORMATION

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

Delbert Smith McHenry, Jr.

August 1968

APPROVED FOR THE GRADUATE FACULTY

_____

Robert Hudson, COMMITTEE CHAIRMAN

_____

Thomas B. Collins, Jr.

_____

Marion Harless

ACKNOWLEDGMENTS

I would like to take this opportunity to acknowledge the contributions Marion Harless and Dr. Thomas Collins have made over the past four years toward the development of a constitution conducive to the present effort. I found their attitudes toward the area of psychology inspiring and their high degree of technical competence a goal toward which I might strive.

The amount of patience, time and advice provided by Dr. Robert Hudson was phenomenal. Never was he too busy to help with a pressing problem or listen and comment on a new idea. Because of his excellent grasp of the area of concept formation, Dr. Hudson's comments were invaluable to the development and completion of this project.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Mednick and Freedman (1960) have attacked the problem of concept formation by conjoining Underwood's notion of response dominance (1956b) and a technique designed to induce mediated generalization of the type attempted by Russell and Storms (1955).

The term response dominance is an outgrowth of Underwood's belief that concept formation depends upon the S's ability to recognize the pertinent relationship between concept instances (1952). The ease of recognition of this relationship, in turn, depends upon the strength of association between the concept instance and the concept response. Response dominance, as it is operationally defined, is intended to provide a quantification of this association. Briefly, response dominance refers to the relative strength of association between a particular response and a given stimulus. Within the context of concept formation response dominance has been given operational meaning by normative studies which have compiled the relative frequency of occurrence of concept responses to written or verbal stimulus instances of that concept. For such a technique to be applicable, however, it has usually been necessary to restrict the responses to a particular category, for example, responses descriptive of sensory impressions. An example from the Underwood and Richardson list (1956a) may be instructive: to the stimulus word apple, 67% of the Ss responsed with red, 19% responded with round, 5% responded with sweet and 9% of the responses were classified as miscellaneous. Thus, we see that the response dominance of the response red

to the stimulus apple is 67%, and that apple is much more closely associated with the concept red, than with the concept sweet.

A certain amount of construct validity has accrued to the response dominance measure, based on the findings of several studies which, while differing in the mode of stimulus presentation and performance measure used, have shown the systematic effect dominance level has upon concept formation. The following studies are intended to exemplify the various modes of stimulus presentation and performance measures used to demonstrate this effect.

Underwood and Richardson (1956b) used a paired associate technique (reception paradigm) in which the S provided a concept response to each of 24 concept instances representing six concepts. Using the mean number of correct responses averaged over concepts and between levels of association, Underwood and Richardson showed that as dominance level increased, performance improved.

Coleman (1964) using time to attainment of the concept label, provided the S with a group of four instances representing a concept at either a high or low dominance level. He found that correct labeling was achieved significantly faster for concepts represented by high dominance instances as compared with concepts represented by a low dominance level.

Rather than varying dominance level, Mednick and Halpern (1962) have manipulated associative rank and obtained results which parallel the findings of Underwood and Richardson (1956b). Associative rank refers to the "rank position of the concept response in the associative

hierarchy (p. 628)." The stimulus presentation procedure was essentially the same as that used by Underwood and Richardson (1956b). Comparing concepts represented by instances at rank position one with concepts at rank position two, with dominance level held constant, Mednick and Halpern found that the number of trials (defined as one presentation of the list of instances) to concept attainment was significantly less if that concept was represented by instances at rank position one as compared with instances at rank position two.

The studies cited above have used various stimulus presentation techniques; all, however, fall under the rubric of the reception paradigm. This paradigm is characterized by experimenter control over the stimulus order of presentation and exposure time, and may be contrasted with a selection paradigm in which the entire stimulus array is exposed indefinitely before the S (Bourne, 1966).

