THE EFFECT OF VERBAL LABELING ON THE REPRODUCTION OF DESIGNS OF SCHIZOPHRENIC AND NONSCHIZOPHRENIC GROUPS

A Thesis

Presented to

The Faculty of the Department of Psychology

The University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

---

by

B. L. Atkison

August 1963

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ABSTRACT

The purpose of this experiment was to study some of the differences in the perception of schizophrenics and normal subjects, especially when past experience (in the form of verbal labels) was introduced into the experimental situation.

The procedure involved flashing designs tachistoscopically and having the Cs draw what they saw. Past experience was introduced to the experimental group by giving the designs labels that did not fit them with complete accuracy. It was hypothesized that, under this condition, distortions in the "direction of the label" would be more pronounced in the reproductions of the normal observers.

The results, under control conditions, were that the schizophrenics produced more distorted reproductions than did the nonschizophrenics. This was as predicted and is consistent with previous research findings.

The results with P (distortions in the direction of the label) were more equivocal. When only dichotomous judgments (marked "P" and "No P") were considered, the performance of the schizophrenics appeared to be more affected than that of normal observers. However, when the designs were divided into three equal groups, from most like the label to least like the label, another answer became

apparent. It was found that normal observers, under experimental conditions of the label set, reproduced drawings that reflected elements of both the percept and the introduced disparate concept (i.e., "label"). As a group, schizophrenic observers could not make this compromise; thus, their performance was interpreted as reflecting a lack of ability to assimilate divergent information and a lack of accuracy in distinguishing relevant from irrelevant in processing this information. Schizophrenic performance in this study was interpreted to be consonant with that of previous studies in terms of such characteristics of schizophrenic behavior as over-literalness and over-inclusiveness.

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CHAPTER I

INTRODUCTION

The primary purpose of this study is to attempt to provide a modest extension to the knowledge already developed concerning differences in perceptual organization between schizophrenic and non-schizophrenic populations. The basic assumption in the above statement--that schizophrenics do perceive the world differently--is supported by a number of studies, e.g., Dunn (1954); Harris (1958); Niebuhr and Cohen (1956); Lovinger (1956); Cohen, Senf and Huston (1956); Cooper (1960); Weckowicz and Witney (1960); and Snyder, Rosenthal and Taylor (1961).

This assumption is also explicit in, at least, two theories of schizophrenia (Arieti, 1955; McReynolds, 1960). Both of these theories postulate that one of the primary differences between normals and schizophrenics in their perceptual transactions concerns differences in effectiveness in assimilating past and present experience. This more specific assumption is supported by the studies of Weckowicz and Witney (1960) and Snyder, Rosenthal and Taylor (1961). The difference seems to be that the schizophrenics are not as efficient in the systematic usage of past experiences as guide lines for coding ongoing perceptual experience.

There have been a number of experiments that have demonstrated that the perceptual organization of normal observers

(Os) is influenced by past experiences, e.g., Bruner and Goodman (1947); Bruner and Postman (1948); Lambert, Solomon and Watson (1949); Perky (1910); Duncker (1939); Bruner, Postman and Rodrigues (1951); Schafer and Murphy (1943); Haggard and Rose (1944), and Carmichael, Hogan and Walter (1932).

At this point, let us set forth special usages in this report for one or two key terms; we shall then give a synoptic statement of the experimental problem.

Perception

Unless otherwise stated, in this report, "perception" refers to visual perception. Further, the term "perception" is used rather loosely to include overt behaviors from which the process of perceptual experiencing is inferred. For example, although "size judgments," "color judgments", "distance judgments", graphic reproductions, etc. are not, strictly speaking, direct representatives of pure perceptual acts, they are frequently interpreted as if this were so. We make this point, at the risk of dwelling upon the obvious, because we feel that the danger of misinterpretation is particularly prevalent in this research area.

In the present study, perceptual organization is inferred from the Os' graphic reproductions of visual stimuli. Although this procedure introduces a certain amount of additional error variance, it does provide the opportunity for a relatively objective system of data analysis.

Past Experience

In this report, "past experience" refers to any prevailing influence upon perception other than that exerted by the absolute characteristics of currently-existent stimuli. Thus, "past experience" may refer to such diverse sources of influence as prior learning (or over-learning), experimental sets, specific or general attitudes, etc.

In the present study, "past experience" was introduced by "labeling" the stimuli at the time of presentation. The label was selected to elicit an "image" (i.e., a familiar representative of past experience) at variance with the actual ambiguous perceptual characteristics of the presented figure.

Statement of Problem

Semi-amorphous designs were presented tachistoscopically to 30 normals and 30 schizophrenics. The Os were asked to draw what they saw. To observe the effects of past experience, E labeled the designs, as described above, for 15 Os in each of the two groups. First, the reproductions were judged to determine if a subgroup of schizophrenics who were not told the "name" of the designs made more distortions than a corresponding group of nonschizophrenics. Second, the reproductions were judged to determine whether or not the introduction of the label produced differential effects upon other subgroups of schizophrenic and nonschizophrenic Os.

CHAPTER II

BACKGROUND AND HISTORY

There have been a number of experimental attempts in the past few years to demonstrate how past experience, either general or specific in nature, affects the perception of normal persons. In this chapter, some examples of these studies are presented in order to give a picture of the results with normal Os (Observers) as a background for other studies using schizophrenic Os. Some of the studies using schizophrenics are then presented for contrast. Finally, the hypotheses of this investigation are stated.

First, let us look at the effect on perception of a specific type of past experience--past experience with special meaning for a person or group. The experiment that started this series and remains the classic is the one by Bruner and Goodman (1947). In this study, two experimental groups, one of "rich" children and one of "poor" children, were asked to judge the sizes of coins. Comparably-sized cardboard discs were judged by control groups. It was found that not only were the coins judged as larger than the cardboard discs but, also, the poor children perceived the coins to be larger than did the rich children.

Bruner and Postman (1948) had women college students adjust a spot of light to make it the same size as various stimulus discs. The discs were of different sizes, and had positive (dollar), negative (swastika), or neutral (diagonals) symbols on them. It was found that the size of the discs, as

well as the values assigned to them, produced variation in the accuracy of size judgments. Increased size of the discs, positively valued symbols, and negatively valued symbols all produced overestimations of size. The positively valued symbol was judged as larger than the negatively valued symbol, and both were estimated as larger than the symbol with neutral value.

