CONCEPT FORMATION AS A FUNCTION OF LOGICAL AND INFRALOGICAL MEDIATION AND STIMULUS IMAGERY-CONCRETENESS

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ABSTRACT

CONCEPT FORMATION AS A FUNCTION OF LOGICAL AND INFRALOGICAL MEDIATION AND STIMULUS IMAGERY-CONCRETENESS

By

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The role of verbal and nonverbal processes in grouping stimuli into conceptual units was examined. Reaction time data were obtained for subjects instructed to group concrete words or abstract words on the basis of logical or infralogical mediation strategies which required the use of verbal or nonverbal associative processes, respectively.

A 2 X 2 X 2 factorial design involving mediational set and order of presentation as between-subjects factors, and stimulus attribute as the within-subjects factor yielded eight conditions, (a) Infralogical mediation with concrete words, (b) logical mediation with concrete words, (c) infralogical mediation with abstract words, and (d) logical mediation with abstract words, for each of two orders of presentation (concrete words-abstract words vs. abstract words-concrete words).

It was hypothesized that: (a) infralogical mediation would be more difficult with abstract than with concrete stimuli resulting in longer response latencies, (b) logical mediation would be relatively less affected by variation of stimulus concreteness, and (c) grouping abstract stimuli should generally require longer reaction times than would grouping concrete stimuli. The results confirmed the latter hypothesis (i.e. concrete words were generally grouped more rapidly than were abstract words). This finding was particularly interesting since abstractness has apparently not been investigated in studies of conceptual behavior. The results, however, did not confirm the predicted mediational set x stimulus attribute interaction. The lack of significance obtained for this interaction was interpreted on the basis of the subjects' apparent failure to use the mediational strategies required.

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INTRODUCTION

An impressive body of evidence has demonstrated that language and verbal process play an important role in human conceptual behavior. However, little research has investigated the role of nonverbal process in grouping stimuli into conceptual units.

Cofer (1960) has suggested that mediating verbal responses are among the most important factors for determining hypotheses in concept formation. Evidence for this position has been obtained by several studies which show the unmistakable influence of verbal process (cf. Cofer, 1960). Judson and Cofer (1955) have reported that when subjects were given a problem solving task of selecting the "unrelated" word in a series of four, the subjects consistently selected and rejected concepts on the basis of prior verbal habits. Similar evidence for a directional effect on hypotheses in problem solving tasks has been offered by Gelfand (1958). In a study of the effect of reinforcement of response systems on the solution of problems to which those systems were relevant, Gelfand reports an unmistakable influence of prior verbal habits. The subjects consistently chose concepts for which they had been primed. Those subjects who had learned

concept-relevant words made few errors in concept learning. The subjects who learned irrelevant words made more errors than subjects who had learned neutral words.

Research on the effects of verbal process in conceptual behavior has been so compelling that Deese and Hulse (1967) have suggested that "the human ability to invent and utilize concepts is one aspect of linguistic activity." Further, Bourne (1966, p. 21) has observed that the present emphasis on language in conceptual behavior has led at least one psychologist who has worked extensively in the area to the conclusion that concepts ". . . are meaningful words which label classes of otherwise dissimilar stimuli" (i.e. Archer, 1964, p. 238).

While it may be useful to investigate conceptual behavior as if it were a subset of language, such an approach may exclude a wide range of behaviors which may be functional for conceptual activity. Predilections toward a something-in-addition-to-words approach are inherent in Bourne's (1966, p. 21) suggestion that,

> not only is it the case that most conceptual groupings have meaningful verbal labels but also some concepts are learned and used almost exclusively in a verbal context. However, while . . . [it may be said that] verbal processes enter into the chain of behaviors appropriate in almost any conceptual problem, there is no reason to assume a strict identity of words and concepts.

Thus while the importance of language in conceptual behavior cannot be denied (cf. Bourne, 1966), the

implication that in many instances it may become impossible to distinguish a concept from its verbal label (Archer, 1964) is unjustified. The fact that subjects can readily identify instances of a concept without being able to describe the underlying attributes which make any particular object an instance of that concept (Hull, 1920) makes Archer's (1964) position untenable. As Hull has observed, people can learn concepts or stimulus groups without being able to put them into words. Further, it would seem that the difficulty a subject has in describing the basis for his groupings, either because the concept is arbitrary and unnatural, or because the stimulus attributes do not lend themselves easily to verbal associations, illustrates the independence of words and concepts. As Bourne (1966, p. 107) concludes (in reference to the concept-language problem), "while the existence of common or at least parallel features may be granted, we should also recognize the essential independence of these processes."

What is needed, then, is a view of conceptual activity which explicitly states the relationship between verbal and nonverbal processes. Generally, the present research will attempt to explore such a relationship based on the assumption that neither verbal nor nonverbal processes are sole determiners of conceptual activity, and based on the suggestion that the functional significance of nonverbal processes may be studied without denying the

obvious relevance of verbal mechanisms (cf. Paivio, 1969, p. 243). More specifically, the present research is concerned with the functional significance of nonverbal imagery and verbal processes as mediators for concept formation.

LITERATURE

While the two-process theory of meaning and mediation developed by Paivio (1969) has received most attention in analyses of associative strategies in paired-associate (PA) learning, and of mediational latencies within stimulus response (S-R) pairs, it presents a model which may prove useful to the study of conceptual behavior. The possible importance of such a model for conceptual behavior is often implied by psychologists who suggest that there is more to conceptual activity than simply verbal meaning and words.

Paivio (1969) has suggested that words derive their meaning through at least two kinds of associative processes. Concrete words (i.e. words which refer to objects, materials, or persons, Paivio, Yuille & Madigan, 1968) presumably derive their meaning through associations with concrete objects and events as well as through associations with other words. Therefore, such words acquire the capacity to evoke both nonverbal images and verbal processes as associative reactions. Abstract words (i.e. words which refer to abstract concepts that cannot be experienced by the senses, Paivio, et al., 1968) however,

derive their meaning primarily through intraverbal experiences and more effectively arouse verbal associative than imaginal processes.

According to the two process theory, imaginal and verbal processes, then, may function as alternative coding systems which affect meaning, mediation and memory. Imagery is postulated to be functionally linked to an abstract-concrete dimension of stimulus meaning such that the higher the concreteness of stimulus items, the more likely they are to evoke sensory images which can function as mediators of associative learning and memory. Verbal mediators, on the other hand, are not assumed to vary functionally with concreteness, but are said to be correlated with verbal associative meaning (i.e. as indexed by such measures as association value, Glaze, 1928, and m, Noble, 1952).