Crouse and Duncan (1963) compared the reception and selection methods of presentation using a card sorting technique. Under the restricted condition (reception paradigm) the S drew one card (face down) at a time from the deck of cards and placed the cards into four groups of five concept instances. The S was not allowed to change a card once it was placed in a group. Under the restricted (selection paradigm) condition the S was free to view the stimulus array of 20 concept instances. The S was also allowed to sort and re-sort until he was ready to test his solution to the problem. Using number of words sorted correctly and sorting time as performance measures, Crouse and Duncan found that the unrestricted procedure resulted in more correct responses, but

slower sorting times, as compared with the restricted sorting procedure. Comparing between levels of association, high dominance words were sorted with fewer errors and in shorter times as compared with low dominance words.

Finally, Bousfield and Puff (1964) investigated the effect of response dominance upon the clustering of concept instances in a free recall situation. The S received a list of 24 concept instances representing three concepts and two levels of association. Bousfield and Puff found that high associative concepts were clustered to a significant degree above the expected level, but that the difference between the degree of clustering for the high and low concept instances did not differ significantly from each other.

Mediated generalization, as theoretically conceived by several investigators (Cofer & Foley, 1942; Osgood, 1953), is a special case of stimulus generalization. Rather than generalizing along a physical dimension, however, meaningful stimuli generalize along a semantic continuum. The essential point is that a stimulus word elicits implicitly, certain responses, and that these responses have been previously conditioned to the stimulus. Russell and Storms (1955) tested the above assumption through the use of what they called verbal chaining. The Ss initial task was to learn a paired associate list consisting of nonsense syllables (the stimulus member) and meaningful words designed to elicit an implicit response. Normative data indicated that this implicit response (when presented as a stimulus) was capable of eliciting its own implicit response. Russell and Storms reasoned that if a non-

sense syllable, e.g., CEF was paired with a word, e.g., stem, which elicits an implicit associate (flower), and if this implicit associate is capable of eliciting a second implicit response, e.g., smell, then in effect the original nonsense syllable would also be conditioned to the final implicit response and the subsequent learning of such a relationship, i.e., CEF-smell should be facilitated. The results of their study supported this hypothesis. Subsequent investigations have supported the findings of Russell and Storms study (McGehee and Schultz, 1961).

Mednick and Freedman (1960) used the normative data of the Underwood and Richardson list to provide a 'base level of association' between the concept instance and the concept response. They then attempted to strengthen this association, i.e., raise the response dominance, through repeated pairings of a concept instance with a word which, theoretically, elicits the concept response. The crucial comparison of this study was between ease of attainment of the concepts which had been facilitated by the paired associate list and the ease of attainment of concepts which had not been facilitated, i.e., the stimulus instance was paired with a word which would not elicit the concept response. It was hypothesized that the facilitated concept would be attained sooner, as manifested by the Ss ability to provide a correct concept response to a randomized list of concept instances presented on a memory drum.

The present investigation was also concerned with demonstrating an artificial increase in the level of association through mediated generalization. Rather than replicating the Mednick and Freedman study, three significant changes have been made in an attempt to extend and

support the assumptions which underlie mediated generalization and the response dominance measure. First, the mode of presentation of the concept instances has been changed to a selection paradigm. Secondly, the present study is a comparison among three levels of association (between the response member of the pair and the concept name) whereas the Mednick and Freedman study used only one level of association compared with no association. Thirdly, the type of associative relationship between the mediator (response member) and concept name is different from that used in the Mednick and Freedman study. Whereas Mednick and Freedman used the Minnesota norms of the Russell and Jenkins list (1954), the present study used the norms provided by the Underwood and Richardson list (1956a). It is hypothesized that given a paradigm of the type described above (specially constructed paired associate list followed by a concept formation problem) the greater the strength of association between a response word and an implicit concept response, i.e., the higher the dominance level, the greater will be the facilitating effect upon concept formation.

CHAPTER II

METHOD

Subjects

Ss were 43 female and 5 male graduate and undergraduate volunteers taken from an introductory psychology class, and nine undergraduate education and psychology classes conducted during the summer of 1968. The median age of the Ss was several years older than would be expected during the normal academic year due to the large number of teachers returning for graduate work and undergraduate refresher courses.