The possibility that the differences in size estimation were due to inherent differences in the properties of the stimuli (Ss), rather than to differences in the value orientation of the Os, was investigated in another study (Lambert, Solomon and Watson, 1949). It was found that, when a poker chip became a secondary reinforcer, children overestimated its size in comparison with other children to whom the poker chip was not a secondary reinforcer. The poker chip became a secondary reinforcer for the Os in the experimental group when the E (experimenter) gave poker chips in return for work performed, then allowed the children to use the chips to buy candy. The control group did the same work and received the candy, but without the use of poker chips. After ten days, the estimates of size of the chips by the Os in the experimental group were significantly larger than those given by the Os in the control group. After one day of extinction, in which candy was no longer given for the chips, the control group and the experimental group did not differ in their estimates of the size of the chips. Then, with one additional day of training

in which the chips were again used by the experimental group to buy candy, this group again overestimated the size in comparison with the control group. However, this group difference was not as large as it had been before the extinction period.

These studies all indicate that an object that has special meaning for a person or group may be perceived differently (at least in terms of size) than equivalent objects of neutral value. The question arises, how does past experience in a more general sense influence perceptual organization? The studies reported below are attempts to meet this question.

One of the first persons to make an experimental study of perception as it is related to other general factors of experience was Perky (1910). Among other things she found that, by instructing an O to look at a neutral field and to imagine he was looking at a certain object, she could project a distinctly visible image on the field without the O's realizing that he was actually seeing the object and not merely imagining it. From this experiment and others in her series, she concluded that the "image of imagination" is not completely dissimilar to the equivalent perceptual experience of the present.

Since that time, there have been a number of experimental attempts to demonstrate some of the more general effects of past experience upon perception. For example, Duncker's (1939) first set of experiments involved having Os match the color of familiar objects on a color wheel. His Ss consisted of an artificial leaf and a donkey that were made of the same material and were about

the same in size. Although the two Ss were the same color the Os, in using the color wheel, judged the leaf to be greener than the donkey. In another experiment in the same series, Duncker had Os eat chocolate and report on their experience. He used both regular dark chocolate and white chocolate which was new and unfamiliar to the Os. He found that, when the Os were blindfolded, they could not tell the difference between the two kinds of candy; but when they were able to see the white candy, they reported that they did not like the taste because it was "too milky," "too buttery," etc. The conditions which Duncker considered important to produce perceptual distortion as an effect of past experience were some degree of ambiguity and a naive subject. He found, for example, that a painter who was used to working with colors did not misperceive the color of objects.

Another experiment in which color was used as a means of studying the influence of past experience on perception is a more recent study by Bruner, Postman and Rodrigues (1951). They instructed four groups of Os to judge the color of ovaloid and elongated ellipsoid Ss; these Ss were given names, i.e., tomato, tangerine, lemon, boiled lobster claw, carrot and banana. Each of the objects to be judged was actually the same color. The situation for the four groups differed in terms of amounts of information given concerning the experimental procedure. For example, one group was given only the minimum information essential for performing as an O. Another group had the experiment

thoroughly explained in advance. This explanation included such information as the fact that all Ss were actually the same color. The four groups were divided into subgroups on the basis of differences in procedure followed to match the color of the S with a color on a color wheel. The methods of presentation were: simultaneous presentation of S and color wheel, successive presentation of S and then the color wheel, and matching the color of the S from memory. It was found that amount of information was positively associated with accuracy of perception. It was also found that simultaneous matching was more accurate than successive matching, and that both of these were more accurate than matching from memory. The inaccuracies in perception were in the direction of the labels. For example, the S termed a "tomato" was judged to be redder than the S labeled as a "lemon." When the Os were matching colors directly, under good lighting and with complete information as to what was happening, the influence of past learning upon perception was negligible.

From these two groups of experiments, it appears that accuracy of perception (at least as concerns the stimulus qualities of size and color) is to some extent influenced by past experience. The consensus seems to be that as the stimulus situation becomes more ambiguous, the O is more inclined to use past experience to organize his perceptions.

If past experience does influence perception, then it should be possible to induce a certain perceptual response by

manipulating past experience. Schafer and Murphy (1943) attempted to do this. They superimposed a number of circular figures in such a way as to produce two complementary profiles. These profiles were alternately presented a number of times until the O recognized each of the profiles as it was presented. One of the two profiles was consistently rewarded. After this training period, the circles were suddenly presented together. This was done quickly, so that the O "saw" only the profile that was dominant at the presentation. The Os consistently reported seeing the previously rewarded profile.

Also, Haggard and Rose (1944) were able to condition perception. They trained their Os to "see" the autokinetic phenomenon, and found that they could condition both direction and magnitude of this perceptual illusion.

Let us look at one more study of the influence of past experience on the perception of normal subjects. This study (Carmichael, Hogan and Walter; 1932) will be presented in greater detail, because the procedures employed will be adapted for use in the current study. The experiment involved the effect of language on perception. The procedure was to use a set of 12 drawn figures, well defined but not clearly recognizable as familiar objects. For one group, each figure presentation was preceded by a spoken word or "label," representing a familiar object. A second group was presented the same pictures, but with a different set of labels for them. The third group was used as a control; the figures were simply presented separately to these Os without prior labeling. After each presentation,

the O was asked to reproduce (draw) what he had seen. The number of repetitions employed was the number of trials necessary for each O before he could reproduce recognizable facsimiles of each of the 12 figures.

The range of numbers of series of presentations was from two to eight. A five-point scale was constructed to measure the amount of distortion in the figures. A scale point of "1" was assigned to essentially accurate reproductions; "2" for slight alterations; "3" for drawings noticeably changed, but not distorted; "4" for marked changes, such as additions, omissions, etc.; and "5" for drawings almost completely changed. They found that more than half of the reproductions fell into Categories 4 and 5 of the five-point scale. They carried out a separate analysis of those reproductions judged to be in Category 5 (903 drawings). Each drawing was rated as being like or unlike "the visual representation of the figure named,"--that is, the drawing was or was not more like the object named than the figure presented. They found that 74 per cent of the distortions in the group using the first set of labels and 73 per cent of the distortions in the group using the second set of labels were more like the "visual representation of the figure named." The authors state that they did a similar analysis of the drawings in Categories 2, 3, and 4 and obtained similar results; however, these results were not reported.

Before reviewing some of the studies of perceptual differences

between schizophrenics and normals, let us briefly examine two attempts to set forth a rationale to account for these differences.