One prediction which may be derived from the two-process theory is that the latency of an associated image to a stimulus word should be longer when the stimulus is abstract and low imagery (I), than when it is concrete and high I; whereas, verbal associative latency should be less affected by variation of concreteness. Paivio (1966) tested this prediction by obtaining reaction time (RT) data for subjects instructed to press a key and give verbal descriptions when either a mental image or an implicit verbal associative occurred to a stimulus word.

The results of the study supported the two-process model: while longer response latencies were found for abstract than for concrete words under both imaginal and verbal instructions, the difference was much greater under the imagery set.

While Paivio's (1966) study established the speed of associative reaction to individual stimulus words for verbal and imaginal sets, it provided no direct evidence for actual mediational efficiency of either of the two processes. Additional support for the validity of the two-process model has been offered by Yuille and Paivio (1967). As a direct test of the speed of establishing mediated linkage between groups of words, Yuille and Paivio measured RT for subjects instructed to link members of S-R pairs with either verbal or imaginal mediators. It was found that, as predicted, imaginal latencies increased with abstractness of the stimulus attribute. This interaction of concreteness of stimulus and mediation set supports the hypothesis that verbal symbolic processes and images are equally available as mediators when the stimulus is concrete, but only verbal mediators are readily aroused when the stimulus is abstract. Further, additional evidence for the differential availability of the two processes has been obtained from PA subjects who have indicated that they used imaginal mediators more often to learn concrete pairs while the reverse was true in the case of verbal mediators (Paivio, Yuille & Symthe, 1966).

STATEMENT OF THE PROBLEM

Although the results of Paivio (1966) and Yuille and Paivio (1967) have provided relevant data on the differential availability of imaginal and verbal processes as associative reaction to individual stimulus items, and for mediated linkage between S-R pairs, no direct evidence has been shown which establishes the availability of verbal or imaginal mediators for members of larger groups of words, or for more complex cognitive process. If nonverbal imagery and verbal processes function as alternative coding systems for PA learning and memory, perhaps they may function similarly in the formation of concepts (i.e. words which have been grouped or classified together on the basis of some common feature or characteristic of each, cf. Bourne, 1966, p. 2). It would seem that a parallel research model may be constructed for concept formation which suggests that the relative speed with which a conceptual grouping is formed, may, at least in part, be dependent upon the degree of concreteness and the imagery value (I) of the stimulus items, and upon the mediational strategy employed.

To provide such evidence, subjects in the present study were required to group concrete or abstract words

within multi-item lists on the basis of logical or infralogical mediation strategies (cf. Reigel, 1965, pp. 4-5). As Reigel has noted, infralogical tasks require responses derived from reference to physical objects and do not rely merely upon verbal abstractions. In order to respond appropriately, the subject must mentally perceive the physical object or the attribute or quality denoted by the stimulus; he must make a "conceptual partition" of the perceptualized object and detect its specific characteristic properties. Thus, infralogical mediation would call for the use of imagery (i.e. a mental picture, or sounds, or other sensory experience, Paivio, et al., 1968) to find a "common feature or characteristic" (i.e. Bourne, 1966) upon which the stimulus words could be grouped. Logical tasks, on the other hand, demand the recognition of classes and their members. Whether spatially and/or temporally combined or separate, the subject need only think of the instances as constituting a group. This definition is quite consistent with the notion that contiguity of stimuli is not necessary for the formation of verbal associative response (Asch, 1969).

Based on the derivative of two-process theory that images and words are differentially available as associative responses and mediators for abstract stimuli, and on the results of previously cited research (Paivio, 1966; Yuille & Paivio, 1967), it was expected that infralogical

mediation would be more difficult with abstract than with concrete nouns as stimulus items, resulting in longer response latencies. Logical mediation, however, should be affected less by variation of stimulus concreteness. Of course, inherent in these predictions is the assumption that generalizations from PA research can be applied to conceptual behavior. While it is clear that such applications are not direct due to the differential complexities of behavior involved in moving from PA learning to conceptual behavior, construction of a parallel model was assumed to be possible for the present research. Garner (1962) has suggested that there is a continuity between paired-associate learning and concept learning: in the usual case of PA learning, one response is assigned to each stimulus. However, by definition, concept learning depends on having several stimuli to each response because the task is for the subject to discover what is common between two or more stimuli. There are, then, more stimuli than responses in the general concept-learning case. Thus, Garner concludes that the basic experimental paradigm for what is called a concept problem is quite similar to the paradigm for a paired-associate learning task in that a series of stimuli is presented and the subject must learn to use different responses for different stimuli. Concept formation, however, may be differentiated on the basis of two specific characteristics:

first, the subject must use the same response for more than one stimulus (i.e. stimulus equivocation). Second, the stimuli must be multi-variate in nature, so that one or more of the variables can be defined as relevant to the response differentiation required, and others as irrelevant.

While the present research does not attempt to resolve this issue, significant differences obtained would indicate need for an approach to conceptual behavior which is, at least, similar to a two-process PA approach.

HYPOTHESES

Major

(1) The latency of discovery of infralogical mediators should be slower for abstract, low I stimuli than for concrete, high I stimuli resulting in longer RTs for forming the stimulus groupings.

(2) The availability and effectiveness of logical mediators should not be similarly affected by variation of abstractness-concreteness.

Minor

(3) In addition to the differential effects of stimulus concreteness and mediation set, grouping abstract stimuli should generally require longer response latencies than would grouping concrete stimuli.

METHOD

Subjects and Design

Fifty-three students (males and females) from introductory psychology classes at Michigan State University volunteered for the experiment as a part of a course requirement. Each was given extra credit for participating in a "study of principles for grouping words."

A 2 X 2 X 2 factorial design was used involving mediational set and order of presentation as between-subjects factors, and stimulus attribute as the within-subjects factor. Twenty-six subjects were run under the infralogical set and 27 under the logical set, the assignment to conditions being random. The subjects were tested as a group during a 1-1/2 hour period. Each subject worked independently.

