Auditory Perception
In Word Association Performance
Of Schizophrenics and Nonschizophrenics

A Dissertation

Presented to

The Faculty of the Department of Psychology

The University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

By

Ann Ferguson Moon

August 1967

Acknowledgements

For the completion of this dissertation, I owe a sincere debt of appreciation to many people. Special thanks are due to Dr. Betty A. Wieland, the chairman of my committee. Her availability, encouragement, and able guidance during the collection and analysis of the data, and during the writing of the dissertation were of crucial importance. Thanks also to Dr. R. B. Mefferd, Jr., Director of the Psychiatric and Psychosomatic Laboratory at the Veterans Administration Hospital and co-chairman of my committee, who made the facilities of the laboratory available for data collection and analysis. The advice, criticisms, and encouragement of both Dr. Wieland and Dr. Mefferd were invaluable.

To the other members of my committee, Dr. L. S. McGaughran, Dr. D. L. Johnson, Dr. D. E. Sheer, and Dr. E. D. Dyer, I also owe many heartfelt thanks for their help and consideration during the final stages of the study. Those under whom I have worked as a student have been influential in shaping my attitudes with respect to psychological issues and in directing my interests in several areas of research.

In addition, thanks to Dr. G. A. Falconer, Director of the Audiology and Speech Pathology Laboratory at the Veterans Administration Hospital, for the use of his

laboratory and for training me in basic audiological procedures. Also appreciated was the cooperation of Dr. A. D. Pokorny, Chief of Psychiatry and Neurology at the hospital, in obtaining subjects for the study.

Finally, I am deeply indebted to the personnel of the Psychiatric and Psychosomatic Laboratory for their assistance in scheduling subjects and in collecting and analyzing the data.

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Abstract

The purpose of the present experiment was to determine whether the cognitive disorder which results in disturbed verbal communication in schizophrenia is a function of a pathological breakdown in the process of perception of auditory word stimuli or in the process of association. In this study, perception referred to the lower order cognitive process which involves recognition and discrimination of individual words from specially constructed lists presented with two sets of instructions. Association referred to the more complex cognitive process which involves reference of the perceived word to a conceptual category from which a word is selected as a response associate.

The procedure involved the presentation of two word lists to 20 pairs of male schizophrenics who were matched with nonschizophrenics for age, intelligence and verbal ability, and educational level. Each subject (S) passed a stringent hearing test to ensure auditory acuity within the normal range. In addition, each S's ability to communicate intelligibly was intact.

The lists were presented in a counterbalanced order, the first with instructions to repeat each word as rapidly as possible. The second list was administered with the usual word association instructions to say the first word which came to mind as rapidly as possible. A reproduction

phase followed, also under time pressure.

The major hypothesis was that the pathological breakdown in schizophrenia which results in disturbed communication lies in the process of perception rather than in the process of association.

The results supported this hypothesis. Schizophrenics misheard significantly more words on the repeat task than nonschizophrenics. In addition, all association response words (RWs) which seemed unrelated to the stimulus word (SW) were scored as Distant (one of nine scoring categories). Words in this category were re-evaluated and re-scored as misheard (MH) if they were judged to be good responses to words with different meanings but phonetically similar to the SW. Such words were then assigned to appropriate categories. As a result, it was found that schizophrenics had significantly more MH words than nonschizophrenics. Furthermore, there were no differences between the 20 matched pairs in the number of Distant association RWs. Nor were any differences found between schizophrenics and nonschizophrenics in the frequency of Distant RWs when words which were not misheard or words which were misheard were considered separately.

In addition to distant responses, other word association variables which have been used as "diagnostic indicators" were examined. The major finding was that besides misperceived SWs, reaction time is a highly stable variable in differentiating schizophrenics and nonschizophrenics. Also considered were commonality, reproduction

failures, and faults.

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Chapter I

Introduction

The primary purpose of the present study was to demonstrate that the cognitive disorder in schizophrenia which results in difficulty in verbal communication is the function of a breakdown in the lower order cognitive process of perception as opposed to the more complex process of association.

Bleuler (1924) felt that the mechanism underlying all schizophrenic symptoms was the loosening of associations. He believed these symptoms to be either a manifestation or an attempt at the restitution of the loosening of the association links between basic memory units. He viewed the latter as stable, while the former were variable.

In recent years, it has been suggested that the pathological breakdown in schizophrenia occurs in perception rather than in association. Studies have focused upon the visual modality, and the literature is replete with studies of visual perception in schizophrenics. The auditory modality, upon which all verbal communication depends, largely has been ignored, although the function of auditory perception in disturbed communication in schizophrenia was suggested even by Bleuler himself. He pointed out some distortions in visual perception and added that, "Analogous disturbances, though not so easy

to demonstrate, are also found in the acoustic field (Bleuler, 1924, p. 58)."

One of the few efforts to approach this neglected area has been made by a group of workers in Scotland (Chapman, Freeman, & McGhie, 1959; Davie & Freeman, 1961; McGhie & Chapman, 1961; Chapman & McGhie, 1962, 1963, 1964; Lawson, McGhie, & Chapman, 1964; McGhie, Chapman, & Lawson, 1965; Chapman, 1966). These authors obtained reports from schizophrenic patients in the early stages of their psychosis with regard to changes in subjective experiences. They found that disturbances in visual perception were reported by only 40%, while disturbances in speech perception were reported by 80%. It would seem that work in the area of speech perception is long overdue.

Word association studies over the years have demonstrated that schizophrenic patients give more uncommon responses to stimulus words than nonpsychotic subjects (S) (Moran, Mefferd, & Kimble, 1964; Johnson, Weiss, & Zelhart, 1964; Sommer, Dewar, & Osmond, 1960; Rapaport, Gill, & Schafer, 1946). These responses which seemed to be unrelated to the SW as it was presented have been called Distant and have been viewed as a manifestation of the breakdown in the process of association referred to by Bleuler and widely accepted. With recent findings pointing to perceptual dysfunction on visual tasks, a re-evaluation of word association responses seems indicated since this latter task is one of the most elementary,

meaningful, and least complex cognitive tasks involving auditory and verbal abilities.

Definitions

Specific usages of the two key terms to be used in this report are set forth below:

Perception is used to refer to the lower order cognitive process involved in the word association task which consists of the recognition and discrimination of individual words. Perception will be measured by the S's ability to repeat accurately a list of words. It will also be measured by assessing distant responses in the context of having been good, scorable RWs to different but phonetically similar SWs.

Association is used to describe a higher order cognitive process which involves reference of a word to a group or category of words to which it seems related. The degree to which this process is not intact will be measured by the number of RWs which are considered to be distant and unrelated to the SWs as they were presented or as they might have been misheard.

Statement of the Problem

This study was an attempt to find evidence that the area of dysfunction in schizophrenic thought disorders is in the process of perception rather than in that of association. In order to investigate this problem, two specially constructed word association lists were

administered to 20 schizophrenics and 20 nonschizophrenics with whom they were closely matched for age, intelligence and verbal ability, and educational level. The first list was preceded by instructions to repeat each word as rapidly as possible. The second list was administered with the usual word association instructions to say the first word which came to mind as rapidly as possible. A reproduction phase followed, also under time pressure.

The word association task was selected as an appropriate task since communication in interpersonal relationships depends upon word discrimination and recognition, a function of perception, and upon reference of the word to a conceptual category before responding, a function of association. Thus, the task makes it possible to evaluate the operation of these two basic cognitive processes.

The major hypothesis was that the pathological breakdown in schizophrenic thought disorders is in the lower order cognitive process of perception rather than in the more complex process of association. Schizophrenic patients were expected to manifest this breakdown by mishearing more words when asked to repeat the first list. If the word which they repeated sounded different from the SW presented to them, it was scored misheard (MH). Likewise, a greater number of RWs which reflected the S's mishearing of the SW were expected on the association task in the schizophrenic patients.

Words were scored without regard to the condition of

the S, i.e., either schizophrenic or nonschizophrenic. All RWs which seemed distant and unrelated to the SW were relegated to a specific category (Distant). These RWs were then re-scored as MH and reassigned to different categories if they were judged to be good responses to words with different meanings but phonetically similar to the SW. It was predicted that schizophrenics would have more MH words than nonschizophrenics and that there would be no significant difference in the number of Distant responses between the matched pairs. Such results would support the major hypothesis that the pathological breakdown is perceptual rather than associative.

In addition to Distant responses, several other word association variables, reaction time, commonality, reproduction failures, and faults, have been called associative disturbances and widely used as diagnostic indicators. These variables were analyzed to determine their possible relationship to perception by examining their relative frequency on words not misheard (NoMH) as compared to MH words. As a matter of general interest, their power to discriminate schizophrenic from nonschizophrenic samples was examined, although this study was not specifically designed to test their validity.

Chapter II

Background and History

In recent years, it has been suggested that the pathological breakdown in schizophrenia lies in the process of perception rather than in the process of association. According to Bleuler (1924) the mechanism underlying all schizophrenic symptoms was the loosening of associations. Yet Bleuler and Kraepelin (1904) before him both recognized the presence of perceptual distortions. Although most references are to visual perceptual distortion, Kraepelin in his description of the syndrome referred to problems in speech perception and distortion by schizophrenic patients. For example, in discussing echolalia he stated, "...he repeats words shouted to him immediately sometimes distorting them (Kraepelin, 1904, p. 27)."

Bleuler, in his famous monograph published in 1911 and published in English in 1950, considered the syndrome described earlier by Kraepelin as a disorder characterized mainly by an alteration of the faculty of association. Stierlin (1967) in discussing the basis for Bleuler's theory referred to the latter's use of Semon's theory of psychic engrams (memory units) and their associative links. In following Semon, Bleuler distinguished these two basic entities in the human psyche and believed that the former were stable while the latter were variable. The associations

are formed from our experiences and integrate themselves into clusters which, under certain conditions, can be evoked and integrated with other clusters. The associations, Bleuler felt, must have a certain "looseness" in the service of our cognitive adaptation, but they must lend themselves to becoming ordered, hierarchically organized, and goal-directed. If these conditions could not be met, and the loosening of associations, facilitated by brain alterations, progressed, the schizophrenic symptoms would ensue. This symptomatology was viewed as either a manifestation or an attempt at the restitution of the loosening of associative links.

According to Bleuler, then, associations between engrams were a function of experience, and engrams were a function of prior perception and memory. The former were variable, while the latter were stable. Yet he must have realized that perception played a role somewhere in the schizophrenic disorder. He stated, "Perception may be imperfect...(psychotics) may perceive a green head of cabbage as a rose, a cucumber as a sausage, and an ear of corn as a fir cone (Bleuler, 1924, p. 57)." Thus, he recognized distortions in the visual modality. He added, "Analogous disturbances, though not so easy to demonstrate, are also found in the acoustic field (1924, p. 58)." This early recognition of the difficulty of dealing with the auditory modality perhaps accounts for the paucity of research in this area.

In the early forties, Beck pointed to the relevance of visual perception with regard to Rorschach productions when he asked, "Are the strange productions of the schizophrenic fantasies conceived by his living in a world of his own creating? Or are they simply mistakes, misapprehensions of real sense impressions? (1944, p. 91)." He also seemed to recognize the possibility that perception rather than association could be the site of the pathological breakdown in schizophrenia.