Materials

Selection of the concept instances and associates. The hypothesis called for stimulus words which have been rated in terms of response dominance, i.e., the "probability of the occurrence of the relevant associative response to the concept instance" (Mednick and Freedman, 1960). The concept instances and their associates were therefore chosen from the Underwood and Richardson list. The design required that the following considerations be made with regard to the choice of materials:

1. The dominance level (mean response dominance of concept instances, see Table 3 and 4) provided by the concept instances must be relatively close for all compared concepts, in order to ascertain the effects of the independent variable, i.e., association value.
2. There must be no concept overlap in the sense that a concept instance must be related to only one of the concepts.
3. The variability of the paired associates should be held to a

minimum with regard to the response dominance.

4. The effect of concept interference was taken into account. It seemed reasonable to assume that a word which elicits five competing responses to a moderate degree would have a different effect than a word which elicits one competing response to a strong degree.

Referring to Table 2 it can be seen that experiment one dealt with three concepts, white, soft, and big at three levels of association, high, medium, and low. Each group was made up of four Ss with groups one through six providing every combination possible given the three concepts at the three levels of association. Thus group one received paired associates which had a high association value for the concept response white, paired associates with a medium association value for the concept response soft, and associates with a weak association value for the concept response big. A similar procedure was carried out for groups two through six. The concepts smell, round, and small at the three association levels provide a second experiment designed to replicate experiment one.

Tables 3 and 4 give the concept instances and paired associates for the various concepts in experiment one and two. Tables 3 and 4 also show that the dominance levels for the three concepts of experiment one are 45.25, 44.75, and 44.75. For experiment two the dominance levels are 44.0, 42.25, and 44.75. The standard deviations provide an index of the variability of the response frequencies around the dominance level. For the three groups of associates for smell the standard deviations are 1.12, 17.27, and 3.76. Finally, under "interference" the number and

percentage of irrelevant concept responses is indicated for each associate; i.e., coffee, 32% (black), 24% (brown), 11% (sour-bitter), 12% (hot), and 9% (miscellaneous responses).

Formation of the paired associate lists. The paired associate lists were made up of three components with each component consisting of four stimulus-response pairs. A component consisted of four stimulus members from a particular concept and four response members for that concept at a particular level of association. For each component four arrangements of the stimulus-response pairs were devised with each stimulus member being paired with each response member only once. This was done to counterbalance any possible effects due to the pairing of a particular stimulus and response.

For experiment one, 12 paired associate lists were developed from the basic components such that each arrangement of a given component occurred once. The particular arrangements of the three components of a given list were chosen at random, given the rule that the three components were to include each concept one time and each level of association one time, and that each arrangement had to occur only once. Thus eight Ss were given any particular component. This procedure was repeated for experiment two. Thus, effects due to particular stimulus-response members within a concept and effects due to the interaction of a particular concept and level of association were counterbalanced (see Table 2). The paired associate lists consisted of 72 pairs, with randomization of the order of presentation of the pairs being carried out within each of the six blocks of twelve concept instances. The 72 pairs were typed,

with double spacing between pairs, on 8 1/2 in. by 25 1/2 in. sheets of Strathmore construction paper (medium weight) with two lists on each sheet. The sheet ends were then glued together to form a band appropriate for use on a Lafayette (model 303-B) memory drum.

The list of concept instances. The concept instance list consisted of the twelve concept instances (representing three concepts), typed with letter gothic face type in all capitals, and centered on 8 1/2 in. by 11 in. white typing paper. A total of 48 lists were constructed (24 per set of three concepts), with each S receiving an individually randomized list.

Procedure

The 48 Ss were randomly assigned to one of the 12 groups and were trained and tested individually. Upon arrival at the site of the experiment the S was seated upon a straight backed metal and plastic chair which was positioned in front of the memory drum and to the immediate right of the E. It was explained to the S that the experiment would be carried out in two parts, with the appropriate instructions preceding each part. The instructions relevant to the presentation of the paired associate list (see appendix) were then read to the S. If there were questions at the end of the instructions, they were answered in a uniform way. For example, many Ss asked, "What do you mean, 'learn the pairs'?" The answer given in all cases was, "Learn the pairs in such a way that if I were to give you one of the members of the pair, you could give me its mate." After the last question was answered, the memory drum was turned on and the list of 12 pairs was presented six

times, each in a different random order with an exposure time of four seconds per pair.

