The role of mediating verbal responses in the conceptual sorting behavior of normals and paranoid schizophrenics.

THE ROLE OF MEDIATING VERBAL RESPONSES IN THE CONCEPTUAL SORTING BEHAVIOR OF NORMALS AND PARANOID SCHIZOPHRENICS

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THE ROLE OF MEDIATING VERBAL RESPONSES IN THE CONCEPTUAL SORTING BEHAVIOR OF NORMALS AND PARANOID SCHIZOPHRENICS

by

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INTRODUCTION

Background

Three trends in current theory and research influenced the formulation of this investigation of the role of mediating verbal responses in conceptual sorting behavior.[1] The theoretical framework stems from Goilard and Miller's (4) mechanisms of the acquired equivalence and acquired distinctiveness of cues. This framework is also based on an earlier suggestion of Gibson's (5) and to some extent parallels Osgood's (13) recent proposal. Experimental studies (13) which have provided data bearing on the adequacy of this framework were also pertinent. Finally, procedures and hypotheses have been derived from a third trend, clinical and experimental comparisons of the conceptual behavior of normals and schizophrenics (6,8).

Theoretical framework. In his classic study, Hull (10) proposed that a concept involved making the same response to "identical elements" in otherwise diverse stimuli. Smoke (16) substituted "common perceptual patterns" for "identical elements." More recently, while granting that both "identical elements"

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1. Conceptual sorting behavior is a variant of concept formation tasks employed in the laboratory. The task begins with a number of stimuli which vary with respect to color, shape, size, etc. These stimuli are then sorted into a number of groups on the basis of possessing some characteristic or combination of characteristics in common.

and "common perceptual relations" are possible determinants of the formation of some concepts, Osgood has questioned whether either notion is sufficiently general to account for all relevant findings. Thus, he questions the possibility of identifying the "identical elements" or "common perceptual relations" in Reed's (13) words or Heidbreder's (9) figures.

Heidbreder (9) invoked the property of "thing-character" of stimuli to explain her observations that object concepts are attained more readily than form concepts, with number concepts being most difficult to achieve. While difficult to quantify, stimuli with marked constancy, shape,-boundedness, and dynamic properties are presumed to possess high "thing-character." Dattman and Israel (3) have reported that, with variation in stimuli, the object, form, number order is not always obtained. Furthermore, Baum (1), proceeding on the basis of Gibson's (5) analysis, found that discriminability of Heidbreder's figures as determined by intra-list intrusions for the first of 16 lists was positively correlated with measures of concept attainment. Thus, Dattman and Israel's data place limits on the generality of the "thing-character" explanation, and Baum's findings cast doubt on the necessity of introducing this notion.

One source of difficulty in the use of the preceding schemes is their fairly exclusive stress on properties of external stimuli. These properties, however, can be altered by response-produced or mediating stimuli. In this connection,

Dollard and Miller have proposed the mechanisms of the acquired equivalence and acquired distinctiveness of cues. Their definitions are as follows:

> According to stimulus-response theory, learning to respond with highly distinctive names to similar stimulus situations should tend to lessen the generalization of other responses from one of these situations to another since the stimuli produced by responding with the distinctive name will tend to increase the differences in the stimulus patterns of the two situations. Increased differentiation based on this mechanism has been called acquired distinctiveness of cues.
>
> On the other hand, if the individual learns to respond to two quite different situations with the same verbal response, the stimuli produced by this response will be a common element mediating an increased amount of generalization from one situation to the other. This has been called acquired equivalence of cues or secondary generalization. (4, p. 174)

These mechanisms can be applied to many concept-formation situations to supplement the "identical elements" and "common perceptual relations" of external stimuli. That is, "identical elements" can be external and/or internal. Specifically, using acquired equivalence, it is suggested that if Ss learn to give the same name to markedly different stimuli, the common mediating stimuli produced by this naming response should provide "identical elements" and thus enhance for the Ss the similarity of those stimuli. Because of this greater similarity the probability of placing those stimuli in the same conceptual category would be increased. Put another way, the common name should mediate the generalization of any verbal or manipulative sorting response from one stimulus given the name to any other

stimuli so named. This suggestion occurs in Osgood's proposal that, "the only essential condition for concept formation is the learning of a common mediating response (which is the meaning of the concept) for a group of object situations, 'identical elements' and 'common perceptual relations' merely facilitating the establishment of such mediators" (13, p. 668).

Acquired distinctiveness complements the mechanism of acquired equivalence. Learning to respond to one set of stimuli with one common name and to each of several other sets with different common names for each set should, by introducing dissimilar mediating stimuli, increase the distinctiveness of each set for the responding Ss. This enhanced distinctiveness should be particularly important when stimuli within one set have some characteristics in common with stimuli of other sets. Thus, stated succinctly, acquired equivalence should contribute to intra-set similarity and acquired distinctiveness to inter-set dissimilarity, with consequent facilitation of conceptual behavior. Parenthetically, discriminability as used by Haum is dependent on dissimilarity of both external and response-produced stimuli.

Studies of concept formation pertinent to the theoretical framework. For the most part, experimental studies of concept-formation have been primarily concerned with relating concept formation to age (17). As a consequence, only a small number of studies, and these largely by ad hoc interpretation, are pertinent to the proposed theoretical framework of this study.

Reed (13) used cards on each of which word instance of a concept appeared with three other words. The task of the S was learning to give the same nonsense syllable name to all cards with names for the same concept such as "vegetable." To explain the concept attainment of Reed's Ss, Osgood advanced a "Mediational model" which, as noted above, is structurally the same as acquired equivalence.

Baum (1) recorded the verbalization of 54 Ss with whom one of Heidbreder's experiments was repeated. Giving each instance of a particular concept the same name hastened the attainment of that concept. Conversely, instances of number concepts were given many different names and it was these concepts that Ss found most difficult to acquire.