First, let us consider Arieti (1955). Although Arieti says nothing about perceptual processes as such, he does say a great deal that can be translated into these terms. For example, he discusses the schizophrenic's withdrawal from social situations and the schizophrenic's decreased use of symbols commonly employed by others. In this same vein, he characterizes schizophrenic thinking as conceptually barren. For Arieti, the process of thinking involves the use of concepts (generalizations) and percepts (specific instances); the thinking of the schizophrenic, as contrasted with the non-schizophrenic, is closer to the perceptual level than to the conceptual level. "In a certain way, the universe of the schizophrenic, of the primitive, and of the child is closer to the immediate perception, to the phenomenological world, and at the same time it is farther from the truth than ours because of its extreme subjectivity (p. 213)."

McReynolds (1960) deals more with the actual perceptual world of the schizophrenic. In fact, perception is of central importance in his theory concerning schizophrenia. According to this theory, the act of perceptual organization is a reinforcing condition. Therefore, people constantly seek the assimilation of new perceptual experience within their conceptual framework. The inability to assimilate percepts is a

basic cause of anxiety. Schizophrenia is a process which inhibits the assimilation of new percepts, and thus prevents the occurrence of reinforcement in ongoing perceptual experience, and ensures the continuance of anxiety evocation so long as the intake conditions remain unchanged. Therefore, while normals actively seek and require new perceptual experience, schizophrenics avoid new perceptions because they are anxiety-producing. This view is consonant with the results of a study by Harris (1953), who compared normals and schizophrenics under conditions of sensory deprivation. He found that, under these conditions, the schizophrenics were not as disturbed as the normals; in fact, some reported having enjoyed the experience. In addition, he reported that the schizophrenics displayed a reduced number of secondary symptoms of the disorder following the deprivation experience.

Let us now consider some of the experiments in the area of perception in which schizophrenic Os were compared with nonschizophrenic Os. The first two experiments to be considered represent attempts to combine "dynamic" and "experimental" approaches.

The first of these was carried out by Dunn (1954). He presented four series of six cartoon-like drawing depicting a mother scolding her son, a mother feeding her son, a mother whipping her son, and a neutral scene of a tree and a bush. The mother-son situations showed the mother's arm in various positions; similarly, in the tree-bush scene, one limb of the

tree was shown in correspondingly altered positions. A group of schizophrenics and a group of medical-surgical patients at a Veterans Administration Hospital made discriminatory judgments concerning the scenes as to differences in position of the mother's arm in the mother-son scenes, and in position of the limb in the tree-bush scenes. It was found that the schizophrenics judged as accurately as nonschizophrenics with the neutral and feeding scenes, but tended to do worse on the scenes involving whipping, and were significantly less accurate in judging the scolding scene. The author interpreted his findings as suggesting that schizophrenics do as well as normals on tasks that are not related to personally relevant material.

Harris (1953) had "good" premorbid schizophrenics, "poor" premorbid schizophrenics, and normals judge the sizes of pictures with various themes that presumably had special meaning for the schizophrenic. He found little group differences in judgments of mean size, although the schizophrenics were more variable in their judgments on some of the pictures. He also found that the good premorbid group performed more like the normals than did the poor premorbid group. One of his incidental findings appears to contradict Dunn's (1954) results. That is, the size judgments of the poor premorbid group were almost as inaccurate for the tree and bush (neutral) scene as for the pictures of mother-son relationships.

Apparently, at least from these two studies, there is the basis for a difference of opinion concerning the schizophrenic's

ability to make accurate perceptual judgments on impersonal material. Dunn's results suggest that schizophrenics do as well on neutral stimuli as do normals, but their performance is disrupted by significant material. Harris (1958), on the other hand, found that pictures having personal significance did not differentially disrupt the performance of his schizophrenic Os. Before considering this problem further, let us look at some experiments that used only neutral material.

Niebuhr and Cohen (1956) studies group differences among acute schizophrenics, chronic schizophrenics, and patients with neurological disorders on Bender-Gestalt reproductions from memory and by matching. Using a student nurse group as a control, they found significant differences in efficiency in each group comparison, except for the comparison between the student nurses, who were most efficient, and the acute schizophrenics who were next. The chronic schizophrenics were significantly less efficient than the acute schizophrenics and the least efficient was the neurological group.

Lovinger (1958), using a size constancy approach with varying degrees of cues, found similar differences between acute and chronic schizophrenics, with the chronic schizophrenics doing much more poorly. Actually, according to his findings, the acute schizophrenics demonstrated a slight tendency to do better than normals.

Cohen, Senf and Huston (1956) tested the performance of early schizophrenics, chronic schizophrenics, depressives and neurotics on three perceptual tasks of varying degrees of com-

plexity. They found that the chronic schizophrenics tended to do worst, and that both schizophrenic groups did less well than the other groups. One interesting finding in their experiment was that amytal enhanced the performance of the schizophrenic group on moderately structured tasks, but not on those considered most-structured, or least-structured.

Cooper (1960) compared normals to schizophrenics on simple perceptual judgments, i.e., length of Galton bar, Sander parallelogram and Kunnapas squares. She rated the schizophrenics according to degree of disturbance and correlated this variable with perceptual accuracy. She found that in every case normals were more accurate and less variable than the schizophrenics. She did not, however, find a significant correlation between degree of disturbance and perceptual accuracy.

From the results of these experiments, it appears that the necessary parameters for understanding the effect of the schizophrenic process on perceptual judgments have not as yet been delineated. This is suggested by the apparent contradictions between some of the results obtained--for example, by Dunn (1954) and by Harris (1958). The theories introduced by Arieti (1955) and by McReynolds (1960) suggest that one of the parameters distinguishing schizophrenic and nonschizophrenic performance concerns differences in the effects of past experience upon perceptual accuracy. The following two experiments may give a clue as to the nature of these effects.

In the first experiment (Weckowicz and Witney, 1960), it was found that schizophrenics were more sensitive to (that is, more influenced by) the Müller-Lyer illusion than were normals. Since it has been found that practice decreases the effects of this illusion, one would expect that if a schizophrenic is "ahistoric," he would continue to be more sensitive to the illusion.

The other experiment involved a Gestalt closure task. Snyder, Rosenthal and Taylor (1961) presented the task to normals and schizophrenics. The figures were line drawings of a boy and a house, each of which contained eight 20-millimeter gaps. When told to reproduce these figures, the schizophrenics closed significantly fewer gaps than did the normals.

The results of these two experiments suggest that the ongoing experience (as reflected in performance) of schizophrenics is not as readily assimilated with past experience (i.e., is not "coded" as efficiently) as that of normal subjects. Thus, schizophrenics did less well on a task involving practice effects, but performed with more accuracy when the criterion of successful performance was the avoidance of "normal" closure tendencies.