Immediately following the presentation of the final paired associate the S received the instructions to the second part of the experiment directing him to divide the twelve nouns (concept instances) into the three groups of four instances and to provide a descriptive adjective for each of the groups (see instructions in appendix). At the end of the first sentence of the instructions, the list of twelve concept instances was given to the S. Following the sentence "Write the group members on the four lines of the sheet provided", a number of work sheets were placed, in a stack, on the table in front of the S. Questions by the S were answered by referring back to the appropriate section of the instructions. On initial trials the S often clustered a group of four nouns on the basis of functions common to the four nouns or on the basis of cause and effect relationships. It was reiterated that the appropriate basis for grouping the nouns was a physical attribute common to the group of four nouns. On any particular trial the S could refer back to the cluster and label of the immediately preceding trial. Other previous attempts could not be reviewed.

As implied in the instructions, feedback was not given until the S had given both a group of four nouns and a label describing the group. Feedback consisted of informing the S of the correctness or incorrectness of both the label and cluster. If a correct label was given describing an incorrect cluster the S was required to re-cluster on the basis of the correct label until the correct grouping was obtained. If a correct

grouping was obtained with an incorrect label describing that group, the S was required to re-label the group until the proper physical attribute was used. When a concept was correctly labeled and clustered, the S was instructed to cross out the members of that concept, i.e., the four concept instances, and to form and label a new group of four. Training and testing time for each S was fifty minutes. Following the testing phase the S was given a general orientation with regard to the purpose of the experiment and the relationship between the paired associate list and concept formation task. He was then thanked for his participation and escorted from the experimental site.

CHAPTER III

RESULTS

In order to obtain the necessary 48 Ss a total of 58 Ss were trained and tested. Since the main interest of this study is in the order of attainment of the concepts which were facilitated at the three levels of association, only the performance of those Ss who attained two or more concepts was analyzed statistically. Eight Ss failed to attain the necessary two or more concepts in the time allowed. The performance of these Ss was therefore dropped from further statistical analysis. The performance of two Ss was not included in the statistical analysis due to experimenter error. The performance of the remaining 48 Ss was analyzed on the basis of the rank order of attainment of the three concepts. Since the correct clustering of the concept instances of the first attained concept reduces by four the number of instances in the list of concept instances, the attainment of the second and third concept is influenced by previously attained concepts. Non-parametric tests of significance were therefore used to make the following comparisons:

Analysis across concepts, between levels of association:

In order to test for a systematic effect of level of association upon the order of attainment of the two groups of three concepts, a Friedman two-way analysis of variance was calculated averaging over the twelve groups and between the concepts facilitated at a particular level of association. Given the column sums (see Table 2) of 97 (high), 95

(medium), and 96 (low) a Friedman two-way analysis of variance provides a difference index of .032, a clearly insignificant value, $p > .05$.

Analysis across levels of association, between concepts:

In order to test for a systematic difference in the rank order attainment of the three concepts for each experiment, a Friedman two-way analysis of variance was computed for each group of three concepts. Since the concepts were completely counterbalanced with respect to level of association, and since all concept instances were approximately at the 50% level of dominance, it was expected that there would be no systematic difference in the order of attainment of the three concepts of the two groups when averaged over dominance level. Given the column sums of 37 (soft), 49 (white), and 58 (big), a Friedman two-way analysis of variance provides a difference index of 9.49, a value significant at the $p < .01$ level. A series of three sign tests showed that soft was attained before big to a significant degree, $p = .01$. The remaining comparisons, i.e., white versus big and white versus soft, did not result in difference indexes reaching significance, $p > .05$.

For experiment two the column sums were 35 (round), 44 (smell), and 65 (small). A Friedman two-way analysis of variance provides a difference index of 19.996, a value significant beyond the $p < .001$ level. A series of three sign tests showed that round and small differed to a significant degree, $p < .001$; smell significantly differed from small, $p = .003$. The remaining comparison, round versus smell, did not result in a significant difference index, $p = .154$.

Analysis within concepts, between levels of association:

Although the overall analysis across concepts and between levels of association did not result in a significant difference index, an analysis between levels of association for each concept could possibly show systematic differences in the order of concept attainment.