The same nonsense syllable name was given to all blocks within each of the four height-size categories into which the 22 Vigotsky blocks of Hanfmann and Kasinin's (8) investigation were to be sorted. Learning the name of each block and sorting it into an appropriate category were carried out within the same trial, thus confounding these processes. Analysis of Hanfmann and Kasinin's procedure, however, suggests that correct categorization by sorting was probably facilitated by learning the names for the blocks. That is, learning the same name for blocks within a given height-size category probably served the dual purpose of making more apparent the similarity of blocks within that category and also making them more distinctive with respect to the blocks within other categories.

In summary, it would seem that these studies can be rein-

terpreted within a framework based on the acquired equivalence and acquired distinctiveness of cues. Osgood and Sosa have dealt with some of Heidbreder's experimental work in similar fashion.

Comparisons of the conceptual sorting behavior of normals and schizophrenics. Hanfmann and Kasanin's study was designed to compare the conceptual behavior of normals and schizophrenics rather than test theoretical schemes. Prior to their work, Hull (10) had reported incidental observations that concept learning of schizophrenics was inferior to that of normals. Also, Cameron (2) analyzed the performance of five schizophrenics on the Vigotsky test but had no normal controls. Goldstein (6) has used various sorting tests in clinical contexts and reports that schizophrenia, like brain injury, involves loss of conceptual ability.

Hanfmann and Kasanin distinguished three levels of sorting behavior. On the conceptual level Ss were able to group the blocks and specify the basis of the grouping. At an intermediate level, the sorting was partially correct but the height-size principle could not be verbalized. When no solution was achieved the S was described as functioning at a primitive level. Proportionately more normals performed at the conceptual level. Furthermore, the normals with superior education achieved higher levels as compared with schizophrenics with superior education, than was the case when normals and schizophrenics with average education were compared. These

results were interpreted as consistent with prior findings of impairment of thinking in schizophrenic patients.

Rosenberg's (15) investigation suggested that the conclusion of impaired thinking of schizophrenics might have to be qualified. Using word similarities, color-form and object sorting tasks, and figure similarity, the schizophrenic Ss of his study were generally superior to a group of poorly educated normals. These results, however, may have been due to the higher educational level of the schizophrenics.

Granting the possibility that differences between poorly educated normals and schizophrenics may be negligible, the suggestion from the above studies, that schizophrenia often leads to less adequate sorting behavior, would seem to be relatively well established. This impairment has been the observational basis of Goldstein's (6) inference that schizophrenia involves the loss of an "abstract set" or "attitude." The "abstract set" or "attitude" is his guess that some fundamental but as yet unspecified alteration of thought processes underlies observed changes in the conceptual behavior of schizophrenics and various other pathological groups. Neither Goldstein nor others (2;6), however, have placed the "abstract set" into the broader and more systematic content of learning principles. Thus it has remained a relatively isolated, largely clinical, phenomenon. When coupled with other observations of language disturbances in schizophrenia (17), however, it is suggested that the loss of the "abstract set"

is equivalent to loss of the mechanisms of acquired equivalence and acquired distinctiveness of cues. That is, because schizophrenics apparently do not name stimuli or have associations with the same degree of consistency as normals, neither mechanism could operate to facilitate conceptual behavior, with the result that such conceptual behaviors are less efficient. This translation of the "abstract set" has two advantages. First, it places the concept within a broader theoretical context, and secondly, the possibility of modifying such "sets" by manipulation of the strength of mediating responses is introduced.

Statement of the Problem

This study was designed to test implications based on the application of acquired equivalence and acquired distinctiveness to conceptual block-sorting behavior. Specifically, it was hypothesized that learning the same name for all blocks within a given height-size category would facilitate subsequent sorting of these blocks into the same categories by enhancing the recognition of similar and dissimilar properties. Also, it follows that acquisition of such naming responses by schizophrenics should lead to block-sorting performances approximating the achievement of normals. This result would bear on the proposed translation of "abstract set" into the mechanisms of acquired equivalence and acquired distinctiveness.

METHOD

Subjects. The Ss were 40 normals and 40 hospital-diagnosed, non-deteriorated paranoid schizophrenics ranging from 20 to 40 years in age. The normals were maintenance personnel, attendants, and nurses at the Northampton State Hospital. While 33 of the paranoids were patients at the same hospital it was necessary to fill the quota of 40 Ss with 3 and 4 patients from the Gardner and Worcester State Hospitals, respectively.

Both normals and paranoids were divided into four groups of 10 Ss each, with five males and five females in each of the resultant eight groups. The outcome of the attempt to match these groups in terms of means of ages and intelligence estimates will be discussed in the results section. When full-scale Wechsler-Bellevue I.Q.'s, obtained within the preceding five years, were available, these were used as estimates of patient intelligence levels. When these I.Q.'s were not available or obtained over five years before, intelligence estimates for patients were based on the Comprehension-Similarities-Arithmetic short-form of the Wechsler-Bellevue. The same short-form I.Q.'s were the intelligence estimates for all normals. Since the full scale and the Comprehension-Similarities-Arithmetic short form correlate ρ .93 (14) the short form scores were considered adequate estimates of full-scale values.

Stimulus materials, apparatus, and presentation of stimuli. Sixteen blocks, somewhat larger on the average than the Vigotsky (8) blocks, served as the stimuli for both pre-sorting experiences and a block-sorting test. These blocks represented the possible combinations of tall (1 in.) and short (½ in.), large top and bottom areas (0.80 sq. in.) and small top and bottom areas (0.45 sq. in.), top and bottom shapes (square and circular) and color (black and white).

Two sets of paired-associate responses for these stimuli were used. One set consisted of familiar words: tall-large, tall-small, short-large, and short-small. These labels were paired with each of the four blocks which fell into the corresponding second-order height-size categories.

The second set was Hanfmann and Kasinin's nonsense syllables: lag, cev, mur, and bik. These were the paired associates for the four blocks within the tall-large, tall-small, short-large, and short-small categories, respectively. The familiar word or nonsense syllable paired associates, or the blocks alone, were used in the pre-sorting experiences. In order to eliminate serial learning, eight different random orders of the block-meaningful label pairs, the block-nonsense syllable pairs, or the blocks alone were used.