Concept Formation Lists

Two-hundred and forty concrete and 240 abstract nouns were selected from a pool of 925 nouns (Paivio, Yuille & Madigan, 1968) scaled on abstractness-concreteness (C), imagery (I), and meaningfulness (m). The concrete nouns were selected on the basis of high C and high I scores, while the abstract nouns were selected on the

basis of low C and low I scores. On a seven point rating scale, the high I, high C nouns selected ranged from 6.20 to 6.90 I (mean 6.49) and from 6.20 to 7.70 C (mean 6.80). The low I, low C nouns selected ranged from 1.63 to 4.10 I (mean 3.14) and from 1.28 to 4.14 C (mean 2.60). The mean m values for the concrete and abstract lists were 6.80 and 4.96 respectively.[1] The Thorndike-Lorge (1944) frequency for concrete nouns used in the present study ranged from 1-100 or more per million. (With AA and A words assigned values of 100 and 50, the mean F for concrete nouns was 43.46.) The F for abstract nouns ranged from 0-100 (mean F = 27.13).[2]

Five concrete lists of 24 nouns each were constructed by random selection, without replacement, from the pool of 240 concrete nouns. The same procedure was followed with the abstract pool to get five abstract lists.

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[1]No attempt was made to control for m since Paivio, Yuille and Madigan (1968) have reported that items which are high on I are also high on m. This relationship is consistent with the view that abstract items derive their meaning largely through intraverbal experience. Further, Paivio (1966) has reported a correlation of .90 between I and m for 32 nouns; and Paivio, Smythe and Yuille (1968) that m is ineffective in PA learning.

[2]It should be noted also that correlational analyses have indicated that frequency was not a significant variable in either PA learning or free recall, the highest correlation (that between PA recall scores, and frequency values of stimulus members) being only 14 (Paivio, 1967). This would seem feasible since Noble (1952) based his frequency measure on the hypothesis that frequency of occurrence in written language would be highly correlated with m.

These lists were combined into a ten page booklet containing one list per page. Each of the booklets contained a set of general instructions and a set of mediation instructions. The mediation instructions for each booklet appeared before the first list and again before the fourth and the seventh lists to reinforce the instructional set.

List presentation was counterbalanced as follows to control for warm-up and fatigue effects ($\underline{C}_j$ represents a high $\underline{I}$, high $\underline{C}$ list; $\underline{A}_j$ represents a low $\underline{I}$, low $\underline{C}$ list):

$$\underline{C}_1, \underline{A}_1, \cdots \underline{C}_5, \underline{A}_5$$
$$\underline{A}_1, \underline{C}_1, \cdots \underline{A}_5, \underline{C}_5$$

Procedure

Each subject received a test booklet containing ten concept formation lists. General instructions were then read aloud by the experimenter while each subject followed the reading. The subjects were required to read each list of 24 words, in consecutive order, beginning each list only when given the signal to do so. After reading a list, the subjects were to pick out the words which they felt should "go together." The groupings were to be based on the mediation instructions given each subject. Thus, those with logical mediation instructions were to form logical groupings; and the others were to form infralogical groupings.

To indicate each grouping formed, the subjects were to check a box next to each word selected. Six columns of boxes were provided for each list to allow the subject to group the words in each list six different ways. At least nine words were to be included in each grouping the subject made. The same list appeared three times on its page to facilitate scanning from list to column (see Appendix A).

Every time a subject finished marking a particular grouping column, he was to record a "time" measure at the bottom of that column. The time measure was a coded number shown on a screen and blackboard at the front of the room. The subjects were informed that they had seven minutes to work on each list (one page). Should a subject occasionally complete six groupings before the seven minutes for that list had passed, he was to wait for the signal from the experimenter before going to to the next list. The subjects were allowed a three minute rest period before the fourth and the seventh word lists to rest and to reinforce their particular mediation set. At the end of the testing period the subjects were asked to record their sex and level of education on the back of the test booklet.

Time Measure

The time measure was composed of two parts: (a) a two-digit number (01 to 80) projected on white paper taped to a front blackboard, and (b) a cycle number which counted the number of repetitions of the 01 to 80 sequence. The two digit number was presented by a Kodak 80-slide Carousel projector. Each number of the series of 80 was shown for 15 seconds. The projector ran continuously providing 1/4 minute divisions of the entire session. The cycle number counted the cycles of 81 units (80 slides plus a space) so that each cycle took approximately 20-1/4 minutes.

The cycle number was written on the blackboard by an assistant following the 01 to 80 series resulting in a three-or-more-digit number which appeared to be a whole unit. (For example, a 90 on the screen and a seven on the blackboard would be recorded as a time of 907.)

Mediation Instructions

Subjects under the infralogical mediation set (Grouping Principle II) were instructed to form groups of words on the basis of images or feelings which each list suggested to them. Their groupings were not to be based on verbal reactions to the words. Examples were presented in the instructions, e.g. FREEDOM, WOODS, SKY might be grouped together on the basis of a mental picture of being

away from others while in the woods looking up at the sky. FREEDOM, JUSTICE, PACT would probably not be grouped since these are verbal associates. It was emphasized that these subjects were to find groups based on sensory rather than verbal associations.

Logical instruction set (Grouping Principle I) subjects were instructed to form word groups on the basis of other related words which each list suggested to them. The related words could be category names, or words which have the same associations or are associates of each other. The groups were not to be based on sensory reactions to the words. Thus, FREEDOM, JUSTICE, PACT might be grouped together on the basis of verbal association. FREEDOM, WOODS, SKY would probably not. It was emphasized that these subjects were to find groups based on verbal rather than sensory associations.

RESULTS

The initial step in the analysis of the data was to assess the effects of the three variables, mediation set (logical vs. infralogical), order of presentation (A list-C list vs. C list-A list), and stimulus-attribute (concrete vs. abstract) for each grouping across the ten lists. Because of the differences in defining latencies for groupings 1-6 (i.e. the assumptions that: (1) the subjects defined each group as being different from the previous ones, and (2) an expected increase in the level of difficulty with each additional grouping) an overall analysis of variance was not considered appropriate. However, an analysis of variance of mediation set by order of presentation by stimulus attribute was carried out separately for each grouping.

Therefore, the data for each grouping (1-6) were each analyzed by a 2 X 2 X 2 analysis of variance with mediation set and order of presentation as between-subject factors, and with stimulus attribute as a within-subject factor. The mean latencies for the three factors by each grouping are presented in Table 1.[3]

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[3]Preliminary analyses showed that there were no systematic differences in latencies between males and

Table 1. Mean latencies (sec.) by stimulus-attribute, order of presentation, and mediation set for each grouping.