Let us now look briefly at the design of the present study and state the hypotheses. First, schizophrenics and nonschizophrenics were divided into four groups, Schizophrenic Control (SC), Schizophrenic Experimental (SE), Normal Control (NC) and Normal Experimental (NE). Each group was asked to reproduce (draw) ten designs presented tachistoscopically. The control

groups were simply told the "number" of each design. Each design was "labeled" (named) for the experimental group. In each case, the "label" was selected to elicit an image (i.e., a familiar representative of past experience) at variance with the actual perceptual characteristics of the presented figure.

Since previous studies of differences in perceptual judgment between schizophrenics and nonschizophrenics have generally found normals to be more accurate, the first hypothesis is: Nonschizophrenics make fewer distortions than schizophrenic under control conditions. Since the weight of evidence suggests that schizophrenics assimilate past and present experience less readily than do normals, the following additional hypotheses are made. The second hypothesis is that, of the two normal groups, the experimental group makes more distortions in the direction of the label. The third hypothesis is that the two schizophrenic groups differ in frequency of distortions "in the direction of the label" (The actual expectancy is the reverse). The fourth hypothesis, which follows from the second and third hypotheses, is that under the experimental group conditions, normals make more distortions "in the direction of the label," than do schizophrenics.

CHAPTER III

METHODS AND PROCEDURES

The methods used in this study correspond generally with those employed in the study of Carmichael, et al. (1932), with certain changes to be described below.

Observers

The Os were all inmates at the Wynn Prison Farm at Huntsville, Texas. This is a treatment center that houses schizophrenic patients as well as patients with other medical disorders. All observers were white male prisoners. There were 30 chronic schizophrenic patients of unquestioned diagnosis, and 30 control observers who were without a history or present signs of psychosis or severely incapacitating neurosis. All observers were:

1. Between the ages of 18 and 50
2. Without a history, or present signs, of organicity or epilepsy
3. Without mental deficiency
4. Without hearing defects
5. Without visual defects (if wearing glasses)
6. Without impairment of dominant arm and hand

Two lists of prisoners (one of normals, one of schizophrenics) were given to the experimenter (E); each contained the names of 34 inmates. Os were run until 30 from each list had been tested.

Apparatus

The apparatus consisted of a Gunter Tachistoscope, Model 103, and a Gunter Timer, Type 200A. The designs were drawn in India Ink on Pencron drafting plastic in such a fashion as to fit inside a circle 1 3/8 inches in diameter. The designs and

the names given to them are seen in Figure 1 (page 20).

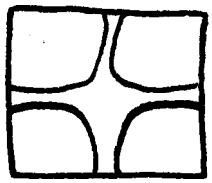
Procedure

Each O was seen individually by the E. In each case, the E introduced himself, offered the O a cigarette and instructed him as follows: "I am going to flash some designs in this box and I want you to draw what you see." The O was given a set of 3 X 3 index cards and a pencil, and asked to draw each design on the back of a separate card. Generally, these were all the instructions necessary, although an occasional observer had to be assured that artistic ability was not required. At this point, the E made certain that the O was ready, and then to the Os in the experimental group said, "This is a diamond in a rectangle; draw what you see." The Os in the control group were told, "This is Design No. 1; draw what you see." The separate designs were flashed in order, without further comment except to give the "names" for the experimental group and the design numbers for the control group. Occasionally, an O would ask a question or comment about a design and would again be told, "Draw what you see." Since there were remarkably few drawings that did not have some resemblance to the stimulus figure, these instructions appear to have been adequate for all groups. All Os were run in one and a half working days. The Os were separated into the experimental and control groups by designating every other name in the original lists as experimental, and the others as control. The Os were kept in these groups regardless of order of appearance.

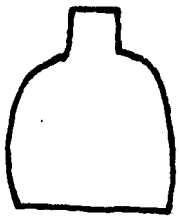
Figure 1

Designs Presented

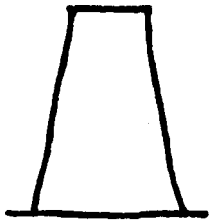
Design No. 1
Diamond in a Rectangle



Design No. 2
Bottle



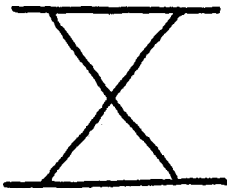
Design No. 3
Hat



Design No. 4
Dumbbell

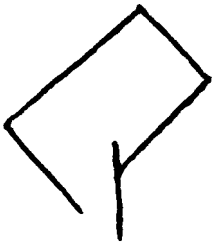
Design No. 5
The Number Four

Design No. 6
Table

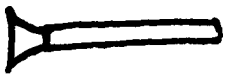


Design No. 7
Kidney Bean

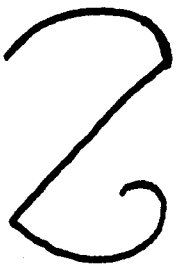
Design No. 8
Trowel



Design No. 9
Broom



Design No. 10
The Number Two



Analysis of Designs

The drawings were all labeled, in code, on the back of the cards, and separated into stacks of individual designs. The sets of cards were given to two judges who were asked to designate them D (for Distorted) if they were markedly distorted from the original design. Next, they were asked to judge the "D" cards as P (for Predicted) if they were distorted and also looked more like the visual image of the name given than like the original design. In other words, the cards designated as "D" included some that were also designated as "P." Each judge had a copy of the original designs in front of him as he made his judgments. Originally, it had been planned that both judges would have to agree that a design was distorted before it would be accepted as being D. The same criterion was to be used for P. However, examination revealed that, despite the instructions, Judge A called many more of the designs D than did Judge B. Since the original criterion would have, in effect, resulted in the use of only Judge B's data, the judgments were analyzed individually, but not combined.

Analysis of Data

Scores were obtained for each O by counting the number of D and P scores he received from each judge. Then, the two sets of judgments were correlated for each of the four subgroups as well as for the total group. The significance of differences between the two sets of judgments was estimated with t tests. Similar tests of significance were carried out for subgroup dif-

ferences for each judge. This was done for both the D scores and the P scores.

CHAPTER IV

RESULTS

Degree of Interjudge Agreement

As reported in the previous chapter, there were some clearcut, systematic differences between the two judges. As seen in Table 1, for each of the four groups, Judge A categorized a significantly greater number of the designs as distorted than did Judge B. The same tendency was evident with P judgments (distortions in the predicted direction, i.e., to look more like the label). However, as can been seen in Table 4, these latter differences were not as large nor as significant.