The blocks were exposed, one at a time, by raising the shutter of a 3 x 4 in. window cut in the 9 x 12½ in. front panel of a 6½ in. deep boxlike exposure device.

The counterbalanced shutter remained up until again lowered by the E. Raising the shutter activated a time-delay relay which turned on a light at the end of a 2-sec. interval. The 2-sec. interval constituted the anticipation period during which S was to respond with the familiar word or nonsense syllable name of the exposed blocks. After the light went on, E informed S of the correct name for the block.

A 12-in. square wooden panel painted gray and divided into four 6 x 6 in. squares by a ¼-in. black line was added for the block-sorting task. At the beginning of each block-sorting trial, one block from each of the four height-size categories, was placed in the outside corner of one of the four squares. Each block was in a different square. Four different sets of four blocks, one for each category, were used for the four trials of the sorting test. Placement of the four blocks of each set, one to each of the four squares, was random, subject to the restriction that a block for each height-size category should appear once in each of the squares. For each set of four blocks there were 12 remaining blocks. On each trial these remaining blocks were exposed in the window, one at a time, in random order.

The 16 blocks were also presented in random order to test for retention of the familiar word or nonsense syllable responses.

Procedure for pre-sorting experiences. The experimental design is summarized in Table 1. The normals and schizo-

Table 1

Summary of Experimental Design*

Type of Pre-sorting Experiences or Conditions	Type of S	
	Normals	Schizophrenics
Learn Familiar Words to 14/16 Criterion	FW-N**	FW-S
Learn Nonsense Syllables to 14/16 Criterion	NS-N	NS-S
See, Discriminate, and Name	SDN-N	SDN-S
Control (No Pre-sorting Experience)	C-N	C-S

* N = 10 in each group
** Abbreviations for groups

phrenics in the familiar word (FW) and nonsense syllable (NS) groups learned the familiar word or nonsense syllable names for the blocks by the paired-associate method to a criterion of 14 of 16 correct anticipations. As noted above, there was a 2-sec.anticipation interval, after which the block remained exposed for about 5-sec. as E told S the name of that block. The S was instructed to repeat the name after E. The specific instructions for the two groups were:

> This is an experiment on learning the names of blocks. It is not a test and therefore we are not concerned with your personal reactions. We are more concerned with the reactions of groups.
>
> When the experiment begins, the door of this box will be raised and you will see a little block in the opening. Shortly after you see the block this bulb (point out bulb on top of box) will light up and, after the bulb lights up I'll tell you the name of the block. When I've told you the name of the block, the door will be lowered. Then I'll raise the door again and you'll see another block in the opening. After you have seen this block for a short while I'll tell you the name of this block. In all I'm going to show you a number of different blocks in the window one by one. Your task will be to learn the correct names for each of the blocks that I show you. To do this, you are to try to guess, or anticipate the name of each block as soon after the window opens as possible, and before the bulb lights up. After the bulb lights I'll always tell you the right name for the block. As soon as you have any idea whatsoever about the name for each that you see, say that name because if it's the wrong name I won't count it against you and you might guess the right name. Don't be discouraged if you don't learn the names right away. It always takes people some time. However, you will learn if you try hard. Your task will end when you have learned the right name for all of the blocks.
>
> Don't try to use any set pattern of responses because I'll show the blocks in different orders. The only way you can learn each block's name is to

pay attention to that block as it appears in the window, and then learn the name which I give the block.

REMEMBER, YOUR TASK WILL BE TO GIVE THE CORRECT NAMES FOR THE BLOCKS BEFORE THE LIGHT GOES ON.

The inter-block intervals were variable, averaging about 5-sec. in length. The inter-trial intervals were about 10-sec. The normals and the schizophrenics in the nonsense syllable conditions had exactly the same treatment with the exception that these Ss learned nonsense syllable labels for the blocks.

The Ss in the two see, discriminate, and name (SDN) groups, saw the blocks after being instructed to see or pay attention to the blocks, to try to discriminate among them, and to give them different names. This condition was introduced to control for exposure to and familiarization with the blocks. These Ss were instructed as follows:

This is an experiment in naming blocks. It is not a test and therefore we are not concerned with your personal reactions. We are more concerned with the reactions of groups. When the experiment begins the door of this box will be raised and you will see a little block in the opening. Shortly after you see the block this bulb will light up. Before the bulb lights you are to name the block. Give it any name that you think fits it. Shortly after the light has gone out the door will be lowered. Then I'll raise the door again and you'll see another block in the opening. You are to tell me the name of this block before the light goes on. You may give it the same name as the first block or a different name.

I'm going to show you a number of different blocks in this window one-by-one and you are to

name each of these blocks before the bulb lights up. Some, or all of the blocks may be given different names; and some or all blocks the same name. What you name them is entirely up to you.

Remember, your task is to name each block before this bulb lights.

It was expected that the normal and schizophrenic familiar word and nonsense syllable groups would differ with respect to number of trials to criterion and hence, total trials. An exact match of total see, discriminate, and name trials with each of these verbal learning groups would then have required four separate see, discriminate, and name groups. The limited number of schizophrenics precluded this procedure. Therefore, the compromise course was to average the number of total trials administered to the four verbal learning groups and to give all Ss in the see, discriminate, and name conditions the number of trials equal to this average. The average number of trials for the four verbal learning groups was 5.9, which was rounded to six trials.

In presenting the blocks to the Ss in these last groups, E attempted to expose them for the same amount of time, on the average, that was required for block-exposure in the verbal learning conditions. The same inter-block and inter-trial intervals were employed.