Order of Grouping	Order of List Presentation	Infralogical Set			Logical Set		
		Stimuli			Stimuli		
		Concrete	Abstract	Mean	Concrete	Abstract	Mean
1	A-C	55.73	68.89	62.31	67.00	83.06	75.03
	C-A	62.31	61.39	61.85	63.20	59.80	61.50
	Mean	59.02	65.13	62.08	65.10	71.43	68.27
2	A-C	56.42	61.44	58.93	59.00	68.06	63.53
	C-A	57.31	55.21	56.26	46.88	56.45	52.34
	Mean	56.87	58.33	57.60	53.61	62.26	57.94
3	A-C	57.75	66.98	62.37	63.46	67.50	65.48
	C-A	49.71	58.15	53.93	53.59	59.00	56.80
	Mean	53.73	62.57	58.15	58.58	63.25	60.89
4	A-C	52.44	60.85	56.65	66.79	68.42	67.60
	C-A	59.31	65.25	62.28	67.98	59.52	63.75
	Mean	55.87	63.05	59.46	67.38	63.97	65.68
5	A-C	58.64	55.68	57.16	59.39	67.61	63.50
	C-A	55.75	56.58	56.17	54.11	63.98	59.05
	Mean	57.19	56.13	56.63	56.75	65.80	61.27
6	A-C	51.00	49.77	50.39	56.59	53.28	54.94
	C-A	66.35	57.72	62.04	69.67	54.69	62.18
	Mean	58.68	53.75	56.21	63.13	53.99	58.56

Stimulus-Attribute

The analysis yielded significant main effects for stimulus-attribute in Grouping 1 ($F(1, 45) = 5.90$, $p < .025$), in Grouping 2 ($F(1, 45) = 5.11$, $p < .05$), and marginally in Grouping 3 ($F(1, 45) = 3.73$, $p < .10$). The mean latencies for these data are presented in Table 2. Specifically, for these Groupings (1, 2 & 3) RTs were faster for lists with concrete stimuli than for those with abstract stimuli. Further, although the effect for stimulus-attribute were not significant for Groupings 4 and 5, the differences were in the expected direction. Grouping 6 showed a marginally significant difference ($F(1, 34) = 3.06$, $p < .10$) in the opposite direction. However, further inspection of the data indicates that no subject attempted a sixth grouping under the logical mediation, A-C presentation set for abstract lists.

Order of Presentation

The only significant effect for order of presentation involved Grouping 6 ($F(1, 34) = 6.08$, $p < .025$),

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females for any of the conditions. Males and females were therefore pooled in the analysis. It should also be noted that two logical set subjects were excluded from the data because the number of words in the groupings they formed ($\bar{x} = 4$) did not conform to the number required by the instructional set. One additional logical and one infralogical subject were also excluded. These subjects recorded their "time" measures incorrectly. Thus the data analysis was performed on 25 infralogical and 24 logical subjects.

Table 2. Mean latencies (sec.) by stimulus attribute and order of grouping.

	Stimulus Attribute	
Grouping	Concrete	Abstract
1	62.61	68.28
2	55.24	60.29
3	56.13	62.91
4	61.63	63.51
5	56.97	60.96
6	58.68	63.13

indicating that RTs were faster for A-C presentations than for C-A presentations. These results were disregarded however due to the fact that N = 0 for the one A-C condition. All remaining groupings with the exception of Grouping 4 had consistent mean differences in the opposite direction (i.e. C-A orders yielded shorter latencies than did A-C orders), however these differences (i.e. for Groupings 1-5) were not significant.

Mediation Set

The main effect for mediation set was not significant, although the mean latencies for infralogical sets tended to be faster than the mean latencies for logical sets with the exception of Groups 2 and 6.

Mediation Set X Stimulus Attribute

The predicted interaction of mediation set X stimulus attribute did not occur. Only a marginal significant difference appeared in Grouping 4 ($F(1, 44) = 3.49$, $p < .10$) indicating that infralogical mediation yielded faster RTs for concrete than for abstract stimuli; while logical mediation yielded faster RTs for abstract than for concrete stimuli. No consistent trends were found in the remaining data.

Order X Stimulus Attribute

A main effect for order X stimulus attribute was found only for Grouping 6 ($F(1, 45) = 10.73$, $p < .01$) indicating that longer response latencies occurred for the type of list (concrete or abstract) presented first. No other trends were found for this interaction.

Mediation Set X Order and the second order interaction of Mediation Set X Order X Stimulus-Attribute were not significant.

The second step in the analysis tested for the effects of lists (1-5 concrete, and 1-5 abstract) by grouping. To do this a 2 X 2 X 5 analysis of variance of mediation set, by order of presentation, by lists was performed for abstract lists and then concrete lists by order of grouping.[4]

Abstract Lists

The difference between abstract lists was significant for all groupings: Grouping 1 ($F(4, 152) = 9.91$, $p < .001$), Grouping 2 ($F(4, 136) = 7.24$, $p < .001$), Grouping 3 ($F(4, 116) = 2.98$, $p < .025$), Grouping 4 ($F(4, 92) = 3.34$, $p < .025$), Grouping 5 ($F(4, 76) =$

[4]Grouping 6 was excluded from this analysis since it contained no members in its logical mediation/C-A order cell.

3.89, $p < .01$) indicating a strong differential effect for lists. The mean latencies for these data presented in Table 3 suggest that the difference was due to a learning effect (i.e. RTs were faster for each successive list).

Order of Presentation

The main effect of order of presentation for abstract lists (i.e. positions 1, 3, 5, 7, 9 vs. positions 2, 4, 6, 8, 10) was significant for Grouping 1 ($F(1, 38) = 7.16$, $p < .025$), and for Grouping 2 ($F(1, 34) = 6.30$, $p < .025$). Specifically, for these groupings, RTs to abstract lists were faster when the abstract lists followed concrete lists (i.e. positions 2, 4, 6, 8, 10) than when the reverse condition was true. The mean latencies for the remaining groupings were also in the same direction, but the tendency was not significant.

Mediation Set

No significant mediation set effect was found for abstract lists either as a main effect or in interaction with other factors with two exceptions (Grouping 3: Mediation Set X Order X Lists interaction, ($F(4, 116) = 3.09$, $p < .05$); and Grouping 1: Mediation Set X Lists interaction ($F(4, 152) = 1.61$, $p < .10$). Specifically, differences in response latencies between abstract lists cannot be attributed to the mediation set manipulation.

Table 3. Mean latencies (sec.) by abstract lists and order of grouping.

	Lists				
Grouping	1	2	3	4	5
1	93.75	71.75	70.63	57.00	62.51
2	82.47	63.78	58.71	48.31	46.61
3	67.29	63.13	58.13	53.75	51.88
4	68.30	61.36	52.17	52.48	50.44
5	72.22	47.44	52.19	48.41	48.19

Order X Abstract Lists

The interaction of order X abstract lists was significant for Grouping 1 ($F(4, 152) = 3.42$, $p < .01$), and Grouping 5 ($F(4, 76) = 2.22$, $p < .10$), indicating that latencies for A-C presentations took longer than those for C-A presentations combined with a differential effect of each successive list. However, since this effect involves an interaction of five different lists for each grouping, the nature of this first order interaction is not entirely clear, nor is the second order interaction found for Grouping 3 (i.e. mediation set X order X lists).