Buss and Lang (1965) and Lang and Buss (1965) reviewed the extensive literature regarding the psychological deficit which might underlie schizophrenia. They concluded that there is a deficit in the initiation of appropriate responses and in the ability to inhibit inappropriate responses to selected stimuli. The literature which they cited suggests that in schizophrenia "external stimuli, associational and biological 'noise', routinely suppressed by normal subjects, intrude, and responses to the appropriate stimuli are not made (Lang & Buss, 1965, p. 98)." They feel that the work of Hernandez-Péon and his associates (1956) serves to localize the specific area of dysfunction in defective sensory inhibition centers. These experimenters were able to suppress the cortical potential in the cochlear nucleus of the cat normally elicited by a tone by simultaneously presenting a competing odor of fish. They felt that this demonstrated that attention involves selective awareness of certain

sensory messages and suppression of others.

The performance of schizophrenics on reaction time and cognitive tasks when compared to that of normals has been explained as "disturbances in selective attention" (McGhie & Chapman, 1961), "input dysfunction" (Venables, 1964), and the inability of the schizophrenic to make maximal use of the "scanning process" which takes place before the response to the stimulus is made (Shakow, 1962, 1963). All these concepts suggest a breakdown in the process of perception. Some literature, of course, still focuses upon association as the primary disturbance in schizophrenia. This has been investigated by requiring schizophrenics to perform psychological tasks in which the S is required to maintain a state of vigilance and to react to instructions and stimuli on the basis of common or usual meanings or associations. Such studies include those with word association (e.g., Moran, 1966; Moran, Mefferd, & Kimble, 1964; Johnson, Weiss, & Zelhart, 1964; Sommer, Dewar, & Osmond, 1960; Rapaport, Gill, & Schafer, 1946; Jung, 1907), the conditioning of common or uncommon associations to words (e.g., Maltzman, Seymore, & Licht, 1962; Sommer, Witney, & Osmond, 1962), verbal concept formation (e.g., Chapman & Miller, 1964),and paired-associate learning (e.g., Lang & Luoto, 1962).

In dealing with perception rather than the higher cognitive functions of association and concept formation, most investigators have been concerned with the visual

modality. For example, Weckowicz and Blewett (1959) investigated size constancy in schizophrenia, Bemporad (1967) used cards showing a number made up of different sized dots against a background of dots in contrasting colors, and Weckowicz (1960) had patients find drawings of common objects with overlapping lines superimposed. The results of such studies suggest that schizophrenics cannot perform as well as normal Ss on these tasks. This is attributed, largely, to some deficit in the process of visual perception.

On the other hand, the word association studies have pointed to the fact that schizophrenics produce more uncommon associations than normals. This finding has been attributed to disturbance in the association process. On more complex tasks (e.g., paired associate learning and verbal concept formation), the conclusion is that these unique associations interfere in the same manner as external distractors and serve to deteriorate performance in schizophrenics.

Thus, the perception studies have dealt mainly with the visual modality, and the association studies have dealt mainly with the higher cognitive processes. Both approaches have failed to meet the challenge to find some way to deal effectively with the modality which suffers in schizophrenia perhaps to a greater extent than any other, i.e., audition. It has been recognized for years that the central problem in schizophrenia is communication.

Sullivan (1944) was an exponent of this view and felt that recognizing a disturbance in language and speech in schizophrenia would be of central concern. Cameron (1939, 1944) maintained that in schizophrenia, the primary function of language, i.e., communication, is gone. Other writers (e.g., Goodstein, 1951; Reusch & Bateson, 1951; Reusch, 1957; Searles, 1961) agree that disturbance in verbal behavior is of marked importance in the syndrome, but as Salzinger, Portnoy, and Feldman (1966) point out, little has been done to study such behavior in an objective manner. Paucity of research in this area was noted in the thirties by Woods. He said, "The literature on the language of schizophrenia is surprisingly scanty when one considers the striking nature and the importance of the subject, since it is through language that the most intimate contact with schizophrenic experience is obtained (1938, p. 290)."

It seems that there has been an awareness over the years that schizophrenia involves primarily a disturbance in communication. In addition, it has been recognized that such a disturbance probably lies in the realm of verbal behavior. Verbal behavior consists of reception of stimuli through the auditory sense modality, the processing of the information, and the subsequent verbal response. It would seem that speech reception, speech distortion, and the interaction between them should be studied in detail and that less emphasis should be placed

upon the more easily accessible visual perception and distortion. It is, after all, through verbal interaction that people communicate.

In exploring the literature for experimental work in the area of audition in schizophrenia, such research was conspicuous by its absence. Possibly the study of speech perception has been neglected because evidence for auditory perceptual dysfunction depends largely upon reports from patients suffering from schizophrenia. To some, the phenomenological approach to the study of any problem is not a "scientific" approach and must be avoided at all costs. Such limitations upon data collection preclude evolving an experimental method for demonstrating and dealing with such phenomena.

A group of workers in Scotland has made a valuable contribution to the study of schizophrenia by means of sampling the subjective experiences of patients at an early stage of their psychosis. McGhie and Chapman (1961) reported attempts in the fifties by Freeman, Cameron, and McGhie to study the chronic schizophrenic condition. The latter authors' observations pointed to a pathological breakdown in "ego function", particularly to an impairment in the process of perception. The trio concluded that instead of attributing schizophrenic symptoms to "defensive activities purposefully related to unconscious conflicts over interpersonal difficulties" (McGhie & Chapman, 1961, p. 103), a more fruitful and more accurate description

would be the reverse. That is, the breakdown in interpersonal relationships was a reaction to the primary cognitive disturbance which they felt lay in the process of perception.

In dealing with chronic patients, the authors found it difficult to communicate directly. Such a patient cannot describe his subjective experiences in a comprehensive manner because of the inroads of the psychosis upon his ability to communicate. He manifests such secondary symptoms as delusions, hallucinations, autism, and withdrawal. Therefore, they felt that in order to get a comprehensive account of changes in subjective experience in schizophrenia, they must gather clinical data from patients early in the psychosis when the ability to describe such experiences is still intact. They oriented their interview to focus upon cognitive disturbances. The inquiry centered upon changes in the patients' experiences. Patients were encouraged to describe these changes in their own words. These informal interviews were recorded and later transcribed verbatim. Chapman (1966) described the sample of 40 schizophrenics in a follow-up of these patients. Since the present study evolved from these clinical data, detailed consideration will be given to them.

The subjects (Ss) were obtained from young in-patients at Gartnavel Royal Hospital and Royal Dundee Liff Hospital in Scotland. The diagnosis of schizophrenia had been confirmed by the consultant psychiatrist in charge of the

cases, and the diagnosis was confirmed in a follow-up. The age range was 17 to 32 years with a mean age of 24.6 years. Two of the forty patients were female. The duration of the illness, as measured from the time the patient became noticeably ill, was from one to 33 months with a mean of 11 months. Eighty-five per cent were unmarried. Interviews one hour in length numbered from two to twelve for each patient. The interviews were structured to provide descriptions of changes in subjective experience which reflected disturbances in attention, perception, memory, motility, thinking, and speech. The number of questions was limited in order to preclude contaminations from the patient's suggestibility and his production of memory illusions and falsifications. The questions were presented in a standard, simple and brief form in order that they might serve as cues for the patient to describe his experiences. Additional questions were avoided. Extraneous stimuli were reduced to improve communication. In addition to a quiet setting, the observer remained relatively immobile so that irrelevant movements, which had proven to be distracting in earlier interviews, were kept at a minimum. Also the observer's verbalizations were controlled, and the patient was allowed as much time as he wished to express himself.

The interview material was then broken into a number of separate statements and arranged by the authors in categories with regard to the symptom being described. Under

the large category heading of perception, reported changes in speech perception were of particular interest. For example, one patient said, "I'm a good listener but often I'm not really taking it in. I nod my head and smile but it's just a lot of jumbled up words to me (McGhie & Chapman, 1961, p. 106)." Another said, "When people are talking the words are going on and on and I don't understand them. It's extremely confusing--like going into a blank wall (McGhie & Chapman, 1961, p. 106)." From these samples of reports, it seems that there is a change in the subjective experience of speech perception.

In addition, there are changes in speech production. One patient said, "I had the impression of what I wanted to say in speech but I couldn't get the words I needed--words that weren't correct came out. I could not get the words that were correct (Chapman, 1966, p. 236)." Another patient said, "If somebody is speaking I just let them continue until they are finished--I can't comprehend what they are saying...I can hear what they are saying all right, it's remembering what they have said in the next second that's difficult--it just goes out of my mind (Chapman, 1966, p. 237)." From these data, several explanations of the dysfunction are possible. There is a suggestion that the problem in schizophrenic communication might lie in the breakdown of associations after the stimuli, i.e., speech, have been perceived. Likewise, it could be a function of disturbance in short-term memory. Just as

likely, it could be a function of speech perception because there is only the report of the patient to substantiate his hearing accurately what the person said to him.

Lawson, McGhie, and Chapman (1964), on the basis of the interviews, felt that the disorder in speech perception was due to a disturbance in the perception of speech patterns rather than the perception of individual words. They said that in normal communication, words are perceived as part of a total pattern of communication and that there is a kind of "automatic ordering of separate items of verbal communication into meaningful sequence (1964, p. 107)." They utilized passages with varying degrees of contextual constraint, i.e., meaningful relationship between the words of the passage. They matched schizophrenic and normal Ss for sex and verbal ability measured by scores on the Mill Hill Vocabulary Test. Then the Ss were presented passages in order of increasing contextual constraint taken from the Miller and Selfridge series (1950). That is, the words in the first passages were totally unrelated while the final passages contained words in a highly meaningful relationship. The Ss were instructed to listen and then to write down as many words as they could remember after the tape recorder was turned off. It was found that schizophrenic patients performed nearly as well as the normals in recalling material with no contextual constraint. They also found that while the normal Ss were able to utilize the increasing degrees of contextual constraint to improve their performance, the schizophrenics were unable to do

this. They concluded that difficulty in speech perception by schizophrenics appeared to be related to the inability to perceive the patterning of the words rather than the individual words. It would seem, however, that this study was not directed specifically at the problem of perception, but rather memory functioning, and that the authors were hasty in concluding that perception of individual words is not a problem in schizophrenia.

One of the most striking findings of this series of papers dealing with changes in subjective experiences by schizophrenic patients (Chapman, Freeman, & McGhie, 1959; Davie & Freeman, 1961; McGhie & Chapman, 1961; Chapman & McGhie, 1962, 1963, 1964; Lawson, McGhie, & Chapman, 1964; McGhie, Chapman & Lawson, 1965; Chapman, 1966) was the distribution of the frequencies of the phenomena reported. Chapman (1966) noted that disturbance in visual perception was reported by only 40%, while disturbance in perception of speech was reported by 80%, and disturbance in speech production by 75%. On the basis of these data, it would seem that disturbance in visual perception as a whole may not be the most reliable diagnostic indicator in the early stages of schizophrenia since it occurs only half as often as disturbances in speech perception. In any event there seems little doubt that investigation of auditory perception in schizophrenia is long overdue.