Procedure for block-sorting test. Immediately after completion of these pre-sorting experiences, the Ss in the familiar word, nonsense syllable, and see, discriminate, and name conditions were introduced to the block-sorting task by the following instructions:

> Now we're going to do something different. (Omit for controls)
>
> This board has four corners. I'm going to place a different block in each corner. Then I'm going to show you some other blocks in this window one at a time. As soon as you see a block in the window, pick it up and put it with one of these blocks in the corners whichyou think the window block matches. Place it as carefully as possible, with the block in the corner to which it matches. Once you have placed a block in one square, do not move that block to any other square.
>
> Now we're ready to start. Here are the blocks which go in the four corners, and here is the first of the other blocks. Remember, put the block with the corner block to which you think it matches.
>
> Trials II, III, & IV
>
> Now let's try to match each window block with one of these four blocks.
>
> Retention:
>
> Now we're going back to the learning task. I'm going to show you the blocks in the window in the same way as when you were learning the names. When the door is raised and before the bulb lights, tell me the name of each block

The normal and schizophrenic controls undertook this under the same instructions with no prior exposure to the blocks. The task required that Ss place each of the 12 blocks in one of the four squares along with the block to

which they thought the exposed block belonged. All groups performed four block-sorting trials with four different sets of blocks, one for each height-size category, in the four corners on each trial.

Procedure for retention test. When Ss in the familiar word and nonsense syllable groups had completed the block-sorting task, they were reintroduced to the verbal learning task. One trial with blocks alone was then administered to test for retention of the verbal responses.

RESULTS

Matching of subjects. Subjects assigned to each of the eight experimental groups were matched as closely as practically possible with respect to age and estimated I.Q.s. (See appendix.) There were five males and five females in each group. Table 2 summarizes the means and standard deviations of ages and I.Q.'s.

The hypothesis of no differences among means of ages was tested by a simple-randomized design analysis of variance (Table 3).[2] Since the F of 1.76 was not significant at the 5% level, indicating that the differences could have occurred by chance, it may be concluded that the groups were matched with respect to age.

A factorial analysis of variance involving type of condition (familiar word; nonsense syllable; aud. discriminate, and mime; and control) and type of S (normal vs. schizophrenic) was used to test the significance of differences among means of I.Q.'s (Table 4). The significant F of 14.43 for type of S indicated that the normals had higher intelligence estimates than the schizophrenics. The F's for conditions and interaction of conditions and Ss were not significant.

Because normals and schizophrenics were not matched for

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2. The statistical techniques employed here and in subsequent analysis are described in (12).

Table 2

Means and Standard Deviations of the Ages and I.Q.'s of Ss in the Eight Groups

	Age in Years		I.Q.	
Group	Mean	SD	Mean	SD
FW-N	28.7	6.7	111.0	10.5
NS-N	26.0	6.0	114.1	15.7
SDN-N	33.2	6.3	112.7	9.1
C-N	27.0	7.1	118.1	16.5
FW-S	31.5	4.7	100.4	16.1
NS-S	31.1	7.0	104.2	8.9
SDN-S	31.5	6.7	103.1	16.6
C-S	32.8	7.3	100.1	10.9

Table 3

Summary of Analysis of Variance of Ages

Source	df	SS	MS	F
Ages	7	806.00	115.14	1.76
Within	72	4714.20	65.46	
Total	79	5520.20		

Table 4

Summary of Analysis of Variance of I.Q.'s

Source	df	SS	MS	F
Conditions	3	156.54	52.1[illegible]	.26
Subjects	1	2892.01	2892.01	14.43*
Conditions x Su	3	240.64	80.16	.40
Within	72	14428.70	200.40	
Total	79	17717.89		

* Significant at the .01 level for 1 and 72 df.

I.Q. it was necessary to ascertain whether this measure was related to the various learning or performance measures employed. Therefore, in the case of Ss in each of the pre-sorting verbalization groups, rank-difference coefficients of correlation (rho) were computed for the relationships between I.Q.'s and trials and errors to the verbal learning criterion, sorting errors, and retention errors (Table 5). Rho's were also computed for the relationships between I.Q.'s and sorting errors for the see, discriminate, and name and control groups.

The 10 rho's involving trials and errors to the verbal learning criterion and retention errors ranged from -.34 to -.72. While only three were significant at the 5% level, the general consistency suggested weak, but possibly significant, relationships between I.Q. and these measures. None of the eight coefficients for I.Q. and sorting errors, which varied from -.52 to +.21 were significant, thus suggesting that I.Q. was probably not related to sorting errors.

Pre-sorting experiences. Means and standard deviations of trials and errors to criterion, total verbalization trials, and total time for verbalization experiences for both normals and schizophrenics in the familiar word and nonsense syllable conditions are summarized in Table 6. The time required for the six see, discriminate, and name trials is also given in Table 6. The time per complete trial for the six groups was approximately equal, with an average of about three minutes per trial.

Table 5

Rank-difference Coefficients of Correlation (Rho's) between I.Q.'s and Pre-sorting Trials and Errors to the Verbal Learning Criterion, Sorting Errors, and Retention Errors*

Group	Pre-sorting Trials	Pre-sorting Errors	Sorting Errors	Retention Errors
FW-N	--**	-.45	-.52	---**
NS-N	-.70	-.72	-.41	-.62
SDN-N			-.50	
C-N			-.11	
FW-S	-.44	-.48	.00	-.65
NS-S	-.48	-.70	-.37	-.34
SDN-S			+.21	
C-S			-.20	

* A Rank-difference Coefficient of from .70 - .75 is necessary for significance at the .05 level for 8 df.

** Not computed because of lack of variability in criterion measures.

Table 6

Means and Standard Deviation of Trials and Errors to Criterion, Total Trials, and Total Times in Min. for the Familiar Word, Nonsense Syllable, and See, Discriminate, and Name Groups

Group	Trials to Criterion		Errors to Criterion		Total Trials		Total Time in Min.	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FW-N	1.5	0.7	13.2	4.4	2.5	2.2	7.1	2.5
NS-N	4.2	2.2	38.6	18.7	5.2	2.2	16.2	6.7
SDN-N	6.0	---	---	---	---	---	16.9	2.4
FW-S	3.7	2.4	34.7	20.5	4.7	2.4	15.9	9.6
NS-S	10.3	2.9	96.7	27.9	11.3	3.3	34.4	9.1
SDN-S	6.0	---	---	---	---	---	17.8	1.3