Concrete Lists

The difference between concrete lists was significant for two groupings: Grouping 1 ($F(4, 156) = 8.24$, $p < .001$), and Grouping 3 ($F(4, 144) = 3.31$, $p < .025$). Specifically, for these groupings (1 & 3), the data suggest a learning effect (i.e. RTs were faster for each successive list). No consistent trends were found in the remaining data for this factor.

Order of Presentation

The only main effect of order of presentation for abstract lists was a marginal effect for Grouping 2 (i.e. RTs to concrete lists were somewhat faster when the

concrete lists preceded abstract lists than when the reverse condition was true, ($F(1, 36) = 3.99$, $p < .10$). Thus, the main effect of order of presentation was not a significant factor in differences between concrete lists.

Mediation Set

A main effect of mediation set for concrete lists was found in two groups: for Grouping 4, RTs were marginally faster under infralogical mediation than under logical mediation ($F(1, 31) = 3.26$, $p < .10$). However, for Grouping 6, the opposite results were obtained (i.e. logical mediation yielded marginally faster RTs than did infralogical mediation, ($F(1, 15) = 3.84$, $p < .10$)). Further, no consistent trends were observed in the remaining data.

Order X Concrete Lists

The interaction of order X concrete lists was significant for Grouping 1 ($F(4, 156) = 6.02$, $p < .001$), and marginally for Grouping 5 ($F(4, 96) = 2.25$, $p < .10$). Again, the nature of this first order interaction is not entirely clear due to the number of levels of lists involved, nor is the second order interaction found for Grouping 4 (i.e. Mediation Set X Order X Concrete Lists, ($F(4, 124) = 3.67$, $p < .01$)).

DISCUSSION

The analyses of the latency data confirm the hypotheses that grouping abstract stimuli generally requires longer response latencies than grouping concrete stimuli. However, the analyses failed to support the hypotheses that (a) the latency of discovery of infralogical mediators is slower for abstract than for concrete stimuli, and (b) the availability and effectiveness of logical mediators are relatively unaffected by variation of stimulus concreteness. No significant interactions occurred for the mediation set X stimulus-attribute factor for any of the groupings with the exception of a marginal effect in Grouping 4; further, no consistent trends were evidenced in the latency data for this interaction.

Major Hypotheses

While the significant main effect of stimulus attribute does not confirm the applicability of two-process theory for the present research, the negative results (mediation X attribute) do not necessitate the rejection of the underlying theory. Since the availability hypothesis (i.e. that images and words are differentially available as mediators for abstract stimuli, and

are equally available for concrete stimuli) has been clearly supported by previous research (Yuille & Paivio, 1967), it would seem that alternative explanations for the present results may be appropriate. One probable explanation for the failure to demonstrate differential effects for the mediation set X stimulus attribute interaction is that the experimental procedure did not arouse persistent mediation strategies.

This interpretation is supported by the suggestion that subjects apparently fail to use, or readily abandon, mediation strategies that are inappropriate for particular types of word pairs (Paivio & Yuille, 1967, 1969). Indicatively, in the present study, one subject under the infralogical set reported that it was not possible to group the abstract words on the basis of sensory reactions. Yet the subject grouped these words and recorded reaction times for each grouping. Thus, although the subjects were assigned a mediation set and were given mediation set reminders after the third and sixth lists, this manipulation may not have been effective for maintaining the set over lists. If this explanation is true, then the latencies for the lists immediately following the mediation set reminders should still conform to two-process prediction. Further inspection of the data, however, revealed no significant difference in the mean RTs to concrete lists which immediately preceded the reminders, and the

differences obtained were in the opposite direction (mean latency under the infralogical set = 3.24; while latency under the logical set = 3.10). Further, contrary to prediction, mean latencies of the abstract lists tended to be longer for infralogical than for logical mediation sets (means = 3.47 and 3.19 respectively). Thus control of the subjects' mediational set, even for the lists immediately following the set, was not accomplished (i.e. Paivio & Yuille, 1967 have suggested that associative strategies are only partly controlled by the experimental sets and that, over trials, subjects increasingly revert to associative habits aroused by the semantic characteristics of the stimulus items). In grouping the words the subjects may have used different mediation strategies interchangeably or one strategy irrespective of its congruence with the required set. Thus, subjects either did not fully understand the task required or they abandoned their mediation sets as the strategies seemed inappropriate (e.g. the subject who reported that he could not group the words under the mediation set required felt free to utilize another strategy).

Another alternative explanation for the lack of effectiveness of mediational set may be found in the consideration of task difficulty for the present study. Garner (1962) has suggested that the excess of stimuli over responses situation, which characterizes concept

learning, is achieved by making certain stimulus attributes irrelevant. Further, it has been found that increasing the number of irrelevant attributes has a markedly deleterious effect on performance for this type of learning (Archer, Bourne & Brown, 1955; Bourne, 1963). Thus, the more irrelevant attributes there are, the harder it is to discover those attributes that are correlated with the correct response. Hence, the irrelevant attributes become the defining attributes of the concept. This result holds even when the irrelevant stimuli are correlated with one another (i.e. redundant, Bourne & Haygood, 1959), though when relevant attributes are redundant, performance is improved.

In the present study, the subjects defined the number of relevant and irrelevant attributes for each list. It would seem, then, that a distinct possibility that the effects of the difficulty of the experimental task (i.e. based on the number of relevant and irrelevant attributes defined within each list) may have overshadowed any mediation X attribute effect. The subjects were essentially required to find a generalization among at least nine items in each list of 24 upon which the grouping of these items could be based. If generalization between the items in the list could be easily formed (i.e. a large number of relevant attributes defined), concept formation would be greatly facilitated. If generalization

was more difficult (i.e. a large number of irrelevant attributes existing), which seemed to be the case, formation of concepts would be likewise difficult. If this explanation is valid, then the relatively short latencies observed for grouping the stimulus words would seem to be indicative of the subjects' failure to follow their particular instruction set. Instead the subjects may have grouped words on the basis whatever ideas came "naturally" or quickly.