For the purposes of this study, four areas of functioning were designated as essential for speech reception and

production in the word association task. Primary perception is the most basic process and refers to auditory perception in the present study. If this first stage is functioning properly, pathways to the auditory cortex are intact, thus making possible the reception and registration of sensory stimuli. Perception has already been defined as a lower order cognitive process which involves recognition and discrimination of individual words. If there is a disturbance in this area, the result might be recognition and subsequent repetition of a word different from the one presented, but at the same time phonetically similar, e.g., bitch - ditch, bits. Malfunctioning at this level might also be detected on a word association task if the RW seems unrelated to the original SW but is a good associate to a phonetically similar word, e.g., bitch - hoe.

Association was defined as a higher order cognitive process by which a word is referred to a conceptual category of words. If the pathological breakdown occurs in this area, distant, unrelated words are likely to be elicited as RWs on a word association task. As pointed out above, such a distant response might be an acceptable associate to a word which is phonetically similar to the SW. In this case, the dysfunction lies in perception and not in association. The fourth area of functioning may be called verbalization and refers to proper motor functioning of vocal organs in the production of words.

In terms of these four functional areas, let us look briefly at the design of the present study and develop the hypothesis. The areas under consideration are perception and association. Primary perception was judged to be intact in all Ss by means of a stringent hearing test. In addition, each S was able to verbalize intelligibly so that the first and fourth functional entities were controlled in all Ss. A word repetition task was designed specifically to measure the functioning of perception, and a word association task was utilized to measure the functioning of association. In addition, RWs on the latter task which at first seemed unrelated to the SW, but which later were judged to be good associates to different but phonetically similar words, were scored as misheard and assumed to be a function of faulty perception. In the past, such RWs have been considered as distant and unrelated to the SWs and have been accepted as a manifestation of a faulty association process. The relative decrement in the two processes was examined by comparing schizophrenics and nonschizophrenics on the tasks.

The Chapman et al. material referred to earlier in this chapter suggested that perception of individual words was not a problem in schizophrenia. Rather, the clinical data suggested that alterations in perceptual functioning in schizophrenia "results in a flooding of consciousness with sensory data to a degree beyond the limits of normal experience (Chapman, 1966, p. 239)." Lawson, McGhie, and

Chapman (1964) tested the hypothesis that the difficulty in speech perception in schizophrenia is related to the inability to perceive the organization inherent in ordinary speech. That is, they felt that there is a breakdown in the organized patterning of words. They utilized the Miller and Selfridge (1950) concept of contextual constraint to test this hypothesis and found that schizophrenics performed nearly as well in recalling material with no contextual constraint as normal Ss. However, the former were unable to make use of the increasing degrees of contextual constraint to improve their performances.

The study, in many ways, failed to test the hypothesis adequately. Their results seemed to be contaminated by the part which short term memory functioning played. It seemed to be less a task directed toward word recognition than one designed to measure the ability to remember words presented sequentially. Also, there were no time limits imposed upon the Ss. Had reaction times been recorded, it is likely that subtle differences might have been found between the two groups.

The hypothesis to be tested in this study was: The pathological breakdown in schizophrenia which results in disturbed communication lies in the process of perception rather than in the process of association. Thus, on the repetition task, the number of words misheard by the schizophrenic Ss will be significantly greater than the number of words misheard by nonschizophrenics. An RW will

be scored as MH if it is different from the SW but phonetically similar to it. Repeating a list of 40 words under time pressure was selected as an appropriate task to determine the accuracy with which Ss were able to discriminate or recognize individual words. Accurate recognition has been postulated to be a function of perception. This simple repetition task should serve as a measure of this process.

If individual words are misheard when Ss are instructed to repeat them, individual words will also be misheard when Ss are told to associate to them. Thus, on the association task, the number of words misheard by schizophrenics will be significantly greater than the number of words misheard by nonschizophrenics. Mishearings will be scored if the RW which seems distant and unrelated to the SW is judged to be an acceptable associate of a word which is phonetically similar to the SW. It also follows that if the breakdown in schizophrenic communication is in perception, the number of RWs scored as distant will not be significantly different between the two matched groups.

Incidental to the major hypothesis, an examination of several variables will be undertaken to investigate the possible effects of perceptual dysfunction. A number of word association studies with schizophrenics, e.g., Moran, Mefferd, and Kimble (1964), Sommer, Dewar, and Osmond, (1960), and Rapaport, Gill, and Schafer, (1946), have demonstrated that schizophrenics have longer reaction

times, lower commonality scores, and a greater number of faults and reproduction failures than normal Ss. These variables, sometimes used as diagnostic indicators (Rapaport et al., 1946), will be analyzed to test these predictions. In addition, they will be examined to see if the expectations are valid when malfunctioning occurs in the perceptual process of schizophrenics and nonschizophrenics.

Although no specific analysis will be attempted to determine the function of a mediating process in the performances of the two matched groups, the concept of idiodynamic set (Moran, Mefferd, & Kimble, 1964) will be considered incidentally. Moran et al. who developed this concept found that in free word association experiments with only the instructions to tell the examiner the first word that came to mind, many Ss responded as if they had been provided with a set, or instructions to give one type of response. This preference for one type of response seems to be an enduring characteristic of some individuals. Although the present study was not designed to deal with this concept and its relationship to schizophrenia, association RWs were scored for set and analyzed as a matter of interest.

Chapter III

Methods and Procedures

Subjects

Experimental subjects. Twenty male experimental subjects (Ss) were selected from the psychiatric patient population at the Veterans Administration Hospital at Houston, Texas. Each potential S was screened by the ward psychiatrist and was judged to have a moderate thought disorder. This disorder was manifested in loose associations, illogical thinking, and impaired judgment. Such symptoms suggest a cognitive disturbance and are frequently found in patients with a schizophrenic thinking disorder. Excluded from the sample of potential Ss were patients with suspected organic involvement and patients whose ability to communicate verbally was impaired because of heavy medication or because of the severity of the pathological disturbance. All potential Ss were oriented for time, place, and person. No patients were selected whose estimate of intellectual functioning, based on the Wechsler Adult Intelligence Scale (WAIS), fell in the Borderline or Mental Defective ranges. One reason for this was that the experiment required a certain degree of intellectual ability to follow instructions and sufficient familiarity with the word stimuli to be able to perform the required tasks. Also considered was the difficulty in matching normal Ss who were drawn from non-psychiatric patients and hospital personnel.

Patients who met these criteria were given a stringent hearing test to ensure auditory acuity well within normal limits. Any patient who could not meet the requirements for normal hearing was excluded from the study.

No attempt was made to obtain schizophrenic Ss with respect to the chronic-acute or process-reactive dichotomies. Nor was any attempt made to differentiate between paranoid, undifferentiated, schizo-affective, or other classifications of schizophrenia. This study was directed toward investigating a particular type of cognitive behavior, i.e., disordered thinking, which is often associated with schizophrenia regardless of the diagnostic label. In general, our limited understanding of the schizophrenic process precludes definitive and meaningful classifications of schizophrenic disorders.

Rather than depending upon traditional labels, an attempt was made to describe as closely as possible the patient sample. Each was asked whether or not he had been hospitalized previously for psychiatric problems. All patients who were selected as Ss reported prior or continuous hospitalizations for similar disturbances. However, since patients are notably unreliable as informants, medical records were carefully scrutinized to corroborate these reports. It was found that in many cases the charts were incomplete with regard to the desired information. Nevertheless, it was decided to utilize these data in describing the sample rather than relying on the patients' reports.

This resulted in an estimate of length and number of known hospitalizations, which is by no means reliable, but which is sufficient for descriptive purposes. The estimated mean length of known hospitalizations was 27.90 months with a standard deviation of 37.69 and a range of one to 144 months. The estimated mean number of known hospitalizations was 3.40 with a standard deviation of 2.28 and a range of one to nine times. Much variability resulted from patients having been hospitalized only once but for a continuous period of time, as long as 12 months in one case.

Control subjects. Control Ss were volunteers from the non-psychiatric patient population and from staff, office, and ward personnel of the hospital. Each schizophrenic S was matched with a nonschizophrenic control on the basis of sex, age, race, estimated intellectual functioning and verbal ability, and educational level (see Appendix A). Although it was not feasible to match Ss for occupation, care was taken to avoid pairing such diverse occupations as day laborer and clerical worker. Each control S was required to pass the same stringent test for hearing acuity as the schizophrenic Ss.

Matching of subjects. Means and standard deviations for the two groups of the variables used in matching are presented in Table 1. The age range in the schizophrenic group was from 22 to 44 years with a mean age of 34.90 years and a standard deviation of 5.98. The range in the

Table 1

Means and Standard Deviations of Ages, IQ Equivalents, and Years of Education of Schizophrenic and Nonschizophrenic Subjects

	Schizophrenic		Nonschizophrenic	
	M	SD	M	SD
Age	34.90	5.98	36.10	6.72
IQ Equivalent	97.95	11.70	99.25	12.16
Education	11.50	3.36	11.80	2.76

control Ss was from 19 to 44 years with a mean age of 36.10 years and a standard deviation of 6.72 (Table 1).

Intellectual quotient (IQ) equivalents were obtained from the WAIS Vocabulary subtest scores. The IQ equivalents in the schizophrenic group ranged from 81 (Dull Normal) to 129 (Superior), with a mean of 97.95 (Average) and a standard deviation of 11.70. The IQ equivalents in the control group ranged from 82 (Dull Normal) to 129 (Superior), with a mean of 99.25 (Average) and a standard deviation of 12.16 (Table 1). Subjects were matched according to the WAIS classifications (Wechsler, 1955, p. 20).

The range in the number of years of education completed by schizophrenic Ss was four to 18 years with a mean of 11.50 years and a standard deviation of 3.36. In the nonschizophrenic control group, the number of years ranged from six to 16 with a mean of 11.80 and a standard deviation of 2.76 (Table 1).

Apparatus

A Maico Model MA-8 Clinical Audiometer was used for the pure tone sweep check and speech reception test. The equipment was housed in an eight-by-nine foot darkened, isolated, sound treated room in the Audiology Laboratory of the Veterans Administration Hospital. Speech signals to the S were delivered through the speech channel of the audiometer.

The S was seated in the adjacent eight-by-eight foot

darkened, isolated, sound treated room with his back to a large glass window separating the two rooms. In addition to a double headphone set leading to the audiometer, the room was equipped with a Shure Model 777 Slim X microphone mounted on an Atlas MS-11C microphone floor stand with a 30 inch boom. This microphone delivered the S's verbal responses to the experimenter through a Bogen five-watt audio amplifier to a high fidelity eight-inch speaker housed in the room with the audiometer where the experimenter sat.

A Grayson-Stadler Model E664-1 Galvanometer was used to obtain a crude estimate of the S's galvanic skin response (GSR) as he performed the two experimental tasks. This piece of equipment was housed in the experimenter's room. Electrodes leading from the galvanometer were attached to the S's left index and middle fingers using Sanborn Redux Electrode Paste and one-half inch black electrical tape to secure the electrodes.