TABLE 1

CONCEPT SUM OF RANKS AT THREE LEVELS OF ASSOCIATION

Concept	Level of Association		
	High	Medium	Low
Smell	15	16	12
Soft	14	10	13
White	15	16	18
Small	21	23	21
Big	20	18	20
Round	12	11	12

Comparing between the three levels of association for the concept smell, a Kruskal-Wallis one-way analysis of variance provided a difference index of 2.81, $p > .05$. As can be seen from Table 1, the sum of ranks at the three levels of association of the remaining five concepts have smaller differences than the concept smell. Since the difference index provided by the Kruskal-Wallis test was insignificant, it can safely be assumed that the difference indexes of the remaining five concepts would also be insignificant; statistical tests were therefore, not calculated for the remaining five concepts.

CHAPTER IV

DISCUSSION

The results do not support the hypothesis that "the greater the dominance level, the greater will be the facilitating effect upon concept formation", nor are they in agreement with the Mednick and Freedman study (1960). Perhaps most surprisingly, the results of the present investigation deviate from what would be predicted from the Underwood and Richardson norms (1956a).

Although the Mednick and Freedman study and the present investigation were both designed to demonstrate the same phenomena, i.e., mediated generalization, there are several methodological differences which could possibly account for the discrepant results. Perhaps the most important difference was the concept formation tasks used in the two studies. Mednick and Freedman presented the concept formation list at a four second rate via a memory drum, a technique which is quite similar to the mode of stimulus presentation Underwood and Richardson used in the development of their normative list. The S in this situation is required to provide, verbally, a concept label or descriptive adjective which characterizes each concept instance as it is presented. Because the stimuli are presented individually, there is very little opportunity for interfering relationships to develop between stimuli. In other words, such a technique appears to be nearly ideal for eliciting responses to the individual nouns in an order which parallel their level of dominance.

Mednick and Freedman refer to the polarizing effect of a strong association between the response black and the concept white "offsetting" (compensating for) the extremely low associations between the remaining three response members and the concept response, white. This effect may be due to the early elicitation of the concept response white to sugar, its stimulus member. A response "run on" (a term Underwood and Richardson use to describe a disposition to elicit a response induced by its previous elicitation) may then occur to any stimulus member in which white was appropriate. This argument could be refuted or supported by looking at the order of attainment of the concept instances of the concept (white for instance). This line of reasoning does not, of course, deny the existence of mediated generalization; on the contrary, the argument is predicated on its existence. What this line of reasoning does imply is that mediated generalization is operative or demonstratable only within a narrowly defined context, i.e., individually presented stimuli with at least one concept instance facilitated by a strong association between it's response member and the concept label. Such a situation, in a sense, magnifies the effect of mediated generalization upon concept formation.

Carrying the above argument to the stimulus presentation procedure used in the present experiment, it is possible that dominance level, as it is operationally defined by Underwood, may not hold when the concept instances are presented concurrently and are available to the S over an extended period of time. Given Underwood's suggestion that (a) a noun can function to elicit a concept response at a particular strength of

association and (b) concept formation depends upon the S's ability to perceive a relationship between concept instances, it is entirely conceivable that a stimulus complex of nouns may interact, resulting in conceptual responses deviating significantly from that predicted from the single stimulus (noun) conditions. An observation of the present study which supports the above argument is concerned with the persistent placement of certain concept instances in incorrect clusters. The noun diaper, for instance, was clustered and labeled originally as soft in 15 out of 24 cases, that is, the first time diaper was used it was characterized as soft before the S changed the descriptive adjective to white, the correct label. According to the Underwood and Richardson list, however, diaper elicited soft in less than 5% of the cases; white was elicited 50% of the time.

A study by Crouse and Duncan (1962) casts a certain amount of doubt as to the validity of the above argument in that fewer sorting errors were made with high dominance concept instances as compared with low dominance concept instances when a selection paradigm was used.