Minor Hypothesis

The significance obtained for the stimulus attribute factor (i.e. that concrete words were generally grouped more rapidly than abstract words) is particularly interesting because the effect of abstractness has apparently not been investigated in studies of conceptual behavior. It may be argued, however, that abstractness in the present study was confounded with familiarity since the abstract words were generally lower on F (cf. Thorndike & Lorge, 1944) than were concrete words. However for reasons already discussed in the methods section of this paper (i.e. familiarity in relation to m), it does not appear that this finding can be attributed to differences in familiarity.

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APPENDIX A

WORD LISTS

LIST ___

	1	2		3	4		5	6
TOMAHAWK			TOMAHAWK			TOMAHAWK		
SALOON			SALOON			SALOON		
MOSQUITO			MOSQUITO			MOSQUITO		
BUTTERFLY			BUTTERFLY			BUTTERFLY		
THORN			THORN			THORN		
CHURCH			CHURCH			CHURCH		
CORPSE			CORPSE			CORPSE		
HURRICANE			HURRICANE			HURRICANE		
TOWER			TOWER			TOWER		
BLOSSOM			BLOSSOM			BLOSSOM		
SKULL			SKULL			SKULL		
PIPE			PIPE			PIPE		
TWEEZERS			TWEEZERS			TWEEZERS		
STEAMER			STEAMER			STEAMER		
HAMMER			HAMMER			HAMMER		
SHOES			SHOES			SHOES		
DOLLAR			DOLLAR			DOLLAR		
VALLEY			VALLEY			VALLEY		
BEGGAR			BEGGAR			BEGGAR		
DIAMOND			DIAMOND			DIAMOND		
STAGECOACH			STAGECOACH			STAGECOACH		
YACHT			YACHT			YACHT		
STRING			STRING			STRING		
CLAW			CLAW			CLAW		
time			time			time		
	_	_		_	_		_	_

List ___

	1	2		3	4		5	6
EGO			EGO			EGO		
GENDER			GENDER			GENDER		
COMPARISON			COMPARISON			COMPARISON		
HINDRANCE			HINDRANCE			HINDRANCE		
INCLEMENCY			INCLEMENCY			INCLEMENCY		
WELFARE			WELFARE			WELFARE		
HEREDITY			HEREDITY			HEREDITY		
DEMOCRACY			DEMOCRACY			DEMOCRACY		
SOUL			SOUL			SOUL		
EXPLANATION			EXPLANATION			EXPLANATION		
DISPOSITION			DISPOSITION			DISPOSITION		
GREED			GREED			GREED		
ATTITUDE			ATTITUDE			ATTITUDE		
POSITION			POSITION			POSITION		
DECEIT			DECEIT			DECEIT		
EVIDENCE			EVIDENCE			EVIDENCE		
CAPACITY			CAPACITY			CAPACITY		
SUPPRESSION			SUPPRESSION			SUPPRESSION		
GIST			GIST			GIST		
AFTERLIFE			AFTERLIFE			AFTERLIFE		
MAJORITY			MAJORITY			MAJORITY		
HEARING			HEARING			HEARING		
ENTERPRISE			ENTERPRISE			ENTERPRISE		
DALLIANCE			DALLIANCE			DALLIANCE		
time			time			time		

List ___

	1	2		3	4		5	6
EARTH			EARTH			EARTH		
HONEYCOMB			HONEYCOMB			HONEYCOMB		
BUTCHER			BUTCHER			BUTCHER		
JAIL			JAIL			JAIL		
LOBSTER			LOBSTER			LOBSTER		
WHALE			WHALE			WHALE		
INK			INK			INK		
WINDOW			WINDOW			WINDOW		
SWAMP			SWAMP			SWAMP		
FOREST			FOREST			FOREST		
DAFFODIL			DAFFODIL			DAFFODIL		
HOTEL			HOTEL			HOTEL		
BEAVER			BEAVER			BEAVER		
SCORPION			SCORPION			SCORPION		
CHIN			CHIN			CHIN		
FLOOD			FLOOD			FLOOD		
BOY			BOY			BOY		
TICKET			TICKET			TICKET		
HOOF			HOOF			HOOF		
ARM			ARM			ARM		
OFFICER			OFFICER			OFFICER		
INFANT			INFANT			INFANT		
FIRE			FIRE			FIRE		
CHAIR			CHAIR			CHAIR		
time						time		

List ___

	1	2		3	4		5	6
TENDENCY			TENDENCY			TENDENCY		
PLEDGE			PLEDGE			PLEDGE		
JUSTICE			JUSTICE			JUSTICE		
CONCEPT			CONCEPT			CONCEPT		
SUPPLICATION			SUPPLICATION			SUPPLICATION		
DEDUCTION			DEDUCTION			DEDUCTION		
DISCONNECTION			DISCONNECTION			DISCONNECTION		
HEALTH			HEALTH			HEALTH		
THOUGHT			THOUGHT			THOUGHT		
BELIEF			BELIEF			BELIEF		
QUALITY			QUALITY			QUALITY		
MOMENT			MOMENT			MOMENT		
UNREALITY			UNREALITY			UNREALITY		
SCIENCE			SCIENCE			SCIENCE		
FORETHOUGHT			FORETHOUGHT			FORETHOUGHT		
PREVIEW			PREVIEW			PREVIEW		
DUTY			DUTY			DUTY		
VANITY			VANITY			VANITY		
ATROCITY			ATROCITY			ATROCITY		
DISTINCTION			DISTINCTION			DISTINCTION		
REPLACEMENT			REPLACEMENT			REPLACEMENT		
PROXY			PROXY			PROXY		
SHAME			SHAME			SHAME		
DEVELOPMENT			DEVELOPMENT			DEVELOPMENT		
time	_	_	time	_	_	time	_	_

List ___

	1	2		3	4		5	6
KETTLE			KETTLE			KETTLE		
POSTER			POSTER			POSTER		
MEAT			MEAT			MEAT		
ALLIGATOR			ALLIGATOR			ALLIGATOR		
VEHICLE			VEHICLE			VEHICLE		
GEESE			GEESE			GEESE		
SLUSH			SLUSH			SLUSH		
CANDY			CANDY			CANDY		
SEAT			SEAT			SEAT		
LAKE			LAKE			LAKE		
QUEEN			QUEEN			QUEEN		
PHOTOGRAPH			PHOTOGRAPH			PHOTOGRAPH		
COFFEE			COFFEE			COFFEE		
SUNBURN			SUNBURN			SUNBURN		
SUGAR			SUGAR			SUGAR		
RIVER			RIVER			RIVER		
JELLY			JELLY			JELLY		
HOUND			HOUND			HOUND		
APPLE			APPLE			APPLE		
MONEY			MONEY			MONEY		
CLOCK			CLOCK			CLOCK		
BULLET			BULLET			BULLET		
ROCK			ROCK			ROCK		
ALCOHOL			ALCOHOL			ALCOHOL		
time	_	_	time	_	_	time	_	_