Stimulus Materials

Two parallel word lists of 40 words each served as stimuli for the two experimental tasks required of each S. The first 20 words of List 1 (see Appendix B) and List 2 (see Appendix C) consisted of pairs of monosyllabic homophenes, i.e., "words which look alike on the lips but sound different (Falconer, 1966, p. 241)." Falconer developed 40 sets of four monosyllabic homophenous words which he organized into two forms, each consisting of

four lists of 20 words. Each word in each list had an associated homophenous word in each of the other three lists of the same form, e.g., lamb, lamp, lab, lap. One homophenous word was placed on experimental List 1 and one of its associates on List 2. These words were chosen because they have been shown to be easily discriminated by normal hearing people (Falconer, 1966). These pairs of words are found in Table 2. For the purposes of this study, all Ss demonstrated auditory acuity within the normal range. Any differences in the ability to repeat correctly such words should be a function of the postulated perceptual disorder in the schizophrenic Ss.

The second half of each experimental list was composed of words derived from word association data made available by the Psychiatric and Psychosomatic Research Laboratory of the Veterans Administration Hospital. Twenty words used as stimuli for word association which are frequently misheard by schizophrenics and the 20 words for which they are usually mistaken were selected. One word of each pair was placed randomly on either List 1 or List 2. These word pairs are found in Table 3.

Procedure

Each potential experimental S was brought individually from his ward to the Audiology Laboratory. He was met by the experimenter who conducted him into the darkened, sound treated testing room and seated him comfortably. The procedure for taping the GSR electrodes to his fingers

Table 2

Monosyllabic Homophenous Pairs of Words Selected From Falconer's Balanced Word Lists (1966)

List 1	List 2
bead	bean
bet	bun
blank	plank
boat	bone
cab	cap
dim	dip
green	meet
ground	crown
gum	cup
hinge	inch
lamp	lamb
mud	met
nod	dot
note	known
plant	plan
said	set
tame	tape
toad	tone
went	when
wick	wing

Table 3

Pairs of Word Stimuli and Words for Which They Are Frequently Misheard by Schizophrenics Based On Their Association Responses

List 1	List 2
ask	ass
bitch	bits
bump	hump
close	clothes
draft	graft
end	in
hive	high
ire	hour
led	laid
loose	lose
lying	lion
mole	mold
park	part
ream	rim
rip	rib
screen	scream
soul	sold
stew	screw
stump	stomp
tenths	tense

was explained so that any fears that he might receive a shock would be dispelled. So that each S could understand in simple terms, it was explained that the purpose was "to measure the sweat on the ends of your fingers." During the several minutes in which the electrode paste was applied and the electrodes taped firmly in place to his fingers, the patient was engaged in light conversation in order to establish rapport. Topics included how he was feeling and what he thought of the hospital. After the first few Ss were tested, GSR records were examined, and it was determined that analysis was not feasible. Since the emphasis in this study was upon speed, the GSRs were in no case completed in the period between presentation of SWs. Thus, GSR responses will not be considered. It was decided, however, to keep the conditions constant for all Ss so that the GSR recording procedure was not discontinued.

When the electrodes were in place, the examiner said: "Is that comfortable, Mr. _____? Good. Now I want to get some information from you." A short interview followed during which the S was asked for his full name, age, educational background, occupation, length of hospitalization, and number of hospitalizations for a similar disorder.

WAIS vocabulary. Next the WAIS Vocabulary subtest was administered according to standard procedures (Wechsler, 1958) in order to obtain a measure of the S's verbal ability and an estimate of his general intelligence. This subtest has been found to hold up better than other subtests on the Scale with intellectual deterioration resulting from

advanced age or pathological conditions (Wechsler, 1958). Because of the semi-darkness of the room, the Vocabulary card which is usually presented to the S so that he may see the words as the examiner calls them out was not used.

Responses were scored 1 or 2 on the basis of the scoring criteria (Wechsler, 1955). Raw scores were added and converted into a Scale score (Table 17 of the WAIS Manual, 1955, p. 77). An IQ equivalent was calculated for each S by multiplying the Scale score by six (the total number of subtests on the Verbal Scale). The resulting figure was the estimated sum of Scale scores for the Verbal Scale. By referring to Table 18 of the WAIS Manual (1955, p. 78) under the appropriate age group, this estimated Scale score was converted into an estimated IQ.

Auditory acuity for pure tones. Following the administration of the Vocabulary subtest, the S was told: "That's fine, Mr. _____. Now we're going to do something a little different. Have you ever had your hearing tested?" If he said "yes", he was told: "Good. You'll know just what to expect, but let me explain it again." The procedure was explained in the same manner to all Ss as follows:

"First, I'm going to place these earphones on your head. I want you to relax while I close this door and go into the room in back of you where the testing equipment is. I'll be able to see you through the window, and if you want to talk to me, just use this microphone. The first thing I want you to do is to listen carefully for

some small sounds. I'm going to present four different tones through the earphones to your right ear. After you hear each tone, raise your hand so that I'll know you heard it. Next, you'll hear the same four tones one at a time in your left ear. I want you to raise your hand the moment you hear each tone just like you did before. Listen carefully because some of them will be hard to hear. Do you understand?"

If the S did not understand the instructions, they were repeated until he did. Then the headphones were placed on his head and adjusted so that they were comfortably in position. The microphone mounted on the boom was moved to a position approximately six inches in front of his face. The experimenter closed the door and entered the adjacent room. As soon as the experimenter was inside, the S was contacted through the speech channel of the clinical audiometer at an intensity of 60 decibels above normal threshold (ASA-1951, re 0.0002 dynes/cm^2). He was asked: "Can you hear me, Mr. _____? Good. Now remember to raise your hand just as soon as you hear each tone."

A pure tone sweep check was performed at 10 decibels above normal threshold at frequencies of 500, 1000, 2000, and 3000 cps in that order. If the S raised his hand, the next tone was presented at the higher frequency until he had acknowledged hearing them all or had been unable to hear any one of them. If the latter was the case, he was thanked for his cooperation, told how well he had done,

and after removing the headphones and electrodes, was allowed to return to his ward.

Auditory acuity for speech reception. If the S passed the pure tone sweep check, he was required to pass a speech reception test (Quiggle et al., 1957) in order to determine that acuity for speech was within normal limits. The speech channel of the audiometer was used to deliver instructions at 60 decibels for this next phase of the experiment. The following instructions were given: "That's fine, Mr. _____. Now I'm going to say some words. I want you to repeat them. You'll hear them through the ritht ear first, then through the left." Spondaic words (Quiggle et al., 1957) were delivered to each ear separately at an intensity of 15 decibels above normal threshold (ASA-1951, re 0.0002 dynes/cm^2). The spondaic word lists come from the Central Institute for the Deaf and consist of words of homogeneous audiability. They are bi-syllabic words spoken with the same stress on each syllable, e.g., baseball, schoolboy, duckpond. Each word was presented with the carrier phrase, "Say the word _____." Words were presented first to the right ear. The S was required to repeat correctly half the words in a group of six words. If he could not repeat accurately 50% of the first six words delivered, six more were given. If he repeated the required number, another group of six words was delivered to the left ear in the same fashion. Subjects who were unable to pass this test were eliminated at this point in

the same manner as those who could not pass the pure tone sweep check.

Word repetition. The audiometer intensity level was raised to 60 decibels above normal threshold for the delivery of the experimental word lists. Persons with normal hearing acuity are able to receive speech signals at this level comfortably without distortion of the sounds.[1] This level of intensity was experienced by the experimenter as more comfortable and natural than higher levels. Subjects whose hearing acuity met the stringent standards for normal hearing were given the following instructions:

"That's fine, Mr. _____. Now just relax a minute. Sit very still. We have to adjust the machine to measure the sweat on your fingers. Okay? Be very still now."

After the galvanometer was calibrated, the S was given the following instructions regarding the actual experiment:

"Now, I want you to repeat some more words for me. This time I'll say the word and you repeat it as quickly as possible. I'll be timing you, so try to be fast. Remember, after I say the word, repeat it as fast as you can. Are you ready? Okay, let's begin."

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[1]In the absence of explicit information in the literature, this level was selected arbitrarily by the experimenter for this study at the suggestion of George A. Falconer, Ph.D., Director of the Audiology and Speech Pathology Clinic who served as consultant.

Each word was delivered by the experimenter as rapidly as possible after the patient had repeated the previous word. The reaction time was recorded to the nearest tenth of a second. Any word which sounded different from the one on the list was recorded. Rarely did more than one second elapse between presentation of the words by the experimenter, response by the S, and presentation of the next word. Skill in manipulating the stop watch, experience in noting reaction times and deviant responses, and thorough knowledge of the word lists made this rapid-fire presentation possible.

Word association. When the list of 40 words to be repeated has been administered, the following instructions were given:

"Fine, Mr. _____. This time I want you to do something different. This time, don't repeat the word I say. Instead, tell me the very first word you think of when I say it. It doesn't make any difference what the word is except that it should be the very first word that you think of after I call out a word. Be just as fast as you can because I'll time you. Now remember, this time don't repeat the word I say. Just tell me the first word that comes to your mind. Do you understand? Okay, let's begin."

Responses and reaction times to the nearest tenth of a second were recorded precisely after the presentation of each of the 40 words of the second list. A reproduction phase followed the standard association task preceded by

the following instructions:

"Now, I'm going to call out the same words again. This time I want you to tell me the same words you said the first time. Try to be quick because I'm going to time you again."

Responses which differed from those given in the association phase and reaction times to the nearest tenth of a second were recorded.

The order of presentation of the two word lists was counterbalanced so that odd numbered Ss repeated List 1 and associated to List 2, while even numbered Ss did the reverse. In each case, the repetition task was given before the more complex association task. It was felt that maintaining this order of presentation would be less confusing for the patients in view of the preceding speech reception test which also required them to repeat words. Thus, the function of ability to change set would be attenuated by building up to the more complex association task after all the repetition tasks had been completed.

The procedure was basically the same for nonschizophrenic control Ss except for modifications necessitated by the matching process. All schizophrenics were tested first. Control Ss had to be matched with schizophrenic Ss in order to determine the order in which the lists would be presented. Other than this, the procedure was the same.

Analysis of Responses

Each response word (RW) to each stimulus word (SW) on both the repeat and association tasks was scored individually. Response words elicited by the repeat instructions were scored as misheard (MH) if the S pronounced them differently from the SW.

The method for analyzing RWs on the association task was more complex. To facilitate scoring and to guard against biasing influences due to knowledge as to whether a given association was made by a schizophrenic or non-schizophrenic S, each stimulus-response pair was transferred to an IBM card and identified by a S number code. These cards were then sorted and listed alphabetically by SW, and within each SW alphabetically by RW. The listing did not contain the S code number so that identification of the group to which the S belonged was precluded. The same procedure was followed for reproduction responses.

Five experienced judges scored each association RW and each reproduction failure (i.e., instance in which the reproduction RW differed from the initial RW) according to nine categories. This scoring system was derived from a factor analytic study mentioned previously (Moran, Mefferd,& Kimble, 1964). Modifications of the original system have been used in a number of word association originating in the Psychiatric and Psychosomatic Research Laboratory of the Veterans Administration Hospital at Houston, Texas. The first five categories described below

are idiodynamic sets.

1. Synonym-Superordinate. The RW has the same meaning as the SW, e.g., cap - hat, or the SW is an immediate member of the class or category denoted by the RW, e.g., hour - time.