Despite these sizeable mean differences, the degree of correlation between judgment arrays was relatively high, as shown in Table 2. For D, the correlation was .74 overall, with correlations within the subgroups running from .40 ($p = .05$) and .48 ($p = .01$) in the NE (Normal Experimental) and SC (Schizophrenic Control) groups to .84 and .90 (both significant at the .01 level) in the NC (Normal Control) and SE (Schizophrenic Experimental) groups. The correlations of P judgments were generally lower than those involving D, but were still significant. Or, to put it another way, the differences in judgment of D concerned primarily the simple determination of the amount of distortion necessary to designate a reproduction as D; differences in P judgments presumably are traceable to more complex judgmental requirements; This distinction will be discussed more fully below.

Table 1

Mean Differences Between Two Sets of Judgments

of Total Distortions For All Four Subgroups

(N = 15 in each group)

	Judge A		Judge B			
Group	M	SD	M	SD	t	P(<)
Schizophrenic Control	8.20	1.86	5.40	2.82	5.10	.01
Schizophrenic Experimental	8.40	1.68	6.33	2.13	2.96	.01
Normal Control	6.53	2.07	3.33	1.84	4.47	.01
Normal Experimental	7.07	1.39	2.67	1.47	8.43	.01

Table 2

Pearson r Correlations Between Judgments of Judge A and Judge B, on Total Distortions and Predicted Distortions

(N = 15 in each group)

	Distortion	p	Predicted	p (/)
Schizophrenic Control	.43	.01	.34	.05
Schizophrenic Experimental	.90	.01	.79	.01
Normal Control	.83	.01	.93	.01
Normal Experimental	.40	.05	.34	.05
Four Groups (Total)	.74	.01	.54	.01

Hypothesis Number 1

The first hypothesis--the NC group makes fewer distortions than the SC group--was confirmed by the data. As shown in Table 3, both judges made a significantly greater number of judgments of D for the SC group. In fact, for each judge, each of the two normal groups made significantly fewer total distortions than either of the corresponding schizophrenic groups.

Hypothesis Number 2

Hypothesis Number 2--the NE group makes more P distortions than the NC group--was not confirmed. As is evident in Tables 5 and 6, neither judge reported significantly more P distortions for the NE group than for the NC group.

Hypothesis Number 3

Hypothesis Number 3--(in reverse form to expectancy) the number of P distortions for the SC and SE group differs-- was not confirmed since the differences did not reach significance for either judge (cf. Tables 5 and 6). However, there was a clear tendency in both sets of judgments toward more P distortions in the SE group.

Hypothesis Number 4

Hypothesis Number 4--the NE group makes more P distortions than the SE group--was not confirmed; in fact, findings were significant in the other direction for Judge B (cf. Table 6).

Further Analysis of Data

In more general terms, the first major hypothesis set forth in this study was that schizophrenics reproduce (and, thus, pre-

Table 3

Differences in Total Number of Distortions for Two Control Groups

(N = 15 in each of two groups)

	M	SD		M	SD	t	P(<)
Judge A							
Schizophrenic Control	8.20	1.86	Normal Control	6.53	2.07	2.25	.05
Judge B							
Schizophrenic Control	5.40	2.82	Normal Control	3.33	1.84	2.39	.05

Table 4

Comparison of Judgments of Predicted Distortions by Judge A and Judge B

(N = 15 in each of four groups)

	Judge A		Judge B			
Group	M	SD	M	SD	t	p (/)
Schizophrenic Control	1.40	1.54	1.07	1.21	.68	n.s.
Schizophrenic Exper.	2.47	2.93	1.67	1.24	1.51	n.s.
Normal Control	1.40	.72	.73	.79	2.11	.05
Normal Experimental	2.07	1.64	.67	.81	3.47	.01

Table 5

Group Differences in Number of Predicted

Distortions (Judge A)

(N = 15 in each of four groups)

Group	M	SD	Group	M	SD	t	p (/)
Normal Control	1.40	.72	Normal Experimental	2.07	1.64	1.69	n.s.
Schizophrenic Control	1.40	1.54	Schizophrenic Experimental	2.47	2.98	1.93	n.s.
Normal Experimental	2.07	1.64	Schizophrenic Experimental	2.47	2.98	1.64	n.s.

Table 6

Group Differences in Number of Predicted Distortions (Judge B)

(N = 15 in each of four groups)

Group	M	SD	Group	M	SD	t	p (/
Normal Control	.73	.79	Normal Experimental	.67	.81	.18	n.s.
Schizophrenic Control	1.07	1.21	Schizophrenic Experimental	1.67	1.24	1.47	n.s.
Normal Experimental	.67	.81	Schizophrenic Experimental	1.67	1.24	2.70	.02

sumably perceive) standardized stimuli with less veridicality than do normal subjects. The second major hypothesis was that, under the experimental set to assimilate current ambiguous perceptual elements into relatively well-learned conceptual classes, schizophrenics are less able than normal subjects to transcend the compelling immediacy of the current perceptual experience. In other words, schizophrenics are deficient in processing information in terms of translating it into the coding units of (what we have termed) "past experience."

The first major hypothesis was confirmed. The second was not and, in fact, the results were in a direction opposite to those expected. Thus, a re-examination of the experimental situation seemed warranted--what were the possible sources of error in the situation? The failure to confirm the expectation that schizophrenics are less able than normals to assimilate current experience with previously learned material in this particular experimental situation could be conceivably attributed to any of several factors.

First, the fault could be in the theory itself; is there a reasonable basis for the expectation that schizophrenics have special difficulty in assimilating past and current experience? The answer would seem to be that there is considerable clinical and experimental evidence to support this view, as previously cited.

A second possible source of error could be traced to sampling deficiencies--i.e., were the schizophrenic and

normal subjects chosen for this study valid representatives of those general classes? In some respects, it would appear that the choice of prisoners as subjects and the lack of closer direct controls over such possibly contributing factors as intelligence, education, etc., certainly produced a less than ideal experimental situation. However, a review of the identifying characteristics for the groups (as cited above) indicates that the prisoners were apparently a relatively homogeneous group, and that the presence or absence of schizophrenic symptomatology remains as presumably the most salient characteristic distinguishing the experimental and control groups.

Another possible source of error that was considered concerned reliability of judgments. Here, again, while the amount of absolute differences between the two sets of judgments clearly suggests that the judges were not adequately trained, the appreciable degrees of correlation between most of these sets would seem to eliminate unreliability of judgment as a major consideration.

There remained several interrelated factors that appeared to be more likely candidates as contributors to the unexpected findings concerning group differences in the assimilability of present and past experience. It was observed that, although there were a relatively large number of D judgments, the number of P judgments was proportionately much smaller, particularly for the NS group. And yet the occurrence of "predicted" distortions (i.e., "toward the direction of the label") was pre-

cisely what the experimental set was intended to produce. Did this mean that, for some reason, the Os (particularly in the NE group) were not responding to the set (i.e., that the experimental instructions were not "taking hold?").