A 2 x 2 factorial analysis of variance design was used to test hypotheses of no differences among means of trials and of errors to the verbal learning criterion of 14 or 16 correct anticipations attributable to the following conditions: (a) type of verbal response (familiar words or nonsense syllables) (b) types of S (normals or schizophrenics), and (c) interaction of type of response and S (Table 7). The F's for type of response, S, and interaction for both trial and error measures were significant at beyond the 1% level. Pairs of means of trials and errors to criterion were also compared by the t-test (Table 8). The results of these comparisons indicated that FW groups learned the verbal task more rapidly and with fewer errors than the other three verbalization groups. While the difference between the means of FW-S and NS-N were not significant, both FW-S and NS-N were superior to NS-S. It was concluded, therefore, that both normals and schizophrenics learned familiar words more rapidly than the same type of S learned nonsense syllables, as is reasonable to expect. Furthermore, the significant F's for interaction suggested that learning nonsense syllables was relatively more difficult for schizophrenics than for normals. Finally, normals learned nonsense syllables as rapidly as schizophrenics learned familiar words, and more rapidly than schizophrenics learned nonsense syllables.

In order to check the possibility that the observed differences among the trial and error means of the four groups

Table 7

Summaries of Analyses of Variance of Trials and Errors to Criterion

Measure	Source	df	SS	MS	F
Trials to Criterion	Responses	1	170.23	170.23	32.18*
	Ss	1	216.23	216.23	40.88*
	Responses x Ss	1	40.02	40.02	7.56*
	Within	36	190.30	5.29	
	Total	39	616.78		
Errors to Criterion	Responses	1	19096.9	19096.9	44.08*
	Ss	1	15840.4	15840.4	36.57*
	Responses x Ss	1	3348.9	3348.9	7.73*
	Within	36	15594.2	433.2	
	Total	39	53880.4		

* Significant at or beyond the .01 level for 1 and 36 df.

Table 8

Comparisons of Differences between Pairs of Unadjusted Means of Trials and Errors to Criterion by t's.

Groups Compared (Higher First)	Differences in Unadjusted Means of: Trials to Criterion	Errors to Criterion
FW-N vs. NS-N	2.7*	25.4**
FW-N vs. FW-S	2.2*	21.5**
FW-N vs. NS-S	8.8*	83.5**
FW-S vs. NS-N	0.5	3.9
FW-S vs. NS-S	6.6*	62.0**
NS-N vs. NS-S	6.1*	58.1**

* Using the mean square for within groups to estimate the error variance, differences between means of 2.1 or greater yield a t significant at the 5% level for 36 df.

** Using the mean square for within groups to estimate the error variance, differences between means of 18.7 or greater yield a t significant at the 5% level for 36 df.

could be attributed to the higher I.Q.'s of the normal Ss, the data were also treated by analysis of covariance. The over-all F's for the mean numbers of trials and errors to criterion, which had been adjusted for initial differences in I.Q.,were significant at beyond the 1% level (Table 9). Therefore, hypotheses of no differences among adjusted means of trials and errors to criterion were rejected. When differences among pairs of adjusted means of trials and errors (Table 10) were tested by t's (Table 11) the same patterns of significant and non-significant differences were obtained as was the case for unadjusted means. Therefore, there was no need to alter the above noted conclusions based on analysis of variance and ts for differences between pairs of unadjusted means.

Block-sorting test. Table 12 presents means and standard deviations of sorting errors over the four sorting trials for each of the eight groups. Error, as used here, means merely that Ss did not place the blocks according to E's criterion of height-size, (see appendix for raw data). There is no implication that other concepts were not employed over the four sorting trials for each of the eight groups. In fact, such concepts were employed and will be described below.

A factorial analysis of variance in terms of type of presorting condition (familiar words, nonsense syllables, see, discriminate, and name, and control and type of S yielded only one F, that for type of condition, significant at the

Table 9

Summaries of Analyses of Covariance for Trials

and Errors to Criterion

Measure	Source	df	SS for I.Q.	SS for Trials	Sums of Cross-Products	SS Adjusted	df	Adjusted ms	
Trials	Groups	3	1170.88	426.48	-258.12	389.33	3	129.78	
to	Within	36	6940.90	190.30	-580.60	141.73	35	4.05	
Criterion	Total	39	8111.78	616.78	-838.72	531.06	38		
Errors	Groups	3	1170.88	38286.20	-2507.80	34673.11	3	11557.70	*
to	Within	36	6940.90	15594.20	-5668.80	10965.35	35	313.30	
Criterion	Total	39	8111.78	53880.40	-8176.60	45638.46	38		

* Significant at beyond the .01 level for 3 and 35 df.

Table 10

Adjusted Means for the Four Pre-sorting Verbalization Groups

Group	Adjusted Means of: Trials to Criterion	Errors to Criterion
FS-M	1.8	16.2
NS-M	4.0	44.1
FS-S	3.1	29.0
NS-S	10.0	94.1

Table 11

Comparisons of Differences between Pairs of Adjusted Means of Trials and Errors to Criterion by t's.

Groups Compared (Higher First)	Differences in Adjusted Means of: Trials to Criterion	Errors to Criterion
FW-N vs. NS-N	3.0*	27.9**
FW-N vs. FW-S	1.3	12.8
FW-N vs. NS-S	8.2*	77.9**
FW-N vs. NS-N	1.7	15.1
FW-S vs. NS-S	6.9*	65.1**
NS-N vs. NS-S	5.2*	50.0**

* Using the adjusted mean square for within groups to estimate the error variance differences between means of 1.9 or greater yield a t significant at the 5% level for 35 df.

** Using the adjusted mean square for within groups to estimate the error variance, differences between means of 18.7 or greater yield a t significant at the 5% level for 35 df.

Table 12

Means and Standard Deviations of Total Errors over Four Block-sorting Test Trials

Condition	Normals		Schizophrenics	
	Mean	SD	Mean	SD
Familiar Word	10.2	11.3	15.4	13.7
Nonsense Syllable	10.0	10.3	22.1	20.4
See, Discriminate, Name	42.7	7.2	41.6	6.6
Control	41.5	5.7	41.1	6.8

1% level (Table 13). Thus, the pre-sorting verbalization experiences of learning familiar words or nonsense syllable led to fewer sorting errors. However, there was no difference between the means of sorting errors for normals and schizophrenics across all pre-sorting conditions.