2. Contrast-Logical Coordinate. The RW contrasts with the SW, e.g., lose - find, or the SW and RW separately denote immediate members of the same class, e.g., stew-soup.

3. Noun-Verb Functional. The SW and RW are a noun and a verb between which there is an explicit functional relationship, e.g., gum - chew.

4. Noun-Adjective Functional. The SW and RW are a noun and an adjective between which there is an explicit functional relationship, e.g., green - leaves.

5. Noun-Noun Functional. The SW and RW are nouns between which there is an explicit functional relationship, e.g., hive - bee.

6. Vague. The RW is vaguely related to the SW but not closely enough to be scored for a set category, e.g., tense - stern.

7. No-Set. The RW is acceptable, but no scoring category is available. This includes RWs which are subordinate to the SW, e.g., clothes - hat, and RWs which are dependent upon the SW for meaning, e.g., screw - driver.

8. Distant. The RW has no relation or a very remote relationship to the SW, e.g., ground - fence.

9. Blank-Repetition. The S fails to respond within 10 seconds or indicates that he has no response or repeats the SW.

After each RW had been scored, those given the numerical score of 8, i.e., Distant, were examined separately. If the RW was considered by the judges to be a good associate of a word with a different meaning but phonetically similar to the SW, it was given an additional score, mishearing (MH), and its category score was changed from 8 to whichever of the remaining scores was applicable. For example, bitch - tent was scored originally as Distant. When re-evaluated for the possibility that the SW had been misheard, it was scored MH, and its category was changed to 3, i.e., Noun-Verb Functional, since the SW was probably misheard as pitch, to which tent is a logical associate.

Next, commonality scores were assigned to RWs based upon the number of times the response was given by the Ss. For example, the RW, chew, received a commonality score of 15 since that number of Ss gave that particular RW to the SW, gum.

Faults were scored in the following manner for each S. Scores 8 and 9 were regarded as faults. Multi-word responses were faults, e.g., bet - race horses. Reaction times which exceeded the S's mean reaction time more than one standard deviation were also scored as faults.

Reproduction failures were scored when RWs on the reproduction phase were different from RWs elicited on the association phase.

Chapter IV

Results

The major hypothesis was that the pathological breakdown in schizophrenic thought disorders lies in the lower order cognitive process of perception rather than in the more complex process of association. It was predicted that the overall number of mishearings on both the repetition and association tasks would be significantly greater in the schizophrenic Ss. More specifically, the latter would mishear significantly more words than the nonshcizophrenics on the repetition task. This should carry over to the association task when each was considered separately since recognition and discrimination of words were necessary in order to repeat or associate to words.

Table 4 presents the means and standard deviations of the number of mishearings on both tasks and on each separately for schizophrenic and nonschizophrenic Ss. The overall mean number of mishearings was 11.00, with a standard deviation of 3.70 for schizophrenics. The overall mean for nonschizophrenics was 5.80 words, with a standard deviation of 3.00. The mean number of mishearings for schizophrenics on the repetition task was 4.30, with a standard deviation of 2.08, while the nonschizophrenic mean was 1.50, with a standard deviation of 0.88. On the association task, schizophrenics on the average misheard 6.70 words with a standard deviation of 2.90. On the same

Table 4

Means, Standard Deviations, and Results of Wilcoxon Matched-Pairs Signed-Ranks Tests Between Schizophrenics and Nonschizophrenics on Number of Mishearings on Repetition, Association, and on Both Tasks

	Schizophrenics		Nonschizophrenics			Wilcoxon
Variable	M	SD	M	SD	n	T
Mishearings (Repetition)	4.30	2.08	1.50	0.88	18	2.0 **
Mishearings (Association)	6.70	2.90	4.30	2.51	20	42.0 *
Mishearings (Repetition and Association)	11.00	3.70	5.80	3.00	19	7.5 **

* Significant at .02 level
** Significant at .01 level

task, the nonschizophrenic mean was 4.30 with a standard deviation of 2.51.

The Wilcoxon matched-pairs signed-ranks test was applied to the data to determine if the consistently greater number of mishearings by schizophrenics was significantly different from that of the nonschizophrenics. For small samples of less than 25, the efficiency of this test is 95% when compared with the parametric t-test (Siegel, 1956). Results of the Wilcoxon are shown in Table 4. Overall, schizophrenics mishear significantly more words than nonschizophrenics ($T = 7.5$, $p < .01$). The differences between schizophrenics and nonschizophrenics on the repetition and association tasks were also statistically significant ($T = 2$, $p < .01$; $T = 42$, $p < .02$). On the basis of the number of misheard words, schizophrenics mishear more words than nonschizophrenics, and this difference is highly significant.

The mishearings in the repeat and association phases were examined as to the proportion that were given by schizophrenics as opposed to nonschizophrenics. These data are shown in Table 5. Under repeat conditions, 74% of the mishearings were by schizophrenics and 26% by nonschizophrenics. Under the association conditions, the proportion of mishearings by schizophrenics dropped to 61%, and that of nonschizophrenics rose to 39%. However, a McNemar test for significance of changes applied to these data indicated that the noted changes in proportion

Table 5

Frequencies of Words Scored MH by Schizophrenics and Non-Schizophrenics, Proportion of Total Number of MH Words On Repeat and Association Tasks, and Results of the McNemar Test for the Significance of Changes

	Repeat N = 116		Association N = 220		
	n	Proportion	n	Proportion	χ^2
Schizophrenics	86	74	134	61	1.25
Nonschizophrenics	30	26	86	39	1.25

were not significant (Table 5). The total number of mishearings on association was greater than the number on repetition, but this was to be expected since association was a more complex task. Thus, although the frequencies of mishearings increased on the association task, they increased proportionately in schizophrenic and nonschizophrenic Ss.

In an attempt to clarify the function of perception as opposed to association in schizophrenia, the RWs scored as distant and unrelated to the SW (Score 8) were analyzed. Five experienced judges identified those distant RWs which were considered to be good associates to words with different meanings but phonetically similar to the SWs. These were re-scored as MH and reassigned to appropriate categories. Until the present time, RWs scored as distant and unrelated to the SW have been considered to be manifestations of faulty association. Thus, it would be predicted that the number of Score 8 (Distant) RWs should be significantly higher in schizophrenics than in nonschizophrenics.

Table 6 contains the means, standard deviations, and results of the Wilcoxon tests between the number of RWs scored under three conditions: Score 8 (Distant) before re-scoring; Score 8 (Distant) after re-scoring; and the number re-scored MH. Before re-scoring, schizophrenics had a significantly greater number of Distant responses than nonschizophrenics ($T = 37$, $p < .01$). However, after

Table 6

Means, Standard Deviations, and Results of Wilcoxon Matched-Pairs Signed-Ranks Tests Between Schizophrenics and Nonschizophrenics for Three Categories: Score 8 (Distant) Before Re-scoring; Score 8 (Distant) After Re-scoring; and Number Re-scored MH

	Schizophrenics		Nonschizophrenics			Wilcoxon
	M	SD	M	SD	n	T
Score 8 (Distant) before re-scoring for mishearings	8.60	3.67	5.55	2.94	20	37 **
Score 8 (Distant) after re-scoring and removal of MH words	1.90	1.44	1.25	1.25	16	43
MH words first scored Distant, then re-scored and removed from Score 8 category	6.70	2.90	4.30	2.51	20	42 *

* Significant at .02 level
** Significant at .01 level

re-scoring and removing RWs which reflected mishearing of the SW, these differences disappeared.

The results seem to offer conclusive evidence in support of the major hypothesis that the pathological breakdown lies in the process of perception rather than in association.

Diagnostic Indicators

Distant responses and mishearings constitute two types of word association responses which have often been used as diagnostic indicators for schizophrenia, e.g., Rapaport, Gill, and Schafer (1946). Other response variables similarly used have included reaction time, commonality, faults, and reproduction failures. Although this study was not designed to test the validity of these diagnostic indicators, their analysis, especially with respect to MH versus NoMH words, should be of interest.

Reaction times. On the basis of previous word association studies with schizophrenics, these Ss were expected to have significantly longer reaction times (RTs) than nonschizophrenics on both the association and reproduction phases. Means, standard deviations, and results of t-tests for differences between schizophrenics and nonschizophrenics on RTs (summed over all 40 words) for each phase are shown in Table 7. On association and reproduction, schizophrenics had significantly longer RTs ($t = 2.61$, $p < .02$; $t = 3.14$, $p < .01$).

Table 7

Summary of t-Tests for Differences Between Schizophrenics and Nonschizophrenics on Association and Reproduction RTs (Summed Over 40 Words)

	Schizophrenics		Nonschizophrenics		
	M	SD	M	SD	t
Association	106.22	43.13	77.53	21.66	2.61 *
Reproduction	94.40	32.32	66.37	18.93	3.14 **

* Significant at .02 level

** Significant at .01 level

Table 8 presents results of t-tests for differences between association and reproduction RTs within schizophrenics and within nonschizophrenics. Reproduction RTs were significantly shorter than association RTs in nonschizophrenics ($t = 3.06$, $p < .01$). There was a trend toward significance in schizophrenics ($t = 1.78$, $p < .10$).

Table 9 presents means, standard deviations and results of t-tests for differences in mean association RTs (average RT per word) between schizophrenics and nonschizophrenics for NoMH and MH words. Schizophrenic RTs were significantly longer than nonschizophrenic RTs on both words which were not misheard and on those misheard ($t = 2.64$, $p < .02$; $t = 2.58$, $p < .02$). Table 10 contains results of t-tests for differences in mean association RTs (average RT per word) between NoMH and MH words within schizophrenic Ss and within nonschizophrenic Ss. There were no significant differences between NoMH and MH words.

Finally, a specific analysis of RTs was undertaken with regard to what happened on the reproduction phase when a word was misheard on the association task. Four categories were formulated, and t-tests for differences between mean RTs per word were computed for schizophrenics and nonschizophrenics (Table 11).