List ___

	1	2		3	4		5	6
APPEARANCE			APPEARANCE			APPEARANCE		
AGREEMENT			AGREEMENT			AGREEMENT		
EXACTITUDE			EXACTITUDE			EXACTITUDE		
FORMATION			FORMATION			FORMATION		
SEMESTER			SEMESTER			SEMESTER		
HONOR			HONOR			HONOR		
CONFIDENCE			CONFIDENCE			CONFIDENCE		
MALICE			MALICE			MALICE		
VIRTUE			VIRTUE			VIRTUE		
CAUSALITY			CAUSALITY			CAUSALITY		
ARRAY			ARRAY			ARRAY		
PROFESSION			PROFESSION			PROFESSION		
FREEDOM			FREEDOM			FREEDOM		
BANALITY			BANALITY			BANALITY		
ILLUSION			ILLUSION			ILLUSION		
ORIGIN			ORIGIN			ORIGIN		
FALLACY			FALLACY			FALLACY		
HISTORY			HISTORY			HISTORY		
PACIFISM			PACIFISM			PACIFISM		
LOYALTY			LOYALTY			LOYALTY		
PERJURY			PERJURY			PERJURY		
INEBRIETY			INEBRIETY			INEBRIETY		
ABERRATION			ABERRATION			ABERRATION		
LIFE			LIFE			LIFE		
time	_	_	time	_	_	time	_	_

List ___

	1	2		3	4		5	6
FOX			FOX			FOX		
ELBOW			ELBOW			ELBOW		
BLISTER			BLISTER			BLISTER		
FUR			FUR			FUR		
HORSE			HORSE			HORSE		
COLLEGE			COLLEGE			COLLEGE		
AUTOMOBILE			AUTOMOBILE			AUTOMOBILE		
FIREPLACE			FIREPLACE			FIREPLACE		
CANE			CANE			CANE		
CATTLE			CATTLE			CATTLE		
BUILDING			BUILDING			BUILDING		
TANK			TANK			TANK		
HOSPITAL			HOSPITAL			HOSPITAL		
SPINACH			SPINACH			SPINACH		
PIANO			PIANO			PIANO		
LANDSCAPE			LANDSCAPE			LANDSCAPE		
LARK			LARK			LARK		
SUDS			SUDS			SUDS		
GRASS			GRASS			GRASS		
PAPER			PAPER			PAPER		
FLASK			FLASK			FLASK		
ACCORDIAN			ACCORDIAN			ACCORDIAN		
MULE			MULE			MULE		
KING			KING			KING		
time	_	_	time	_	_	time	_	_

List ___

	1	2		3	4		5	6
FOLLY			FOLLY			FOLLY		
NONSENSE			NONSENSE			NONSENSE		
HARDSHIP			HARDSHIP			HARDSHIP		
FACILITY			FACILITY			FACILITY		
MEMORY			MEMORY			MEMORY		
DISCRETION			DISCRETION			DISCRETION		
IMPOTENCY			IMPOTENCY			IMPOTENCY		
RATING			RATING			RATING		
OWNERSHIP			OWNERSHIP			OWNERSHIP		
APTITUDE			APTITUDE			APTITUDE		
SATIRE			SATIRE			SATIRE		
DIRECTION			DIRECTION			DIRECTION		
FRANCHISE			FRANCHISE			FRANCHISE		
FUNCTIONARY			FUNCTIONARY			FUNCTIONARY		
EXPRESSION			EXPRESSION			EXPRESSION		
MISCONCEPTION			MISCONCEPTION			MISCONCEPTION		
INCIDENT			INCIDENT			INCIDENT		
CENTENNIAL			CENTENNIAL			CENTENNIAL		
COOPERATION			COOPERATION			COOPERATION		
THEORY			THEORY			THEORY		
IMPULSE			IMPULSE			IMPULSE		
VIGILANCE			VIGILANCE			VIGILANCE		
ALLEGORY			ALLEGORY			ALLEGORY		
QUANTITY			QUANTITY			QUANTITY		
time			time			time		

List ___

	1	2		3	4		5	6
MOSS			MOSS			MOSS		
PENCIL			PENCIL			PENCIL		
ANKLE			ANKLE			ANKLE		
DRESS			DRESS			DRESS		
WOMAN			WOMAN			WOMAN		
ENGINE			ENGINE			ENGINE		
DOOR			DOOR			DOOR		
LEOPARD			LEOPARD			LEOPARD		
MONARCH			MONARCH			MONARCH		
LIBRARY			LIBRARY			LIBRARY		
CRADLE			CRADLE			CRADLE		
BOWL			BOWL			BOWL		
MONK			MONK			MONK		
AMBULANCE			AMBULANCE			AMBULANCE		
ORCHESTRA			ORCHESTRA			ORCHESTRA		
MAST			MAST			MAST		
OCEAN			OCEAN			OCEAN		
UMBRELLA			UMBRELLA			UMBRELLA		
BOTTLE			BOTTLE			BOTTLE		
SNAKE			SNAKE			SNAKE		
BODY			BODY			BODY		
PHYSICIAN			PHYSICIAN			PHYSICIAN		
LEMON			LEMON			LEMON		
NUN			NUN			NUN		
time	_	_	time	_	_	time	_	_

List ___

	1	2		3	4		5	6
PROMOTION			PROMOTION			PROMOTION		
SAVANT			SAVANT			SAVANT		
FAULT			FAULT			FAULT		
ATTRIBUTE			ATTRIBUTE			ATTRIBUTE		
MERCY			MERCY			MERCY		
HATRED			HATRED			HATRED		
DEBACLE			DEBACLE			DEBACLE		
EMANCIPATION			EMANCIPATION			EMANCIPATION		
CONQUEST			CONQUEST			CONQUEST		
FATE			FATE			FATE		
MANAGEMENT			MANAGEMENT			MANAGEMENT		
LEGISLATION			LEGISLATION			LEGISLATION		
INGRATITUDE			INGRATITUDE			INGRATITUDE		
ABDICATION			ABDICATION			ABDICATION		
ECCENTRICITY			ECCENTRICITY			ECCENTRICITY		
BETRAYAL			BETRAYAL			BETRAYAL		
INTEREST			INTEREST			INTEREST		
SENSATION			SENSATION			SENSATION		
PREDICAMENT			PREDICAMENT			PREDICAMENT		
EXCUSE			EXCUSE			EXCUSE		
LAW			LAW			LAW		
COST			COST			COST		
EXCLUSION			EXCLUSION			EXCLUSION		
time	_	_	time	_	_	time	_	_

APPENDIX B

GENERAL INSTRUCTIONS

General Instructions

This is a study of principles for grouping words. In this booklet you will find 10 different lists of words. Your task will be to pick out words you feel go together according to a grouping principle which you will be given.