When differences among the adjusted means of total errors for the eight groups were tested my means of analysis of covariance, the F of 16.04 permitted rejection of the null hypothsis at beyond the 1% level of significance (Table 14). While not formally tested by analysis of covariance procedures, inspection of the adjusted means indicates that the familiar word and nonsense syllable experience, were largely responsible for these differences (Table 15).

Null hypotheses with respect to differences between pairs of unadjusted means of errors as well as between pairs of adjusted means of errors were tested by t's. Table 16 and 17 summarizes these differences. Using the mean square for within groups from the analyses of variance and covariance to estimate the error variances of these tests, a difference between unadjusted means of 11.1 was necessary for significance at the 5% level. For adjusted means this difference was 10.5.

Comparisons of both unadjusted and adjusted means indicated that each of the normal and schizophrenic familiar word and nonsense syllable groups made significantly fewer errors than the remaining four groups. None of the differences among pairs of see, discriminate, and name and control groups were

Table 13

Summary of Factorial Analysis of Variance of Means of Total Errors over the Four Sorting Trials

Source	df	SS	ms	F
Conditions	3	15018.65	5006.22	32.49*
Subjects Normality	1	312.05	312.05	2.02
Conditions X Normality Subjects	3	562.05	189.35	1.22
Within	72	11092.80	154.07	
Total	79			

* Significant at the .01 level for 3 and 72 df.

Table 14

Summary of Analysis of Covariance of Means of Total Sorting Errors over the four Sorting Trials

Source	df	SS for IQ	SS for Sorting Errors	Sum of Cross-products	SS Adjusted	df	Adjusted ms	F
Groups	7	3,289.19	14,992.75	96.87	15,353.49	7	2,193.35	16.04*
Within	72	14,428.70	11,992.80	5,740.90	9,708.61	71	136.74	
Total	79	17,717.89	26,985.55	5,827.77	25,062.10	78		

* Significant at the .01 level for 7 and 71 df.

Table 15

Adjusted Means of Total Errors over the Four Sorting Trials

Condition	Normals	Schizophrenics
Familiar Word	11.4	12.4
Nonsense Syllable	12.4	20.6
See, Discriminate, and Name	44.6	39.6
Control	45.5	37.9

Table 16

Differences (with Signs Disregarded) between Unadjusted Means of Sorting Errors over the Four Sorting Trials

	FW-N	NS-N	SDN-N	C-N	FW-S	NS-S	SDN-S	C-S
FW-N	0.2	32.5*	31.3*	2.3	11.9*	31.4*	30.9*	
NS-N		32.7*	31.5*	5.4	12.1*	31.6*	41.1*	
SDN-N			1.2	27.3*	20.6*	1.1	1.6	
C-N			26.1*	19.4*	0.1	0.4		
FW-S				6.7	26.2*	25.7*		
NS-S					19.5*	19.0*		
SDN-S						0.5		

* Significant at the .05 level for 72 df.

Table 17

Differences, (with Signs Disregarded) between Adjusted Means of Sorting Errors over the Four Sorting Trials

	NS-N	SDN-N	C-N	FW-S	NS-S	SDN-S	C-S
FW-N	1.0	33.2*	34.1*	1.0	9.2	28.2*	26.5*
NS-N		33.2*	33.1*	0.0	8.2	27.2*	25.5*
SDN-N			0.9	32.2*	24.0*	5.0	6.7
C-N				33.1*	24.9*	5.9	7.6
FW-S					8.2	27.2*	25.5*
NS-S						19.0*	17.3*
SDN-S							1.7

* Significant at the .05 level for 71 df.

significant. The unadjusted and adjusted means of FW-N, NS-N, and FW-S did not differ beyond chance expectations. While the unadjusted means of FW-N and NS-N were significantly smaller than the unadjusted mean of 22.1 errors for NS-S, the differences between adjusted means failed to reach the 5% level of significance.

The see, discriminate, and name and control normals and schizophrenics sorted the blocks into height-size categories with greater consistancy than that expected by chance alone. This suggested that Ss in these conditions were sorting on the basis of other characteristics. Therefore, placements of every block were examined to ascertain the characteristics which determined their categorization.

Table 18 summarizes the means of the number of blocks to be sorted whose characteristics coincided with the four blocks placed in the four corners of the sorting panel. This procedure showed that the verbal training groups sorted according to height and size both separately and in combination. The first-order preferences of the see, discriminate, and name Ss were shape, color, height, and size, in that order. With the exception of group SDN-S which sorted by height-color slightly more than shape-size, the order of preference for second order categories was shape-color, shape-height, shape-size, color-height, color-size, and height-size. Thus, the height-size training category was least preferred by those Ss who had not

Table 18

Means of Numbers of Placements According to First, Second, and Third-order Categories

	First-order				Second-order						Third-order			
Group	Shape	Color	Height	Size	Shape Color	Shape Height	Shape Size	Color Height	Color Size	Height Size	Shape Color Height	Shape Color Size	Shape Height Size	Color Height Size
FW-N	24.3	18.6	44.3	39.2	6.1	21.1	15.8	15.5	14.0	37.9	3.6	1.1	11.6	3.6
FW-S	27.1	19.5	41.5	35.9	8.7	21.8	15.3	14.6	12.4	32.8	4.5	2.0	9.9	4.5
NS-N	20.8	18.0	43.2	40.1	4.1	18.4	14.8	14.5	14.2	37.0	2.5	0.8	13.6	12.0
NS-S	31.7	26.1	37.0	32.1	17.8	21.1	15.6	15.5	13.4	26.0	7.1	5.1	10.5	8.0
SDN-N	46.4	39.6	21.3	17.8	38.8	19.8	16.1	14.4	12.9	5.3	13.7	12.1	3.3	0.7
SDN-S	43.3	36.5	23.7	17.2	32.9	21.6	13.9	14.4	12.2	6.5	12.4	9.4	4.5	1.5
C-N	42.9	35.0	24.4	17.7	32.6	21.3	14.1	13.8	11.5	6.1	12.7	9.9	4.5	0.6
C-S	45.5	34.8	25.2	17.4	33.4	23.7	15.2	14.0	10.4	7.1	13.1	9.3	5.8	0.5

had the common name learning experience. In general, the *see*, *discriminate*, and *name*, and *control* Ss did not sort in terms of third-order categories. When they did, shape-height-size, and particularly color-height-size were rarely employed. It will also be noted that means of frequencies of placement with respect to each of the various categories are strikingly similar among the four *see*, *discriminate*, and *name* and *control* groups.