Further reflection led to the tentative conclusion that, since the set had apparently been effective in the earlier study of normal subjects by Carmichael, et al., the difference between the two situations should be examined more closely. It was then observed that the original study had involved judgments involving several degrees of predicted distortion (later telescoped in actual data analysis), while the current study employed a simple dichotomy of marked distortion vs. its absence. It seemed possible that this dichotomous distinction might be so gross that some of the data were being overlooked.

This line of reasoning converged with the following more rationally derived consideration, and this convergence led to the decision to re-analyze the data, as set forth below. The original rationale was that, if normals employ past experience more effectively in the assimilation of current experience, their response to the experimental set should be to reproduce figures most closely correspondent with the label, or representative of past experience. And yet the figures were, by design, quite noticeably divergent from the concept invoked by the label. If we were to place more emphasis upon the process of assimilation and less upon our perhaps overly-concretized conception of "past experience,"

it might be reasonably expected that normals might resolve the discrepancy by compromising, or "assimilating", both sources of information, while schizophrenics might conceivably be less able to resolve the polar extremes of "leveling" or "sharpening" in processing the same conflicting information. As such, the successful assimilation of conflicting information might be considered as one important aspect of effective use of past experience, in a more general sense.

Following these lines of thinking, we re-analyzized the data in the following way. E first took the cards for each design for the two control groups, shuffled them together, placed them face up so that no identifying marks were visible, and divided each packet into three equal piles of ten designs as follows: (a) most distorted; (b) medium distortions; and (c) least distorted. As is evident in Table 7, the findings of this analysis were consistent with those of the earlier dichotomous judgments; schizophrenics reproduced more extreme distortions when the set was introduced. Group differences in medium distortions, under those conditions, were not apparent.

Essentially the same judgmental procedure was followed in re-analyzing the data in terms of distortions "in the direction of the label" (i.e., P distortions"). Again, all reproductions were separated according to the ten different designs, and then further distributed for three separate group comparisons--NE vs. SE, NE vs. NC, and SE vs. SC. For each

Table 7

Differences between Two Control Groups in Distributions of Judged Total Distortions According to Revised Trichotomous Analysis

(N = 15 in each group with 10 drawings per C)

	Most Distorted	Medium Distortions	Least Distorted
Normals	33	50	67
Schizophrenics	67	50	33
X^2	7.56	_	7.56
P	.01	_	.01

Note: Overall (2 x 3) chi-square is 14.32, $P < .01$.

of these group comparisons, designs were again judged to fall in three equal piles as follows: (a) most "distorted" - i.e., most resemblant of the label concept; (b) medium "distortions;" and (c) least resemblant of the label concept.

The results of this analysis are shown in Table 8. The key comparison--that between the NE and SE groups--rather clearly supports our second-guessing that the most appropriate distinction between normals and schizophrenics in this particular type of problem-solving situation concerns differences in ability to assimilate, or compromise, disparate elements of "past experience" and current experience (cf. the group differences in "medium distortions"). The other two group comparisons were between experimental and control groups within the schizophrenic and nonschizophrenic samples; they were intended to provide further information concerning the previously raised methodological question as to whether or not the experimental instructions "took hold" in this research problem as contrasted with similar operations in the Carmichael, et al., (1932), previously cited. A clear answer does not emerge. In the original (dichotomous) analysis, the experimental set seemed to be effective for schizophrenic O's, but not for normals; in the re-analysis of the data, the situation was reversed. In this case, we must defer (we suppose) to the previously-cited observed difference between NE and SE groups as a basis for inferring the effectiveness of the introduced experimental variable, and leave the cleaner question of the overall effectiveness of this experimental

Table 8

Group Differences in Distributions of Judged Predicted Distortions According to Revised Trichotomous Analysis

(N = 15 in each group with 10 drawings per C)

	Most Like Label	In Between	Least Like Label
SC Group	48	49	53
SE Group	52	51	47
NC Group	39	55	56
NE Group	61	45	44
X^2	4.82	1.00	1.44
P	.05	N.S.	N.S.
NE Group	54	61	35
SE Group	46	39	65
X^2	.64	4.82	9.00
P	N.S.	.05	.01

Note: Overall (2 x 3) chi-squares are as follows: SC vs. SE, 0.56, P not significant; NC vs. NE, 7.28, $P < .05$; NE vs. SE, 14.48, $P < .01$.

procedure for the future.

Incidental Findings.

For the reasons cited above, the data were also re-examined informally to search for additional evidence supporting our post hoc reasoning concerning group differences in predicted distortions.

When the figures were flashed in the experiment, they appeared to be in a square, since the Pencron drafting tape was slightly darker than the white paper surrounding it. Only 8 (2.7 per cent) of the drawings of normals were drawn with squares around them, but 49 (16.3 per cent) of the drawings of schizophrenics had squares around them. This becomes even more notable when one examines the records of the experimental Os, separately. Since the designs were named in the experimental condition, the expectation would be that other stimuli, such as the square, would be ignored. Under the experimental condition, only 1 (0.7 per cent) of the normals' drawings were in squares, whereas 21 (14 per cent) of the schizophrenic drawings were in squares. These differences in proportion are highly significant, and provide further support for our reasoning that the normals were more able in both conditions to determine the relevant variables whereas the schizophrenics had difficulty determining relevant variables (i.e., in "using past experience") even with the aid of cues.

Instead of an inference of group differences in ability to judge relevancy, it could be argued that schizophrenics

simply add more things to their drawings than do nonschizophrenics. However, this seems to be an unlikely condition when one considers the numbering of the designs. In the instructions to the control groups, the Cs were told, "This is Design No. 1," ... "This is Design No. 2," ... etc. Although none of the designs was numbered by either of the experimental groups, four of the 15 schizophrenic controls, and seven of the 15 nonschizophrenic controls numbered their designs. Although this difference is not significant, it does not provide support for the latter interpretation.

CHAPTER V

DISCUSSION

Because of the unexpected findings and the resulting need to explain the basis for the re-analysis of the data, much of the discussion material was introduced in the Results chapter. Consequently, the ensuing discussion of the study will be largely confined to a review of the findings for each hypothesis set forth within the context of previous findings that have been obtained within these areas.