The finding of the present study that there were systematic differences between concepts in the ease of concept attainment, even though dominance level was equated between concepts, suggest that a factor other than dominance level is important in concept attainment. It is not at all clear why such differences were obtained between the order of attainment of the different concepts. It appears that the difficulty in the attainment of the size concepts, i.e., big and small, may have played a significant part in the obtained differences. Similar results were

obtained by Crouse and Duncan (1962) in that some concepts (smelly) were easier to cluster than others (long) when averaged across dominance level. Mednick and Freedman (1960), using the same group of three concepts used in experiment one of the present investigation, did not find significant differences between the non-facilitated concepts and the buffer concept (large). However, a comparison of results between the two studies is difficult due to the differences in performance measures and mode of stimulus presentation.

At this point it seems appropriate to point out a type of interference which, while rare in the present study, was free to operate in an uncontrolled fashion. Consider the noun pony, a concept instance of small in the present study, as it was paired with chestnut, the response member of the pair at a weak level of association, or low dominance level. The relevant, i.e., intended, mediation was to occur along the concept dimension of small. However, a second concept dimension, brown, was free to provide a second avenue for mediation to occur. Thus, there were a few concept responses, other than the intended one (in this example small), that were common to both the stimulus and response members of the paired associate list, as indicated by the Underwood and Richardson list. Further research should control for this particular type of interference in that concept attainment is, in all likelihood, impeded by such irrelevant associations.

A final point concerns the comparability of the Ss of the present study with the Ss used in the normative study of Underwood and Richardson (1956a), and the Mednick and Freedman experiment (1960). Although the

older median age of the Ss of the present investigation as well as the predominance of females in the obtained sample had no obvious effect upon dominance level as it influenced concept formation, an improved replication of the design of the present study would equate the age and sex variables with the previously mentioned studies.

CHAPTER V

SUMMARY

This investigation was concerned with demonstrating differences in order of concept attainment as a function of the degree of association between a concept instance and concept response, using mediated generalization. To this end 48 Ss were exposed six times to a paired associate list consisting of 12 concept instances, representing three concepts, each of which was paired with a response member designed to elicit the relevant concept response at one of three strengths, high, medium, or low. The S was then required to group the 12 concept instances into three groups and to label each group with the physical attribute that characterized the group members. An analysis of the results showed that (a) averaging across all concepts, level of association did not affect the order of attainment of the concepts, (b) certain concepts were easier to attain irrespective of level of association, and (c) for each concept, level of association did not systematically affect the order of attainment of the concept. Discrepancies between the results of the present study and previous investigations were discussed in terms of differences in mode of stimulus presentation and performance measures.

REFERENCES

Bourne, L. E., Jr. Human conceptual behavior. Boston: Allyn and Bacon, 1966.

Bousfield, W. A., & Puff, C. R. Clustering and response dominance. Journal of Experimental Psychology, 1964, 68, 76-79.

Cofer, C. N., & Foley, J. P., Jr. Mediated generalization and the interpretation of verbal behavior: I Prolegomena. Psychological Review, 1942, 43, 513-540.

Coleman, E. B. Verbal concept learning as a function of instructions and dominance level. Journal of Experimental Psychology, 1964, 68, 213-214.

Crouse, J. H., & Duncan, C. P. Verbal concept sorting as a function of response dominance and sorting method. Journal of Verbal Learning and Verbal Behavior, 1963, 2, 480-484.

Kendler, H. H., & Karasik, A. D. Concept formation as a function of competition between response produced cues. Journal of Experimental Psychology, 1958, 55, 278-283.

McGehee, N. E., & Schultz, R. W. Mediation in paired associate learning. Journal of Experimental Psychology, 1961, 62, 565-570.

Mednick, S. A., & Freedman, J. L. Facilitation of concept formation through mediated generalization. Journal of Experimental Psychology, 1960, 60, 278-283.

Mednick, S. A., & Halpern, S. Ease of concept attainment as a function of associative rank. Journal of Experimental Psychology, 1962, 64, 628-630.

Osgood, C. E. Method and theory in experimental psychology. New York: Oxford University Press, 1953.

Russell, W. A., & Jenkins, J. J. The complete Minnesota norms for responses to 100 words from the Kent-Rosanoff Word Association Test. ONR Technical Report, 1954, No. 11.