Retention of verbal responses. Immediately following the sorting test Ss in the four pre-sorting verbal learning groups were tested for retention of verbal responses. Means and standard deviations of retention errors are presented in Table 19. Analysis of these differences by a 2 x 2 analysis of variance resulted in significant F's for *familiar word* vs. *nonsense syllable* and normal vs. schizophrenic sources of variation (Table 20). Analysis of covariance indicated that, when means of errors were adjusted for initial differences in I.Q., differences among the adjusted means were significant at beyond the 1% level (Table 21). Although these differences were significant it should be noted that all groups retained the labels at fairly high levels, the lowest being 4.9 errors or 11.1 correct responses.

For *t*-tests based on error estimates computed from the unadjusted and adjusted mean squares for within groups, a difference of 2.10 between pairs of unadjusted means of errors, and of 1.85 for adjusted means was necessary for

Table 19

Means and Standard Deviations of Retention Errors for Verbal Learning Groups

Condition	Normals		Schizophrenics	
	Means	SD	Means	SD
Familiar Word	0.8	1.4	1.9	1.7
Nonsense Syllable	2.5	2.6	4.9	.9

Table 20

Analysis of Variance of Means of Retention Errors

Source	df	SS	ms	F
Familiar Word vs. Nonsense Syllable	1	55.23	55.23	10.15**
Normal vs. Schizophrenic	1	30.63	30.63	5.63*
Interaction	1	4.22	4.22	
Within Cells	36	195.90	5.44	
Total	39			

* Significant at .05 level for 1 and 36 df.
** Significant at .01 level for 1 and 36 df.

Table 21

Summary of Analysis of Covariance of Means of Retention Errors

Source	df	SS for I.Q.	SS for Retention Errors	Sums of Cross-products	Adjusted SS	df	Adjusted ms	F
Groups	3	1170.88	90.08	96.02	86.27	3	28.76	7.21*
Within	36	6940.90	195.90	624.90	139.64	35	3.99	
Total	39	8111.78	285.98	720.92	221.91			

* Significant at the .01 level for 3 and 35 df.

significance at the 5% level,(Tables 22, 23). While the differences between the unadjusted means of FW-N and NS-N were not significant, adjustment of these means showed significantly fewer errors for FW-N. The differences between the pairs of unadjusted and of adjusted means of errors for FW-N and FW-S were not significant. However, those between FW-N and NS-S were significant. While failing to reach significance for unadjusted means, the difference between the adjusted means of FW-S and NS-N in favor of the former groups, were barely short of the 5% level of significance. FW-S made significantly fewer retention errors than NS-S. This was not the case for the difference between the adjusted means of NS-N and NS-S. Thus, both normals and schizophrenics retained meaningful labels better than nonsense syllables. The differences between adjusted means for normals and schizophrenics with the same verbal responses, however, could have resulted from chance factors.

Table 22

Adjusted Means of Retention Errors

Condition	Normals	Schizophrenics
Familiar Word	0.9	1.3
Nonsense Syllable	3.1	4.6

Table 23

Differences between Unadjusted and Adjusted Means

of Retention Errors

Groups Compared (Height first)	Differences (Sign Disregarded) Between: Unadjusted Means*	Adjusted Means**
FW-N and NS-N	1.7	2.2**
FW-N and FW-S	1.1	0.4
FW-N and NS-S	4.1*	3.7**
FW-S and NS-N	0.7	1.8
FW-S and NS-S	3.0*	3.3**
NS-N and NS-S	2.4*	1.5

* Differences of 2.10 significant at .05 level for 36 df.

** Differences of 1.85 significant at .05 level for 35 df.

DISCUSSION

Pre-sorting experiences. Both normals and paranoids learned familiar words more rapidly than nonsense syllables. This finding is consistent with other data which indicates that rate of acquisition of verbal response increases with increased familiarity and meaningfulness of the stimuli (13). Also, the more rapid learning of normals, when compared to schizophrenics responding with the same familiar word or nonsense syllable labels, provides additional confirmation of prior observations that schizophrenics tend to perform more poorly than normals (11).

Block-sorting test. Both normals and schizophrenic groups, who had learned the same familiar word or nonsense syllable names for blocks within each of the four height-size categories, made significantly fewer sorting errors on the same test trials than did the Ss of the see, discriminate, and name and control groups.

During the four sorting trials E provided no reinforcement of correct placements. Therefore, it is not surprising that the sorting behavior of the see, discriminate, and name and control normals and schizophrenics remained at low levels with respect to height-size placements. The frequencies of their placements were probably due to Ss preferences for shape-color and, to a lesser degree, shape-size categories.

The performance of the see, discriminate, and name groups, when compared to that of the controls, suggests that exposure to and familiarization with the blocks had no effect on sorting behavior as indicated by the equality of means of sorting errors as well as of means of placements for these four groups across each of the first, second and third- order categories. It is possible, but not likely, that the instructions to discriminate among and give different names to the blocks may have worked against correct placements by Ss in the see, discriminate and name groups. It seems doubtful, however, that the SDN-S group was handicapped by having a smaller number of pre-sorting trials than the NS-S groups, particularly since this group had more trials than the FS-S group.

There is some evidence that exposure to and familiarization with the stimuli of some tasks leads to positive transfer to those tasks (7). This is apparently not the case with the block-sorting test of this study. Thus, the results of the block-sorting test seem consistent with the hypothesis that learning common names for all stimuli with a given category should facilitate subsequent placement of blocks within that category.