The first category included cases in which the SW was misheard, and the RW was repeated correctly on the reproduction phase. Schizophrenics had significantly shorter RTs on reproduction ($t = 2.30$, $p < .05$), while

Table 8

Summary of t-Tests for Differences Between Association and Reproduction RTs in Schizophrenics and Nonschizophrenics (Summed Over 40 Words)

	Association		Reproduction		
	M	SD	M	SD	t
Schizophrenics	106.22	43.13	94.40	32.32	1.78 *
Nonschizophrenics	77.53	21.66	66.37	18.93	3.06 **

* trend (.10 level)

** significant at .01 level

Table 9

Summary of t-Tests for Differences Between Schizophrenics and Nonschizophrenics in Mean Association RT (Average RT Per Word) For NoMH and MH Words

	Schizophrenics		Nonschizophrenics		
	M	SD	M	SD	t
NoMH	2.72	1.21	2.07	0.69	2.64 *
MH	2.65	1.09	1.91	0.55	2.58 *

* Significant at .02 level

Table 10

Summary of t-Tests For Differences Between NoMH and MH Words in Mean Association RT (Average RT Per Word) Within Schizophrenics and Nonschizophrenics

	NoMH		MH		
	M	SD	M	SD	t
Schizophrenics	2.65	1.09	2.72	1.21	-0.50
Nonschizophrenics	1.91	0.55	2.07	0.69	-1.22

Table 11

Summary of t-tests for Differences Between Mean Association and Reproduction RTs (Average RT Per Word) for Schizophrenics and Nonschizophrenics in Four Reproduction Categories When the RW was Scored MH

		Association		Reproduction			
		M	SD	M	SD	n	t
Reproduction RW was same as association RW	Schizophrenics	2.58	2.00	2.11	1.54	68	2.30*
	Nonschizophrenics	1.99	1.24	1.71	1.49	58	1.45
Reproduction failure was not scored MH	Schizophrenics	2.38	1.12	2.67	1.62	19	-0.71
	Nonschizophrenics	2.32	1.45	1.85	1.00	9	1.29
Reproduction failure was also scored MH	Schizophrenics	2.44	1.91	2.32	1.24	31	0.50
	Nonschizophrenics	2.61	1.83	3.27	2.34	12	-0.80
Reproduction failure was repetition of SW or a blank	Schizophrenics	2.67	1.15	3.68	2.23	14	-1.45
	Nonschizophrenics	2.61	0.95	4.21	2.88	7	-1.05

* Significant at .05 level

differences between RTs did not reach significance in nonschizophrenics. Where the SW was misheard and the reproduction failure RW was not scored MH, i.e., the S heard the SW correctly on the reproduction phase and gave an appropriate RW, there were no significant differences in either schizophrenic or nonschizophrenic Ss. The third category was characterized by a reproduction failure which was also scored MH. This would seem to indicate that the S misheard the SW twice. No significant differences were found. Finally, when the association RW was scored MH, and the reproduction failure was a repetition of the SW or a blank, although the t-tests did not reach significance in either schizophrenics or nonschizophrenics, examination of Table 11 indicates that both groups of Ss had slightly longer RTs on the reproduction phase.

Commonality. As predicted from previous word association studies, schizophrenics were expected to have lower commonality scores than nonschizophrenics. Means, standard deviations, and t-test results for differences between commonality scores per word in the two groups appear in Table 12. Over all 40 words, nonschizophrenics had significantly higher scores ($t = -2.31$, $p < .05$). Words that were not misheard and those that were misheard were analyzed separately. There were no significant differences on words which were not misheard. However, on words which were misheard, higher commonality in nonschizophrenics reached the .01 level of significance ($t = -2.90$).

Table 12

Summary of t-tests for Differences in Commonality Scores Per Word Between Schizophrenics and Nonschizophrenics Over All Words, on NoMH and on MH Words

	Schizophrenics		Nonschizophrenics		
	M	SD	M	SD	t
All Words	3.15	0.86	3.60	0.86	-2.31 *
NoMH Words	3.50	0.95	3.78	0.88	-1.27
MH Words	1.36	0.35	1.85	0.74	-2.90 **

* Significant at .05 level

** Significant at .01 level

Thus, it appears that commonality, at least in this sample, may serve as a diagnostic indicator only when words are misperceived. In support of this was the t-test analysis between commonality scores on NoMH and MH words within each group of Ss (Table 13). Both schizophrenics and nonschizophrenics had significantly higher commonality scores on NoMH words ($t = 9.46$, $t = 7.81$, $p < .001$).

Faults and reproduction failures. On the basis of schizophrenic word association studies, it was expected that schizophrenics would have more faults and reproduction failures than nonschizophrenics. As defined earlier, faults included RWs scored as Distant (Score 8), repetition of SW or blank (Score 9), multi-word responses, and RTs which exceeded the S's mean RT by more than one standard deviation. Reproduction failures were those responses elicited during the reproduction phase which deviated from the RW on the association phase.

Means and standard deviations of number of faults and reproduction failures per word for schizophrenics and nonschizophrenics are found in Table 14. The table contains results of the Wilcoxon tests for differences between schizophrenic and nonschizophrenic pairs on all words, on NoMH words, and on MH words. As predicted, schizophrenics had significantly more faults and reproduction failures than nonschizophrenics when all words were considered ($t = 40$, $p < .02$; $t = 41$, $p < .02$). These

Table 13

Summary of t-Tests For Differences in Commonality Per Word Between NoMH and MH Words in Schizophrenics and Nonschizophrenics

	NoMH		MH		
	M	SD	M	SD	t
Schizophrenics	3.50	0.95	1.36	0.35	9.46 *
Nonschizophrenics	3.78	0.88	1.85	0.74	7.81 *

* Significant at .001 level

Table 14

Means, Standard Deviations, and Results of the Wilcoxon Between Schizophrenics and Nonschizophrenics on Number of Faults and Reproduction Failures Over All Words, On NoMH Words, and On MH Words

	Schizophrenics		Nonschizophrenics		Wilcoxon		
	M	SD	M	SD	n	T	
Faults							
All Words	0.38	0.17	0.24	0.11	20	40.0	*
NoMH Words	0.38	0.18	0.23	0.11	20	39.0	*
MH Words	0.39	0.27	0.33	0.39	18	63.0	
Reproduction Failures							
All Words	0.38	0.18	0.24	0.13	20	41.0	*
NoMH Words	0.36	0.17	0.24	0.13	20	43.0	*
MH Words	0.42	0.27	0.31	0.28	18	56.5	

* Significant at .02 level

differences were also significant on words which were not misheard ($t = 39$, $p < .02$; $t = 43$, $p < .02$). These differences did not reach significance on words which were misheard. It appears that nonschizophrenics were just as likely to have a fault or reproduction failure on misperceived words as the schizophrenics so that on such words, these variables do not function as diagnostic indicators. A Wilcoxon test within the two groups between the number of faults and reproduction failures on NoMH and MH words yielded no significant difference.

Scoring Categories

Of considerable interest, but having little meaning in the context of the major hypothesis for which this study was designed, was the type of RWs given by the Ss. Table 15 presents the means, standard deviations, and results of the Wilcoxon between the number of words in each of the nine scoring categories for schizophrenics and nonschizophrenics over all 40 words. It will be noted that nonschizophrenics gave significantly more Set 3 (Noun-Verb Functional) responses than schizophrenics ($t = 26$, $p < .01$). The latter group, as expected from the preceding analysis of faults, had significantly more repetitions of SWs and more blanks ($t = 11.5$, $p < .01$).

When the same comparisons were made separately for NoMH and MH words, as shown in Tables 16 and 17, these differences were found to be significant only on words

Table 15

Means, Standard Deviations, and Results of Wilcoxon Matched Pairs Signed-Ranks Tests Between the Number of All Words in Each of the Nine Scoring Categories for Schizophrenics and Nonschizophrenics

(N = 40 Words in Each Category)

	Schizophrenics		Nonschizophrenics			Wilcoxon
Category	M	SD	M	SD	n	T
Set 1 (Synonym-Superordinate)	10.90	3.96	12.40	4.49	18	59.0
Set 2 (Contrast-Coordinate)	4.80	3.79	4.15	4.19	19	88.0
Set 3 (Noun-Verb Functional)	4.95	2.48	7.60	3.03	19	26.0 *
Set 4 (Noun-Adjective Functional)	2.60	1.43	2.30	1.49	17	53.0
Set 5 (Noun-Noun Functional)	6.40	2.30	7.70	2.58	19	57.5
Score 6 (Vague)	0.80	0.69	0.60	0.75	10	18.5
Score 7 (No-Set)	2.65	1.56	2.35	1.69	15	47.0
Score 8 (Distant)	1.90	1.44	1.25	1.25	16	43.0
Score 9 (Repetition of SW or Blank)	5.05	4.74	1.65	1.31	17	11.5 *

* Significant at .01 level

Table 16

Means, Standard Deviations, and Results of Wilcoxon Matched-Pairs Signed-Ranks Tests Between the Number of NoMH Words in Each of the Nine Scoring Categories for Schizophrenics and Nonschizophrenics With Ns for Each Category

	Schizophrenic		Nonschizophrenic			Wilcoxon
Category	M	SD	M	SD	n	T
Set 1 (Synonym-Superordinate)	9.30 N = 186	3.69	11.20 N = 224	4.38	18	54.5
Set 2 (Contrast-Coordinate)	3.80 N = 76	3.33	3.70 N = 74	4.04	19	67.5
Set 3 (Noun-Verb Functional)	4.00 N = 80	2.20	6.75 N = 135	2.75	20	24.5 *
Set 4 (Noun-Adjective Functional)	1.95 N = 39	1.10	2.05 N = 41	1.39	13	43.0
Set 5 (Noun-Noun Functional)	5.90 N = 118	2.45	7.15 N = 143	2.66	20	67.0
Score 6 (Vague)	0.50 N = 10	0.69	0.30 N = 6	0.47	18	9.0
Score 7 (No-Set)	1.95 N = 39	1.39	2.00 N = 40	1.45	15	55.5
Score 8 (Distant)	1.55 N = 31	1.27	1.15 N = 23	1.09	15	46.0
Score 9 (Blank or Repetition of SW)	4.35 N = 87	4.33	1.40 N = 28	0.99	18	21.5 *

* Significant at .01 level

Table 17

Means, Standard Deviation, and Results of Wilcoxon Matched-Pairs Signed-Ranks Test Between the Number of MH Words in Each of the Nine Scoring Categories for Schizophrenics and Nonschizophrenics With Ns for Each Category

	Schizophrenic		Nonschizophrenic		Wilcoxon	
Category	M	SD	M	SD	n	T
Set 1 (Synonym-Superordinate)	1.60 N = 32	1.23	1.20 N = 24	0.77	18	64.0
Set 2 (Contrast-Coordinate)	1.00 N = 20	0.92	0.45 N = 9	0.60	16	32.5
Set 3 (Noun-Verb Functional)	0.95 N = 19	0.99	0.85 N = 17	0.87	14	48.0
Set 4 (Noun-Adjective Functional)	0.65 N = 13	0.81	0.25 N = 5	0.44	11	15.0
Set 5 (Noun-Noun Functional)	0.50 N = 10	0.61	0.55 N = 11	0.99	8	17.5
Score 6 (Vague)	0.30 N = 6	0.57	0.30 N = 6	0.57	6	10.5
Score 7 (No-Set)	0.65 N = 13	0.87	0.35 N = 7	0.49	13	27.0
Score 8 (Distant)	0.35 N = 7	0.49	0.10 N = 2	0.31	9	10.0
Score 9 (Blank or Repetition of SW)	0.70 N = 14	0.92	0.25 N = 5	0.55	12	20.0

which were not misheard ($t = 24.5$, $p < .01$; $t = 21.5$, $p < .01$).

Chapter V

Discussion

Without question, the results of this experiment strongly support the hypothesis that the pathological breakdown in schizophrenic thought disorders occurs in the lower order cognitive process of perception rather than in the more complex process of association. This was clearly demonstrated, first of all, by presenting Ss with the simple task of repeating a list of words. Schizophrenics were found to mishear significantly more words than nonschizophrenics. Thus, it appears that Bleuler (1950) was wrong when he emphasized the loosening of associations as the underlying mechanism in schizophrenia. As a result of Bleuler's influence, researchers have focused on either higher order cognitive processes such as association or concept formation, ignoring the more basic process of perception. Or they have ignored the cognitive dimension entirely and have adopted a fragmented physiological point of view.