Hypothesis Number 1

The studies by Niebuhr and Cohen (1956); Lovinger (1956); Cohen, Senf and Huston (1956); Cooper (1960) and Weckowicz and Witney (1960) suggested that schizophrenics are less accurate in their perceptual judgments than are normals. These findings are not in agreement with those obtained by Dunn (1954) and Snyder, Rosenthal and Taylor (1961). However, the latter two studies were done under special conditions and are not necessarily direct contradictions of the previously mentioned studies. Therefore, the first hypothesis was: The NC group makes fewer distortions than the SC group. The data from the present study confirmed this hypothesis. Two judges categorized a significantly greater number of the schizophrenics' drawings as "markedly distorted." In addition, on further analysis when the reproductions of each design were divided into three equal groups according to degree of distortion, the schizophrenic

group again had significantly more drawings in the most distorted category. Thus, there is additional evidence that, when asked to reproduce simple figures that are presented for short durations of time, normals are more accurate than schizophrenics.

Hypothesis Number 2

Studies by Bruner and Goodman (1947); Bruner and Postman (1948); Lambert, Solomon and Watson (1949); Perky (1910); Duncker (1939); Bruner, Postman and Rodrigues (1951); Schafer and Murphy (1943); Haggard and Rose (1944); and Carmichael, Hogan and Walter (1932) had all shown that past experience (or one of the components of past experience as discussed earlier) affects the perceptual judgments of normal Os. The second hypothesis was: The NE group makes more P distortions than the NC group. That is, normals would be affected by the label so their drawings would be distorted in the direction of the label. With all the evidence from the earlier studies, it was quite surprising when this hypothesis was not confirmed by the original findings based upon dichotomous judgments. The earlier methodology had required a judgment of "marked distortion" in the direction of the label to be considered P; this had resulted in a very small number of judgments of P drawings. When the data were re-analyzed according to a less gross system of categorizing, it became clear that normals had been influenced by the label.

Hypothesis Number 3

The theories of Arieti (1955) and McReynolds (1960), as well as the studies by Dunn (1954); Harris (1958); Niebuhr and Cohen (1956); Lovinger (1956); Cohen, Senf and Huston (1956); and Cooper (1960); Weckowicz and Witney (1960); and Snyder, Rosenthal and Taylor (1961) suggest that schizophrenics organize their perceptions differently than nonschizophrenics. The suggestion is that schizophrenics are less effective than normal persons in assimilating past experience and present information. Therefore, the third hypothesis was: The SZ group differs significantly from the SC group on the number of P distortions; the actual expectation was for no group difference. Although this hypothesis was not confirmed since the differences did not reach significance for either judge, sets of judgments tended both toward more P distortions in the SZ group. This same tendency was noted in the later analysis, as set forth above.

Hypothesis Number 4

The fourth hypothesis was an outgrowth of the second and third. If past experience has a greater effect on the ongoing experience of normals than that of schizophrenics, the expectations would be: The NZ group makes more distortions in the direction of the label than does the SZ group. This hypothesis was not confirmed with the data of the original analysis; actually, findings were significant in the other direction for Judge B, and approached signifi-

cance in that direction for Judge A. With the re-analysis, there again was not a significant difference in P distortions with the one-third of the drawings looking most like the label, but there was in the middle third of the reproductions that represented middle values, or "compromises," in which the reproductions of the NE group retained some of the elements of each of the conflicting response requirements - i.e., to follow the perceptual figure and to follow the "label" set.

It is here that the difference between normal and schizophrenic responsiveness is most clearly drawn. The normal person can (and, presumably, frequently does) assimilate divergent information, whether between past and ongoing experience or between other conflicting sources. The schizophrenic shows a special deficit in this type of information-processing as well as in judging accurately along a relevant-irrelevant continuum. The lack of ability to assimilate divergent information and to accurately judge relevancy, as demonstrated by the schizophrenics in the present study, seems consonant with the clinical and experimental formulations of Cameron, Chapman, McReynolds, and others in terms of over-literalness, over-inclusiveness, over-abstraction, etc.

This is seen in both the formal and informal analyses of data in the present study. For example, in terms of over-inclusiveness (or extreme "leveling"), the only drawing of a "broom" for Design 10 that presented detail to the

point of drawing separate straws was done by an O in the SE group. Similarly, the only drawing of the figure "4" for Design 5 that presented a classical closed figure, rather than the more frequently used open figure, was also by an O in that group. It was the relatively few extreme P distortions such as these that were being "picked up" as "marked distortions" by the two judges in the original analysis.

In summary, this experiment leads to two conclusions. First, it is apparent that the reproduction of simple designs from memory is done much more accurately and effectively by normals than by schizophrenics. Second, schizophrenics are unable to assimilate past and ongoing experience as effectively as normals, as demonstrated in the reproduction of these simple geometric designs. The second conclusion must necessarily be only a tentative one, since it was arrived at from after-the-fact reasoning. However, it does not seem unlikely that additional research in this area would prove confirmatory.

CHAPTER VI

SUMMARY

The purpose of this experiment was to study some of the differences in the perception of schizophrenics and normal subjects, especially when past experience (in the form of verbal labels) was introduced into the experimental situation.

The procedure involved flashing designs tachistoscopically and having the Os draw what they saw. Past experience was introduced to the experimental group by giving the designs labels that did not fit them with complete accuracy. It was hypothesized that, under this condition, distortions in the "direction of the label" would be more pronounced in the reproductions of the normal observers.

The results, under control conditions, were that the schizophrenics produced more distorted reproductions than did the nonschizophrenics. This was as predicted and is consistent with previous research findings.

The results with P (distortions in the direction of the label) were more equivocal. When only dichotomous judgments (marked "P" and "No P") were considered, the performance of the schizophrenics appeared to be more affected than that of normal observers. However, when the designs were divided into three equal groups, from most like the label to least like the label, another answer

became apparent. It was found that normal observers, under experimental conditions of the label set, reproduced drawings that reflected elements of both the percept and the introduced disparate concept (i.e., "label"). As a group, schizophrenic observers could not make this compromise; thus, their performance was interpreted as reflecting a lack of ability to assimilate divergent information and a lack of accuracy in distinguishing relevant from irrelevant in processing this information. Schizophrenic performance in this study was interpreted to be consonant with that of previous studies in terms of such characteristics of schizophrenic behavior as over-literalness and over-inclusiveness.