Russell, W. A., & Storms, L. H. Implicit verbal chaining in paired associate learning. Journal of Experimental Psychology, 1955, 49, 287-293.

Underwood, B. J. An orientation for research on thinking. Psychological Review, 1952, 59, 209-220.

Underwood, B. J., & Richardson, J. Some verbal materials for the study of concept formation. Psychological Bulletin, 1956, 53, 84-95. (a)

Underwood, B. J., & Richardson, J. Verbal concept learning as a function of instructions and dominance level. Journal of Experimental Psychology, 1956, 51, 229-238. (b)

APPENDIX

TABLE 2

ALL POSSIBLE COMBINATIONS, GIVEN TWO GROUPS OF THREE CONCEPTS AT THREE LEVELS OF ASSOCIATION

Group	Level of Association		
	High	Medium	Low
group 1	white	soft	big
group 2	white	big	soft
group 3	soft	white	big
group 4	soft	big	white
group 5	big	white	soft
group 6	big	soft	white
group 1	smell	round	small
group 2	smell	small	round
group 3	round	small	smell
group 4	round	smell	small
group 5	small	round	smell
group 6	small	smell	round

TABLE 3

CONCEPT INSTANCES, AND ASSOCIATES AT THREE LEVELS OF RESPONSE DOMINANCE: EXPERIMENT ONE

WHITE

	Low		Medium		High	
Concept Instance	Interference	Associate	Interference	Associate	Interference	Associate	Interference
diaper	17-8-7-5-13	bungalow	46-7-5-33	cigarette	15-14-6-15-17	chalk	20
ivory	14-12-9	button	61-15-5-14	collar	16-19-21	milk	17
hospital	23-14-11-5-14	sugar	82-7	salt	10-7-5	napkin	12*-7-19
frost	54-12	hailstone	49-14-8-7-14	linen	14-9-19	snow	14-8-8
d.l. = 45.25		8.50		47.25		74.0	
s.d. = 13.37		2.18		9.81		8.22	

SOFT

flannel	12-5-8-20	banana	59-12-5-13	bread	35*-28	bed	24
kitten	25-13-21	cradle	29-24-5-31	silk	41-6-5-9	fur	6-5-14
jellyfish	49-5-15	lard	41-27*-5-13	skin	17-9*-23	pillow	5*-8
moccasin	13-11-23	pup	5-11-27	butter	62-7-11	velvet	24-9
d.l. = 44.75		10.5		33.25		76.25	
s.d. = 9.45		1.5		8.14		7.12	

BIG

ocean	20-12-24-11	anchor	57-15-7-17	zoo	30-7-31	auditorium	16
walrus	13-13-28	camel	30-15-20-21	ape	46-5-19	city	5-23
boulder	19-10-10-16	forest	52-14-10-12	hog	19-15-26-16	elephant	11-6
gym	21-26	platter	38-29-23	limousine	27-26-14-5-7	mansion	17
d.l. = 44.75		10.25		25.75		80.5	
s.d. = 7.53		3.46		5.31		4.93	

Note.-- * indicates values representing the amount of concept overlap.

TABLE 4

CONCEPT INSTANCES, AND ASSOCIATES AT THREE LEVELS OF RESPONSE DOMINANCE: EXPERIMENT TWO

SMELL

Concept Instance	Low Interference	Low Associate	Medium Interference	Medium Associate	High Interference	High Associate	High Interference
pine	25-8-23	coffee	32-24-11-12-9	gardenia	28-7	manure	7-10
gasoline	7-38	cigarette	33-15-6*15-17	garlic	25-17	ammonia	12
zoo	32-7-31	ginger	40-15-11-22	sardine	22*-20-5-23	garlic	7-12
sulphur	36-16	cabbage	53-15*-5-16	cheese	43-6-6-19	skunk	8-14
d.l. = 44		12.25		44.5		82.25	
s.d. = 8.8		1.1		17.3		3.76	