After you have looked over the words on a particular list, ways of grouping the words will occur to you. Indicate your first grouping in the first column provided by checking (✓) the words you wish to group. Your second grouping of the same list should be marked in the second column, your third in the third column, etc.

There is room for six groupings on each page, but you may not think of that many. Just mark the groupings which occur to you most naturally. Some will be common, some original; some will come quickly, others only slowly. Sometimes you may be able to describe the basis for your groupings; sometimes you may not. Mark each as it occurs to you. If there is a word on any list you don't know, just cross it out and ignore it. Try, however, to include at least 9 words in each grouping you make.

Please turn to the sample list on the following page.

Sample List

Notice that the check (✓) marks in each column indicate one grouping of words. In the sample list, the words EPISODE, MISCHIEF, CHILD, CAMP, MOTHER are in the first group. Words REMINDER, BIRD, PEPPER, CRISIS, ELEPHANT, CHANCE, EVENT are not. The six columns provide space for six such groups.

Also notice that the list of words is repeated three times on the page. This is simply for your convenience.

	1	2
EPISODE	✓	
REMINDER		
MISCHIEF	✓	
BIRD		✓
PEPPER		
CRISIS		
CHILD	✓	✓
ELEPHANT		✓
CHANCE		
CAMP	✓	
EVENT		
MOTHER	✓	✓
time	907	528

	3	4
EPISODE	✓	✓
REMINDER	✓	
MISCHIEF		
BIRD	✓	
PEPPER	✓	
CRISIS		✓
CHILD	✓	
ELEPHANT	✓	
CHANCE		✓
CAMP		
EVENT		✓
MOTHER		
time	708	319

	5	6
EPISODE	✓	
REMINDER	✓	
MISCHIEF		
BIRD	✓	
PEPPER	✓	
CRISIS	✓	
CHILD	✓	
ELEPHANT	✓	
CHANCE		
CAMP		
EVENT	✓	
MOTHER	✓	
time	6510	0115

Every time you finish marking a particular grouping column, please record the "time" at the bottom of that column, as indicated in the sample. This is the number shown on the screen and blackboard at the front of the room. For example, a 90 on the screen and 7 on the blackboard would be a time of 907. Remember to record the "time" for each column.

OK, the principle you should use for grouping words is described on the next page. Different people have different grouping principles. You will read your grouping principle now. You will also have a couple of chances to rest and refresh your memory on your grouping principle as you work through the booklet. Turn the page now and read your grouping principle to yourself.

APPENDIX C

MEDIATION SETS

Grouping Principle 1

There are at least two ways in which people react to a word. They may think of other related words (a verbal reaction), or they may think of a picture or image or feeling (a sensory reaction). In forming your groups of words, you are to use the first type of reaction as much as possible. That is, form groups on the basis of the words the list suggests to you. These may be category names or words which have the same associations, or are associates of each other. The groupings should not be based on sensory reactions to the words. For example:

	1	2
PINEAPPLE		✓
ORANGE		✓
BALL		
FREEDOM	✓	
WOODS		
JUSTICE	✓	
GRAPE		✓
OBSESSION		
HINDRANCE		
PACT	✓	
THOUGHT		
SKY		

FREEDOM, JUSTICE, PACT might be grouped together on the basis of verbal association. FREEDOM, WOODS, SKY would probably not be grouped, since these would likely be grouped on the basis of a mental picture of being away from others while in the woods looking up at the sky, or on the emotional response "joy."

ORANGE, PINEAPPLE, GRAPE might be grouped together on the basis being "fruit," a verbal category. ORANGE, BALL, GRAPE would not, if the basis for that grouping was "round." You are to find groups based on verbal, rather than sensory, associations. Now turn to the next page, and look up.

Grouping Principle 2

There are at least two ways in which people react to a word. They may think of other related words (a verbal reaction), or they may think of a picture or image or feeling (a sensory reaction). In forming your groups of words, you are to use the second type of reaction as much as possible. That is, form groups on the basis of the images or feelings the list suggests to you. The groupings should not be based on verbal reactions to the words. For example:

	1	2
PINEAPPLE		
ORANGE		✓
BALL		✓
FREEDOM	✓	
WOODS	✓	
JUSTICE		
GRAPE		✓
OBSESSION		
HINDRANCE		
PACT		
THOUGHT		
SKY	✓	

FREEDOM, WOODS, SKY might be grouped together on the basis of a mental picture of being away from others while in the woods looking up at the sky, or on the emotional response "joy." FREEDOM, JUSTICE, PACT would probably not be grouped, since these are verbal associates.

ORANGE, BALL, GRAPE might be grouped together on the basis of being "round." ORANGE, PINEAPPLE, GRAPE would not, if the basis for that grouping was "fruit," a verbal category.

Form groups on the basis of emotion, feeling, image, location, sound, color, taste, size, odor, etc. . . . You are to find groups based on sensory, rather than verbal associations. Now turn to the next page, and look up.

APPENDIX D

INSTRUCTIONAL SET REMINDER

OK, remember, using your particular grouping principle, form groups containing at least 9 words. Cross out any words you don't know and ignore them. Record the time at the bottom of each column when you have finished that grouping.

You'll have 7 minutes to work on each list. Should you occasionally get 6 groupings before the end of the time limit, wait for the signal before going on to the next list.

APPENDIX E

MEDIATION SET REMINDER

Reminder

Grouping Principle 1

Remember, you are to find groups based on verbal (FREEDOM, JUSTICE, PACT), rather than sensory associations (FREEDOM, WOODS, SKY). Form groups on the basis of category names, or words which have the same association or are associates of each other. The groupings should not be based on sensory reactions to words.

Reminder

Grouping Principle 2

Remember, you are to find groups based on sensory (FREEDOM, WOODS, SKY), rather than verbal associations (FREEDOM, JUSTICE, PACT). Form groups on the basis of emotion, feeling, image, location, sound, color, taste, size, odor, etc. The groupings should not be based on verbal reactions to words.