For normals there was no evidence that, when both types of verbal materials were learned to a fairly high level of mastery, familiar words were more effective bases for transfer than nonsense syllables. Also, while schizophrenics

learned the verbal responses less rapidly than normals, it would seem that, given the same final level of verbal learning, the degree of transfer approximated that of the normals. Thus, these results suggest that schizophrenics are not always markedly inferior to normals with respect to conceptual behavior.

The present findings could also be interpreted as indicating that verbal learning had provided the schizophrenics with the "abstract attitude" or "set," a condition which has been presumed to be depressed or absent in such Ss. There is, therefore, some evidence in the equal achievement of the schizophrenics, for the hypothesized equivalence of the "abstract" attitude and the mechanisms of acquired equivalence and acquired distinctiveness. However, this conclusion is most tentative. The Ss of this study were relatively young, non-deteriorated paranoids. Other groups or types of schizophrenics might not be able to learn verbal responses to high levels of proficiency. Moreover, other conceptual tasks might yield different results.

The analysis of placements of the see, discriminate, and name groups and of the controls indicated that these Ss tended to sort according to shape and color both separately and combined, that is, they were responding on the basis of shape, color, or shape-color concepts. It seems likely, therefore, that training to label according to height-size involved training against initial sorting or conceptual perferences.

If so, Ss should be able to learn labels for shape-color more rapidly than for height-size. Furthermore, if shape-color categories were to be used as bases for sorting, almost error-less performance would be expected of Ss who had previously learned common labels for blocks within each of these categories.

Retention of verbal responses. Retention of verbal labels was high for all verbal learning groups. Familiar words were better retained than nonsense syllables by both normals and schizophrenics as was expected (13). However, differences between normals and schizophrenics making the same verbal responses were not significant.

SUMMARY

It was hypothesized that learning the same name for blocks within a given height-size category and a different common name for all blocks within each of three other height-size categories would facilitate subsequent placement of blocks into appropriate height-size categories. In addition, the effects of such pre-training in labelling on subsequent sorting performance of both normals and paranoid schizophrenics was to be compared.

Forty normals and 40 schizophrenics were each divided into four groups of 10 Ss each. These groups were equated for sex and age but the groups of normals had significantly higher I.Q.'s. Sixteen blocks served as stimuli for pre-sorting experiences and a block-sorting test. The pre-sorting experience of one group of normals and one of schizophrenics involved learning different familiar words for four blocks within each of four height-size categories. Another group of normals and of schizophrenics learned nonsense syllable names for the blocks. A third group of normals and of schizophrenics saw the blocks under instruction to see, discriminate among, and name them. These six groups plus normal and schizophrenic controls were then given four trials on a block-sorting task.

In accordance with the experimental hypothesis the normals and schizophrenics who had learned familiar word or nonsense

syllable responses for blocks within given categories were able to sort blocks into these categories with fewer errors than Ss in the see, discriminate, and name or control conditions. An analysis of placements, however, indicated that Ss without height-size verbalization experiences sorted according to shape, color, and shape-color.

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APPENDIX

Table 11

Ages and I.Q.'s of Ss in the Eight Experimental Groups

Subject	Sex	Condition PW Age	PW IQ	HS Age	HS IQ	JAM Age	JAM IQ	C Age	C IQ
Normals	M	25	127	20	91	35	109	28	137
	M	26	96	26	115	36	122	26	133
	M	28	120	31	111	40	111	40	115
	M	31	92	31	139	21	110	21	118
	M	39	109	40	95	24	130	37	77
	F	20	115	20	110	40	123	40	121
	F	21	110	21	110	36	99	23	133
	F	23	109	29	127	29	104	33	110
	F	36	116	24	104	32	113	28	127
	F	33	113	24	139	39	106	25	110
Schizophrenics	M	35	99	33	107	34*	92	28	80
	M	29	80	20*	97	27	112	20	91
	M	25*	115	33**	88	28	71	32	104
	M	32	88	29	97	32**	107	40	111
	M	35	116	39	101	37**	119	34**	97
	F	24	87	39	118	35	112	38	120
	F	35	82	36	106	22	118	40	89
	F	34	122	33	104	38	78	33	104
	F	39	123	22	105	40	121	29	105
	F	27	92	22	119	22	101	20	100

* From Gardner State Hospital

** From Worcester State Hospital

Table 12

Sorting Errors for the Four Trials Separately and Combined

Condition	Normals Trials					Schizophrenics Trials				
	1	2	3	4	Combined	1	2	3	4	Combined
FW	0	0	0	0	0	9	9	8	10	36
	4	1	0	0	5	1	2	0	0	3
	1	12	1	12	26	1	0	0	0	1
	9	9	8	3	29	0	2	9	1	12
	0	0	0	0	0	10	1	2	3	16
	0	0	0	0	0	8	8	8	3	27
	8	8	8	1	25	0	0	0	0	0
	2	1	1	0	4	12	12	0	0	24
	2	0	0	0	2	0	0	0	0	0
	10	1	0	0	11	10	12	4	9	35
NS	1	0	0	0	1	1	0	0	0	1
	0	0	3	0	3	9	8	8	8	33
	1	0	4	6	11	12	8	5	8	33
	1	0	0	1	2	12	12	12	11	47
	7	5	4	8	24	12	12	12	12	48
	3	0	0	0	3	0	5	2	0	7
	5	7	1	4	17	12	12	12	12	48
	2	4	0	0	6	0	0	0	0	0
	7	8	9	8	32	0	0	1	0	1
	1	0	0	0	1	3	0	0	0	3
SDN	12	12	12	12	48	12	12	12	12	48
	11	10	10	9	40	12	12	12	12	48
	12	12	12	12	48	8	8	10	8	34
	12	12	12	12	48	9	8	11	8	36
	12	12	1	0	25	12	12	12	12	48
	9	9	10	12	40	12	12	12	12	48
	8	8	10	10	36	12	12	12	12	48
	12	12	12	12	48	9	7	11	12	39
	12	12	12	12	48	10	8	9	7	34

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