ROUND

balloon	17-8-20	thimble	37*-19-15-9-7	pill	46*-7-19	barrel	15-6-7
derby	29-14-24	bean	49-18*-6-15	capsule	51*-27	baseball	11-10-5*-4
belly	24-8-5-19	cork	27-25-21-21	eye	10*-8-6-26-19	dome	5-5-9-12
platter	29-10-23	pear	44-14-7-5-21	dime	23-15*-13-9-9	head	9-5*-20
d.l. = 42.25		10.0		28.0		69.5	
s.d. = 8.17		2.12		3.75		2.18	

SMALL

mouse	7-27-12	earthworm	44-17-5-24	bungalow	9-7-5-33	atom	13
pony	14-12-27	chestnut	47-18-14*-11	capsule	22*-27	crumb	21
cabin	28-11-23	stone	63-6*-6-19	closet	64-12	flea	14
lint	38-7-8-15	puddle	61-30	waist	24*-12-20	germ	16
d.l. = 44.75		10.25		41.0		84.0	
s.d. = 6.61		2.59		10.22		3.1	

Note.-- * indicates values representing the amount of concept overlap.

TABLE 5

RAW DATA FOR SUBJECTS OF EXPERIMENT ONE

Group	Level of Association		
	High	Medium	Low
group 1	white	soft	big
subject 1	1	2	3
" " 2	1	2	3
" " 3	3	1	2
" " 4	3	1	2
group 2	white	big	soft
subject 1	1	3	2
" " 2	1	3	2
" " 3	2	3	1
" " 4	3	2	1
group 3	soft	white	big
subject 1	1	2	3
" " 2	1	2	3
" " 3	1	2	3
" " 4	2	3	1
group 4	soft	big	white
subject 1	3	1	2
" " 2	3	1	2
" " 3	2	3	1
" " 4	1	2	3
group 5	big	soft	white
subject 1	2	1	3
" " 2	3	1	2
" " 3	2	1	3
" " 4	3	1	2
group 6	big	white	soft
subject 1	3	1	2
" " 2	1	2	3
" " 3	3	2	1
" " 4	3	2	1

TABLE 6

RAW DATA FOR SUBJECTS OF EXPERIMENT TWO

Group	Level of Association		
	High	Medium	Low
group 1	smell	round	small
subject 1	2	1	3
" " 2	2	1	3
" " 3	2	1	3
" " 4	2	1	3
group 2	smell	small	round
subject 1	3	2	1
" " 2	1	3	2
" " 3	2	3	1
" " 4	1	3	2
group 3	round	smell	small
subject 1	1	2	3
" " 2	1	2	3
" " 3	1	3	2
" " 4	2	3	1
group 4	round	small	smell
subject 1	2	3	1
" " 2	2	3	1
" " 3	2	3	1
" " 4	1	3	2
group 5	small	round	smell
subject 1	3	2	1
" " 2	1	2	3
" " 3	3	2	1
" " 4	3	1	2
group 6	small	smell	round
subject 1	3	1	2
" " 2	3	2	1
" " 3	2	3	1
" " 4	3	1	2

APPENDIX

INSTRUCTIONS RELEVANT TO THE PAIRED ASSOCIATE LIST

The box like instrument in front of you is called a memory drum. It's function is to present printed words. In this experiment the words will appear two at a time. Twelve pairs of words will be presented six times each for a total of 72 presentations. The order of presentation of the pairs will vary. In other words there will be no set pattern or sequence of presentation. Your initial task is to learn the 12 pairs of words. Do you have any questions?

APPENDIX

INSTRUCTIONS RELEVANT TO THE LIST OF CONCEPT INSTANCES

I will now give you a typed list of 12 nouns. The 12 nouns can be divided into three groups on the basis of a commonly shared physical attribute. Your task is to divide the 12 nouns into the three groups and to give the adjective that describes each group of four. Again, you are to provide three groups and the physical attribute, or adjective, that describes the members of the group. A different adjective describes each of the three groups. Write the group members on the four lines of the sheet provided. Write the descriptive adjective in the box above the lines. When you correctly cluster the first group and correctly label that group I will so inform you, and you may move on to the second grouping. Each noun can be used in only one group so that the first correct grouping eliminates four possibilities. If the grouping is incorrect I will point out which part or parts is incorrect, i.e., the label, the grouping, or both, and will instruct you to try again. Do you have any questions?