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APPENDIX

Judge A

Raw Data for Schizophrenic Controls

	Design											
SCO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1	d	d	P	P	d			d	P	d	8	3
2	d	d	P	d			d	d	d	P	8	2
3	d	P			d		d		d	P	6	2
4	d	d	d	d	d	d	d	d	d	d	10	0
5	d	d	d	d	d		d	d	d	d	9	0
6	d	d	d	d	d		d	P	d	d	9	1
7	d	d	P	d	d		d	d	d	P	9	2
8	d	d	d	d	d	d	d	d	d	d	10	0
9	d	d	d	P	d		d		d	P	8	2
10	d	d	d	d	d	d	d	d	d	d	10	0
11	d						d	P		d	4	1
12		d	P	D	D	P	d	d	P	P	9	4
13	d	d					d	d		d	5	0
14		d	d	P	d		d	d	d	P	8	2
15	d	d	d	d	d	d	d	d	P	P	10	2
D(d≠P)	13	14	12	12	12	5	14	13	13	15	123	
P	0	1	4	3	0	1	0	2	3	7		21

Judge B

Raw Data for Schizophrenic Control

	Design											
SCO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1	d	d		P				d			4	1
2	d	d		d				d	d	d	6	0
3		P							d		2	1
4	d	d	d	d		d		d	d		7	0
5	d	P	d	d				P	d	d	7	2
6	d	d	d	d			d	d	d	d	8	0
7	d	d	d	P	d			d	d	P	8	2
8	d	P	d	d					d	d	6	1
9				P							1	1
10	d	d	d	d		d	d	d	d	d	9	0
11	d							d			2	0
12								d	P		2	1
13	d	d					P	d			4	1
14			d	P			d	d		P	5	2
15	d	d	d	P	d	d	d	P	P	P	10	4
D(d≠P)	11	11	8	11	2	3	5	12	10	8	81	
P	0	3	0	5	0	0	1	2	2	3		16

Judge A

Raw Data for Normal Control

	Design											
NCO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1	d	d			d			d	d	P	6	1
2	d		P	P	d		d			d	6	2
3	d		P				d	d	d	P	6	2
4		d	P				d	d	d	P	6	2
5	d	d		d	d		d	d		d	7	0
6	d		d		d		d			d	5	0
7	d	d	d	d	d		d	P	d	d	9	1
8	d		P	d	d	d	d	P		P	8	3
9	d	d	P	d	d		d	d	d	d	9	1
10	d	d	d		d	d	d	P	d	P	9	2
11		P							d		2	1
12	d	d					d			P	4	1
13	d	d	d	d	d		d	d	P	d	9	1
14			P	P	d		d			d	5	2
15	d	d	d	P			d	d		P	7	2
D(d≠P)	12	10	11	8	10	2	13	10	8	14	98	
P	0	1	6	3	0	0	0	3	1	7		21

Judge B

Raw Data for Normal Control

	Design											
NCO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1		P						d	d	P	4	2
2	d									d	2	0
3	d										1	0
4								d	d	P	3	1
5								d		d	2	0
6	d		d							d	3	0
7	d	d	d				d	d	d	d	7	0
8				P			d			P	3	2
9	d	d	d	d						d	5	0
10	d	P	d				d	d	d		6	1
11		P									1	1
12			d								1	0
13		d	d	d				d		d	5	0
14		P		P						d	3	2
15		P	d	P				d			4	2
D(d≠P)	6	8	7	5	0	0	3	7	4	10	50	
P	0	5	0	3	0	0	0	0	0	3		11

Judge A

Raw Data for Schizophrenic Experimental

Design

SEO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1	d		d		d		d	d	d		6	0
2	d				d		d			d	4	0
3	d	d	P	d	d		d	P	d	P	9	3
4	d	d	P	P	d		d	P	d	P	9	4
5	P	d	d	d	d	d	d	d	d	P	10	2
6	P	d	d		d		d	P	d	P	8	3
7	P	d	P	d	P	d	d	P	P	P	10	6
8	d	d	d	d	d	d	d	d	d	d	10	0
9	d	d	P	d	d			P	P	P	8	4
11	d	d	P	P	d	d	d	d		P	9	3
12	d	d	d	d	d	P	d	P	d	P	10	3
14		d	P	P	d		d	d	d		7	2
15	d	d	d	d	d	d	d	d		P	9	1
16	d	d	P	P	d			P	d	P	8	4
18		d	P	d	d		d	d	d	P	9	2
D(d≠P)	14	13	14	12	15	6	13	14	12	13	126	
P	3	0	8	4	1	1	0	7	2	11		37

Judge B

Raw Data for Schizophrenic Experimental

	Design											
SEO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1	d	P	d						d		4	1
2	d									d	2	0
3	d	d	d				d	P	d	P	7	2
4			d	P				P	d	P	5	3
5	P	d	d	d		d		d	d	d	8	1
6	P	d	d				d	d	d		6	1
7	d	d	d	d	P	d	d	P	P	P	10	4
8	d	d	d	d		d	d	d	d	d	9	0
9	d	P		d				d	d	P	6	2
11	d	P		P		d		d		d	5	2
12	d	d	d	d		d	d	d	d	P	9	1
14		d		P				d	P		4	2
15		P	d		d	d		d		d	6	1
16	d	d		P				d	d	P	6	2
18	d	P	P	d			P	d	d		7	3
D(d≠P)	12	13	10	10	2	6	6	13	12	11	95	
P	2	5	1	4	1	0	1	3	2	6		25

Judge A

Raw Data for Normal Experimental

Design

NSO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1	d	d		d	d		d	d			6	0
3	d	d	d	P	d		d	d	d	P	9	2
4	d	d	P		d		d	d	P	P	8	3
5	P	d	P				d	P		P	6	4
6		d	P	P			d	P			5	3
7	d	d	P			d		P			5	2
8	d		P	d	d	P	d	P	d	P	9	4
9	d	d		d	d	d	d	P	P		8	2
10	d	d	P	d	d		d	d	P	d	9	2
11	d	d	d		d		d		d	P	7	1
13	d	d	P	d	d			P	d	P	8	3
15	d	d		P	d		d	P		P	7	3
16	d		d		d		d		d	P	6	1
17	d	d		d	d			d	d	d	7	0
18	d	d	P		d			d		d	6	1
D(d≠P)	14	13	11	9	12	3	11	13	9	11	106	
P	1	0	8	3	0	1	0	7	3	8		31

Judge B

Raw Data for Normal Experimental

Design

NEO	1	2	3	4	5	6	7	8	9	10	D(d≠P)	P
1		d		d				d		d	4	0
3		P		P				d	d	d	5	2
4	d										1	0
5	P									d	2	1
6				P					P		2	2
7	d	d									2	0
8	d	P				d		d		d	5	1
9								d			1	0
10			d					d	d		3	0
11			d						d		2	0
13	d	d	d					d		d	5	0
15		P		P							2	2
16									d	d	2	0
17								d			1	0
18				P				d		P	3	2
D(d≠P)	5	6	3	5	0	1	0	8	5	7	40	
P	1	3	0	4	0	0	0	0	1	1		10