The concept of schizophrenia as a nosological entity appeared late in medical history. Kraepelin was the first and almost only writer until Bleuler who attempted to structure the concept. Around the turn of the century, his efforts at synthesis resulted in a description of the syndrome. Bleuler, who published his famous monograph in 1911, was the second person to make a major contribution

to the understanding of schizophrenia. He saw the syndrome described as a progressive organic disease by Kraepelin, as a disorder characterized by an alteration in the faculty of association. He conceived of the human "psyche" as composed of two basic entities, i.e., engrams (psychic memory units) and associative links. The former were stable, the latter were variable. Loosening of associative links between engrams, facilitated by alterations in the brain, was the mechanism underlying schizophrenia.

It is obvious that this formulation overlooked the role which perception plays in the life of a human being. Bleuler himself did not overlook perception; he merely failed to recognize its importance as the basic process underlying the manner in which a person experiences his environment. With regard to psychotics, he stated that "perception may be imperfect (1924, p. 58)." After giving recognition to disturbances in visual perception, he added that "analogous disturbances, though not so easy to demonstrate, are also found in the acoustic field (1924, p. 58)." It seems that he regarded disturbances in perception as "secondary" symptoms, much as he regarded hallucinations and delusions. "Loose associations", "fragmented thinking", and "bizarre ideas" were recognized as primary symptoms of schizophrenia and were considered to be manifestations of disturbances in the association process.

It was unfortunate that his theory was promulgated at a time when its enthusiastic reception was virtually

assured because of lack of understanding of the syndrome. It is also unfortunate that his theory has been so zealously perpetuated that the 1911 monograph remains a major reference to this day. Because of this almost dogmatic acceptance, the role of perception, especially auditory perception, has been minimized, and its systematic investigation has been delayed.

Of course, auditory perception is very difficult to handle in a strictly "scientific" sense. How another person perceives something, i.e., how he receives information about it, is not easily measured. Knowledge of perceptions depends upon verbal reports. This means that perceptions might be contaminated by interpretations based upon the S's prior experience or tainted by his ability to communicate accurately. Also involved is the interpretation of the verbal report by the experimenter. Obviously, there is much more to perception than simple observation and reporting of sensory data.

In order to illustrate how emphasis upon association has led to neglect of perception despite recognition of its presence, let us consider briefly the Rapaport, Gill, and Schafer (1946) presentation of the word association test as a diagnostic clinical tool. These authors stress "associative disturbances" as major diagnostic indicators. They do not overlook perception, because their list of 25 associative disturbances includes as number 24, misunderstanding of the stimulus word. However, they do not give it credit for being a function of perception rather than

association. Instead, they specify that mishearing the stimulus word "...most frequently...occurs on specific words because of a specific affective difficulty centered in their connotations (p. 31)." They furnished an example: "...suck (sock) - 'hit' was given by a subject who compensated for his strong oral passive dependent trends by a show of independent, aggressive, manly bearing (p. 31)."

One of the associative disturbances which they highlighted as a reliable diagnostic indicator was the "distant reaction." These were reactions which were "related to the stimulus-word in a far-fetched manner (p. 31)." Although this book was published 20 years ago, even today the presence of distant responses on word association records is considered to be diagnostically significant. For example, Schafer's book on diagnostic indicators, first published in 1948 (and in its tenth unrevised printing in July of 1963), emphasizes that schizophrenic word association records will contain "distant associations." Rapaport et al. (1946) concluded their discussion of distant reactions with: "We have now seen how the Schizophrenics and overideational Preschizophrenics, with their pathologically loose connections in thinking... have significantly higher incidences of such distant reactions (p.82)."

One of the examples presented by Rapaport et al. to illustrate distant reactions clearly demonstrates the bias of the authors. They overlooked the obvious mishearing of the SW in the example, "breast" (trust) - "frankness (p.41)."

In addition, it should be mentioned that the Ss in their sample were unmatched and were not tested for normal hearing acuity.

Since distant associations have been so specifically designated as characteristic of schizophrenic word associations, the present study was designed to test the power of distant responses to discriminate between schizophrenics and nonschizophrenics. When the association RWs were first scored according to a nine-category scoring system, the number of Score 8 (Distant) responses was significantly greater in the schizophrenics. Superficially, it seemed that Rapaport et al. were correct about the diagnostic power of distant responses which they assumed reflected disturbances in association. However, when RWs scored first as Distant were re-evaluated, re-scored as MH, and reassigned to appropriate categories, the differences between the number of Distant responses in schizophrenics and nonschizophrenics dramatically disappeared. Just as dramatically, significant differences occurred between the two groups of matched Ss in the number of words which were misheard. This finding was consistent with the results of the repetition task and pointed more strongly than ever to disturbance in the process of perception.

During the analysis of the data in the present study, it was noted that the number of mishearings in both schizophrenics and nonschizophrenics increased substantially on the association task. It seems that the added complexity

of the second task caused a proportionate increase in the number of words misheard by both schizophrenics and non-schizophrenics. The role which perception plays in this increase is suggested by McGhie and Chapman (1961). They feel that schizophrenics "are swamped by a flood of sensory input which they are unable to control (Venables, 1964, p. 5)." In both tasks of the present study, the external sensory input to a large extent was controlled by presenting one word at a time. On the first task, repetition, the S's attention was carefully focused upon a simple, well-circumscribed commission so that external and internal distractors were minimal in dealing with stimulus cues. On the second task, association, although the external stimulus input remained essentially the same, there was probably an increase in internal distractors over which there were no controls. It is speculated that the instructions of the second task required the activation of some higher order cognitive strategy to deal with the stimulus cues and that this increased internal distractors in both groups of Ss. Nonschizophrenics reflected the influence of these distractors in less efficient performance. Disruption of information processing at the level of perception in the schizophrenics added to their already inefficient functioning.

Concept of Diagnostic Indicators

Distant responses and mishearings are two types of word association RWs which have been called diagnostic

indicators and assumed to reflect associative disturbances. As discussed above, distant responses are not valid for diagnostic purposes, although their occurrence may be a manifestation of disturbed association. On the other hand, mishearings successfully discriminate schizophrenics from nonschizophrenics and are clearly a function of perception rather than association. Other response variables used as diagnostic indicators include reaction time, commonality, faults, and reproduction failures (Rapaport, Gill, & Schafer, 1946). This study was not designed to test the validity or power of these variables to detect pathology. Nevertheless, the possible relationship of mishearing to these variables was of interest, and their analysis was undertaken.

Reaction time. The results of the analysis of RTs was consistent with findings in other word association studies that schizophrenics have significantly longer RTs than nonschizophrenics. This tendency may be a manifestation of associative disturbances as Rapaport et al. believe. It could just as easily be considered to reflect dysfunction in the "scanning process" (Shakow, 1962) or "disturbance in selective attention" (McGhie & Chapman, 1961), both of which are perceptual functions.

The latter authors (1961) describe the alterations of perception in schizophrenia as "...a heightening of sensory vividness." Patients report that they find themselves attending almost involuntarily to certain features

in their perceptual fields which they have not noticed before. In order to be task-oriented, these patients must make some conscious attempt to exert control over the increased sensory input. Conscious intervention requires more time than normally to perform a task such as word association.

This explanation takes on added significance when association and reproduction reaction times are compared. Reproduction times were significantly shorter than association RTs in nonschizophrenics, reflecting efficient memory functioning, intactness of associations which facilitate recall, and, more than likely, unimpaired perceptual operations. The schizophrenics did not have shorter RTs on reproduction than association. Thus, their characteristic pattern of longer RTs continued to be manifested. Whether or not the SW was misheard did not affect these RT patterns. It seems that reaction time, regardless of whether it is a function of association or perception, is a highly reliable diagnostic indicator in word association.

Although no differences were found in reproduction RTs between words that were not misheard and words that were misheard on association, the possibility remained that there might be RT differences in MH words related to how they were perceived on reproduction. Thus, RTs were considered for four types of reproduction response categories.

The most frequent category in both groups of Ss was when the reproduction RW was identical with the original RW which had been scored as MH. Under these conditions, schizophrenics rather than nonschizophrenics had shorter RTs on reproduction, while the latter, who typically have shorter RTs, exhibited no differences.

These RT patterns were contrary to the general schizophrenic-nonschizophrenic patterns. Nonschizophrenics appeared to "pause" before responding. It might be speculated that these Ss correctly perceived the SW the second time it was presented and were indecisive about how to respond: to follow the instructions and repeat the RW they gave before; to give a different RW to the SW as they correctly perceived it; or not to respond at all or to repeat the SW. It is also possible that Ss did not remember previously hearing the now correctly perceived SW. As a matter of fact, analysis of response failures and faults support this line of reasoning. It was found that on MH words, the tendency of the schizophrenics to have more reproduction failures and faults disappeared. On these misperceived words, nonschizophrenics were just as likely to make these two types of responses as the schizophrenics.

Next, cases were examined where the SW was misheard on association, and the S reflected hearing the SW correctly the second time by giving an appropriate RW instead of repeating the first RW. Frequencies were very small, and

significance was not attained, but there were interesting differences in the directions of the means. Under these conditions, schizophrenics seemed to "pause" before responding, while the nonschizophrenics averaged shorter RTs. This either reflects the characteristic RT tendency of schizophrenics or suggests that once a nonschizophrenic makes up his mind to give a RW to the SW as he correctly perceived it the second time, he does so without hesitation. On the other hand, it might be speculated that the schizophrenic who changed his second RW was confused momentarily about what to do with a different SW and had to make a conscious effort to decide what to do.

Another group of words scored MH on association were also scored MH on a reproduction failure. That is, Ss seemed to mishear the SW twice, but in this case, to give a different response each time. Again, differences between the means were negligible and frequencies were small, but the nonschizophrenics who responded in this manner tended to "pause". This suggests that they were unsure about the SW or could not remember the first RW.

Finally, a group of reproductions was examined in which the S responded with a repetition of the SW or a blank. Again, the differences between association and reproduction RTs were not significant, but both schizophrenics and nonschizophrenics had longer reproduction RTs. Probably this was an artifact of the manner in which RTs were recorded for the blanks, i.e., a limit of 10

seconds. The mean of the nonschizophrenics was slightly greater than that of the schizophrenics. Once more, this might reflect their indecisiveness as to whether they should follow the instructions and give the word they gave before, or give an associate to the SW they heard the second time. In these few cases, they either could not remember the RW or did not respond within 10 seconds.

It must be stressed again that the number of cases under consideration was too small to be meaningful. It will be noted, for example, that the last analysis considered only seven out of the 86 MH responses of the nonschizophrenics (Table 11, p. 54).

Commonality. The results of analysis of commonality scores was confusing, but, in general, the entire method for handling commonality is confusing. As predicted from other word association studies, commonality was higher in nonschizophrenics than in schizophrenics, but the significance of this difference disappeared on NoMH words. Thus, in this study with the particular words which were used, commonality served to differentiate schizophrenics only on the misperceived words. Further, both schizophrenics and nonschizophrenics, considered separately, had higher commonality on words which they did not mishear than on words which they did mishear.

These results are contaminated by all sorts of problems. Commonality was not a variable considered in the construction of the stimulus lists. For the majority of

the words used, there are no commonality norms available. More important, however, is the problem of how the commonality of misheard words is to be determined. Are they scored on the basis of the misheard SW for which the RW was given as an associate? Or should they be scored on the basis of the original SW even if the RW is a good associate of a different but phonetically similar word? (The same types of problems arise from use of homonyms.) How should blanks and repetitions of SWs be treated? Should they be counted as zero commonality points in the analysis, or should they be dropped from the analysis altogether? In either case, the true picture of commonality is distorted. In one case, it is deflated because of contamination from another response variable, and in the other case, it is inflated for the same reason. All this means, then, that a really effective way to deal with commonality in any word association study has not been found.

Faults and reproduction failures. Faults and reproduction failures proved to be valid diagnostic indicators except when SWs were misheard. Differences disappeared in the latter cases suggesting that nonschizophrenics were just as likely to commit a fault or a reproduction failure when a word was misheard as schizophrenics.

Faults were defined as RWs scored Distant, repetition of SW or blank, excessively long RTs, and multi-word responses. The first three types of response have been

analyzed separately. Distant responses were found not to be different in schizophrenics and nonschizophrenics. There were significant differences in the occurrence of repetitions and blanks, with schizophrenics having significantly more than nonschizophrenics. Reaction time has been shown to be a very reliable variable with schizophrenics having significantly longer RTs than nonschizophrenics. Multi-word responses were very few in number in this study. This may have been a function of the selected schizophrenic sample since other studies usually find more of this type of response in schizophrenics. Also the sequence of tasks may have influenced the predominance of single word responses, since the two tasks preceding the word association task required single word responses. Thus, although certain kinds of faults were of interest, the total fault score added little information.

Overall, the two most meaningful and stable diagnostic indicators are longer RTs and more repetitions and blanks in schizophrenics. The former variable is the more stable since differences are significant on all words, on NoMH words, and on MH words. The latter variable loses its significance on misperceived words. Of all the diagnostic indicators, then, only reaction time seems to be as stable as mishearings. Since mishearings are a function of perception, it is highly probable that reaction time is also.

Scoring Categories

Category frequencies were too small to allow any conclusions about the function of idiodynamic set. Also the word lists were not constructed to test the relevance of this concept to schizophrenic thought disorders. It was of interest, however, that nonschizophrenics showed a marked preference for Noun-Functional words. Whether this preference was a function of the word lists used or the particular sample of nonschizophrenics could not be determined in the present study. Whatever the determinant of this tendency in the nonschizophrenics, it was not operating in the schizophrenics.

Another point of interest was the changes which occurred between scoring categories used on NoMH words and MH words. A McNemar test was performed on the small number of cases in each category. Schizophrenics showed a significant tendency to respond with Noun-Noun RWs on MH words. Nonschizophrenics gave more Vague RWs on MH words. Again, no interpretation will be made since these tendencies could be either a function of the word lists used in the study or of the sample of Ss who were specially selected and carefully matched.

Implications for Treatment

Although the results of this experiment were not completely definitive concerning the role of auditory perception in schizophrenia, they add to limited knowledge

in a long-neglected area. Controlled conditions necessary to test the specific hypothesis concerning perception make generalizations to more normal situations somewhat unfeasible. Also the sample of Ss was not only small, but very carefully selected to meet certain criteria. Foremost among these criteria were intactness of the ability to communicate verbally and to receive sensory stimuli via the auditory modality within normal limits. Also they had to be oriented well enough to follow the instructions accompanying a relatively complex series of tasks, i.e., word definition, word repetition, and word association. Characteristically, these abilities deteriorate in schizophrenia. This means that the sample used was not drawn from a severely disturbed population manifesting secondary symptoms such as hallucinations. Care must be exercised when generalizing the results of this study to other psychotic populations. Finally, medication and length of hospitalization were not controlled. These variables, for the purposes of this study, were not considered to be relevant as long as the patient could function in the required manner.

The finding that speech perception is greatly distorted in schizophrenia has implications for the treatment of schizophrenics. The very foundation for language and communication is faulty. Interpersonal relationships are disrupted, and the schizophrenic finds himself faced with a new unstable and volatile relationship with other people

and with his environment as a whole. He feels that he no longer has the ability to cope with his distorted world. It seems as if outside forces are now acting upon him, and he is helpless to deal with these new experiences.

He reacts to these subjective changes in experience first with perplexity, then with fear. Much like an infant, he has no control over the input of sensory information. Rational explanations for the changes in his perceptual world are formulated, and in this manner delusions and hallucinations become manifest. These secondary symptoms alienate him from other people, and he may be regarded as withdrawn and autistic. In these ways, the altered relationship between the schizophrenic and his environment caused by a breakdown in perceptual functioning may be manifested. The exact etiology and best treatment to correct this condition are unknown. There is no agreement among researchers concerning the specific basic organic process which might be defective. Aberrations in brain structure, biochemical and metabolic changes, or misdirected electrical impulses between cells may all contribute to an impaired perceptual process.

In the meantime, schizophrenia remains a clinical problem to be dealt with in a clinical setting in the most effective and feasible way. Knowing that there is an overload of sensory stimuli on the defective perceptual system of the schizophrenic might enable the clinician to manipulate the environment to reduce stimulus input. Such measures

might attenuate the psychologically devastating effects of gross perceptual changes in subjective experience. To some extent, medication serves to reduce internal stimuli and in effect, relieves the overload.

Chapman and McGhie (1963) suggested that the probability of an organic pathological process underlying schizophrenia need not imply that psychotherapy in any form is futile. An understanding of the difficulties the patient is having with distorted perceptual experiences might facilitate establishment of communication with him. That is, it might be possible to alter the verbal communication so that the patient's altered mode of perception may more readily accommodate it. More specifically, short, simple, concise sentences should be used with schizophrenics. An attempt to elicit feedback from patients would enable the therapist to know how his communication was received and give him information about how to deliver his next communication. Alterations in the rate normally used in speaking might enable patients to understand more words. Repetition might serve to give structure and context to individually misperceived words.

In addition, a more fruitful approach might be implemented in the treatment of schizophrenics which is directed toward helping them develop techniques for handling altered relationships with the environment. Patients might be taught to live with their cognitive disabilities so that more satisfactory adjustment may be made outside the

institution.

These are just a few of the implications which follow from the finding that schizophrenic symptoms result from impaired perception. To find more specific methods for dealing with behavior manifested by schizophrenics, more research is needed. The major problem in schizophrenia has been recognized to be a breakdown in communication. Dealing with this problem at the point at which the disturbance occurs, i.e., perception, rather than on a higher level of cognitive functioning, i.e., association and concept formation, seems to offer the most promise for understanding the syndrome. It is time for methodological considerations to be placed in perspective, so that the use of reports of subjective experiences of patients may be considered just as reliable a measure as more complex tasks such as association or sorting.

Chapter VI

Summary

The purpose of the present experiment was to determine whether the cognitive disorder which results in disturbed verbal communication in schizophrenia is a function of a pathological breakdown in the process of perception of auditory word stimuli or in the process of association. In this study, perception referred to the lower order cognitive process which involves recognition and discrimination of individual words from specially constructed lists presented with two sets of instructions. Association referred to the more complex cognitive process which involves reference of the perceived word to a conceptual category from which a word is selected as a response associate.

The procedure involved the presentation of two word lists to 20 pairs of male schizophrenics who were matched with nonschizophrenics for age, intelligence and verbal ability, and educational level. Each S passed a stringent hearing test to ensure auditory acuity within the normal range. In addition, each S's ability to communicate intelligibly was intact.

The lists were presented in a counterbalanced order, the first with instructions to repeat each word as rapidly as possible. The second list was administered with the usual word association instructions to say the first word

which came to mind as rapidly as possible. A reproduction phase followed, also under time pressure.

The major hypothesis was that the pathological breakdown in schizophrenia which results in disturbed communication lies in the process of perception rather than in the process of association.

Results supported this hypothesis. Schizophrenics misheard significantly more words on the repeat task than nonschizophrenics. In addition, all association RWs which seemed unrelated to the SW were scored as Distant (one of nine scoring categories). Words in this category were re-evaluated and re-scored as mishearings if they were judged to be good responses to words with different meanings but phonetically similar to the SW. Such words were then assigned to appropriate categories. As a result, it was found that schizophrenics had significantly more mishearings than nonschizophrenics. Furthermore, there were no differences between the 20 matched pairs in the number of Distant association RWs. Nor were any differences found between schizophrenics and nonschizophrenics in the frequency of Distant RWs when words which were not misheard or words which were misheard were considered separately.

In addition to distant responses, other word association variables which have been used as "diagnostic indicators" were examined. The major finding was that besides misperceived SWs, reaction time is a highly stable variable

in differentiating schizophrenics and nonschizophrenics. Also considered were commonality, reproduction failures, and faults.

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Appendices

Appendix A

Raw Data for Variables Used for Matching Schizophrenic and Nonschziophrenic Ss

Pair Number	Experimental (E) or Control (C)	Age	Years of Education	IQ Estimate
1	E	29	11	105
	C	28	13	105
2	E	32	15	99
	C	37	14	94
3	E	35	14	106
	C	41	14	105
4	E	41	12	100
	C	41	12	106
5	E	42	12	106
	C	41	12	106
6	E	30	12	99
	C	35	13	100
7	E	35	10	88
	C	35	12	88
8	E	43	16	118
	C	44	16	112
9	E	37	18	129
	C	43	16	129
10	E	34	9	87
	C	39	9	82
11	E	44	8	84
	C	44	7	82

Appendix A (continued)

Pair Number	Experimental (E) or Control (C)	Age	Years of Education	IQ Estimate
12	E	26	12	105
	C	26	12	105
13	E	44	4	84
	C	39	8	82
14	E	36	6	100
	C	33	9	93
15	E	34	13	93
	C	29	14	93
16	E	38	9	94
	C	44	6	106
17	E	33	12	93
	C	35	12	106
18	E	22	12	95
	C	19	12	103
19	E	33	10	81
	C	36	12	82
20	E	30	12	93
	C	33	12	105

Appendix B

Stimulus Words in List 1

1. Hinge
2. Bet
3. Nod
4. Toad
5. Lamp
6. Said
7. Boat
8. Ground
9. Plant
10. Wick
11. Gum
12. Blank
13. Cab
14. Went
15. Mud
16. Green
17. Dim
18. Bead
19. Note
20. Tame
21. Tenths
22. Mole
23. Rip
24. Soul
25. Led
26. Bitch
27. Ire
28. Loose
29. Park
30. End
31. Ask
32. Ream
33. Lying
34. Screen
35. Hive
36. Stump
37. Draft
38. Stew
39. Close
40. Bump

Appendix C

Stimulus Words in List 2

1. Crown
2. Bun
3. Plan
4. Wing
5. Inch
6. Dot
7. Set
8. Cup
9. Known
10. Bean
11. Tape
12. Greet
13. Lamb
14. When
15. Plank
16. Net
17. Tone
18. Cap
19. Dip
20. Bone
21. Tense
22. Mold
23. Rib
24. Sold
25. Laid
26. Hour
27. In
28. Lose
29. Part
30. Bits
31. High
32. Rim
33. Lion
34. Scream
35. Clothes
36. Stomp
37. Screw
38. Ass
39. Graft
40. Hump