A WORD ASSOCIATION ANALYSIS OF SCHIZOPHRENIC THOUGHT PROCESSES

A Dissertation

Presented to

the Faculty of the Department of Psychology

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

By

John A. Helton

August, 1976

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ABSTRACT

This study was a comparison of word association patterns of matched schizophrenic and nonpsychiatric patients. Patients were matched in age, sex, race, education, and verbal fluency. A series of ten word association conditions was administered which varied in instructions. The conditions were free association, repeated free association, five continuous associations, popular association, definition of the stimulus, and final free association. Response patterns consisted of (a) response quality (judged by the degree to which a response was a quick, meaningful, single word), (b) response commonality (judged by response rank among responses of a reference group to the same stimulus words), (c) response latency in tenths of seconds, (d) semantic relationship of stimulus-response pairs, and (e) temporal series of two or more responses. These patterns were more compatible with several of the many postulated causes of the schizophrenic condition.

It was found that the basic cognitive responses of schizophrenics were not disrupted. Rather, schizophrenic patients tended to change more from one semantic set to another than did nonpsychiatric patients. Schizophrenic responses were less common and less quick, especially after the first continuous association response was produced. The acceptable responses of schizophrenic patients varied more than those of nonpsychiatric patients. Response faults were not fully explained by perceptual mistakes, lack of stimulus word knowledge, motivation, or a calculated effort to appear "sick." The results were more compatible with fluctuating attention and editing deficit postulates.

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CHAPTER I

INTRODUCTION

Since the early 1900's, it generally has been assumed that peculiarities in schizophrenic language reflect problems in cognition[1] which are basic to the disorder (cf. Bleuler, 1950). Yet the exact nature of schizophrenic problems in cognitive functioning has remained unclarified despite years of study from a number of theoretical positions. Cognition subsumes "internal behaviors" such as ideas and images.

Bleuler was the first to contend that schizophrenic language was the result of an "associative disturbance."[1] Associative disturbance is one of many postulated causes of schizophrenia. It is postulated that basic cognitive responses are disrupted. Bleuler, and Jung (1918) proposed a word association method in order to make associative disturbance more observable for study. The word association method consists of responses elicited by stimulus words presented with the instructions, "Give me the first word that comes to mind when you hear my word." In Bleuler's view, responses to the task of word association indicate "weak threads" in schizophrenic thinking. Special attention was given to responses which were not quick, meaningful, single words--they are hereafter called "response faults."[1]

A partial list of response faults is as follows (Rapaport, Gill, & Schafer, 1946): (a) no response, (b) repetition of the stimulus word without further response, (c) repetition of the same response word to

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[1]A glossary of terms is included in Appendix A for terms so marked.

several stimuli, (d) multiword response, (e) response latency over three seconds, (f) "clang"[1] response, (g) "distant"[1] response, (h) "neologism"[1] response, and (i) "mishearing"[1] response. Rapaport, et al., reported that schizophrenics gave more response faults than did control subjects. However, until response faults are related to "fundamental processes" of brain function, they remain mere diagnostic indicators of the schizophrenic condition (cf. Underwood, 1957).

The concept of associative disturbance and the technique of word association have stimulated extensive research. A correspondingly large amount of literature has accumulated on the subject, involving different theoretical positions as to the basis of the disturbance. The present study was an attempt at a more comprehensive definition of the problem than that which now exists.

A series of ten word association conditions was administered which varied in instructions. The conditions were free association,[1] repeated free association,[1] five continuous associations,[1] popular association,[1] definition of the stimulus word, and final free association. Word response patterns of matched schizophrenic and nonpsychiatric patients were constructed of levels of (a) response quality,[1] (b) response commonality,[1] (c) response latency in tenths of seconds, (d) semantic[1] relationships of stimulus-response pairs, and (e) temporal series[1] of two or more responses. Control subjects, control tasks, and control words were used to help define the responses patterns of chronic schizophrenic patients.

CHAPTER II

REVIEW OF THE LITERATURE

Word Association Methods

In addition to the "free association" task of Jung and Bleuler ("Give me the first word that comes to mind when you hear my word"), the following word association techniques appeared to be of particular relevance to this study: (a) instructions to limit responses to one class of associations (Galton, 1879; Jenkins, 1959; Jung, 1966; Siipola, Walker, & Kolb, 1955; see Table 1); (b) repeated observations similar to test-retest (Jung, 1918; Moran, Mefferd, & Kimble, 1960; Moran & Swartz, 1970; Rapaport, et al., 1946); and (c) a series of tasks where the responses to one of these tasks affects response on subsequent tasks (Cohen & Camhi, 1967; Hiner, 1971; Lisman & Cohen, 1972; Price, 1972; Smith, 1970; Stern & Riegel, 1970). The various techniques were developed rather independently of one another, and are associated with different theoretical postulates as outlined in Table 1.

Word Association Measures

The theoretical postulates in Table 1 also are outlined with various measures of word association responses. Some measures in the literature have been directly associated with a postulate. For other measures, the association has contained less empirical assumptions.

By the late 1930's, there were two distinct interpretations of word association responses (Woodworth, 1938). The first had a clinical perspective. Response faults were used to diagnose specific "dynamic" motivational complexes.[1] Symonds (1931) provided a review of many of these early word association studies.

TABLE 1

The Postulates

Postulates	Methods	Measures	Expected Observations
(a) Perceptual dysfunction[1] (McGhie, Chapman, & Lawson, 1964; Venables, 1964)	repeated free association[1]	response faults[1] mishearing responses[1] response latency[1]	quick improvement of response faults, short latency with mishearing responses
(b) Associative disturbance[1] (Bleuler, 1950; Broen, & Storms, 1966; Moran, Mefferd, & Kimble, 1964)	free association[1] popular association[1] continuous association[1]	response faults commonality[1] idiodynamic set[1]	no improvement of response faults, disrupted trends of commonality and idiodynamic set responses
(c) Fluctuating attention[1] (Shakow, 1962)	no special instructions	response faults idiodynamic set	temporal series[1] of idiodynamic set and non-response fault responses
(d) Editing deficit[1] (Cohen & Camhi, 1967; Boland & Chapman, 1971)	originality instructions[1]	response faults response latency idiodynamic set	no improvement of response faults, short latency with common[1] or with synonym responses[1]
(e) Insufficient motivation[1] (Bleuler, 1950)	no special instructions	above perseveration[1]	no improvement of responses, long latency,[1] perseverations, low productivity
(f) Impression management[1] (Price, 1972)	no special instructions	response faults response latency distant responses[1]	no improvement of response faults, long latency with distant responses

[1] A glossary of terms is included in Appendix A for terms so marked.

The most respected of the early interpretive systems is that of Jung (1918). When applying this system, Jung (1916) first studied response latency and response content to ascertain "types" of respondents. The four types of respondents in his view are as follows: (a) "objective" as seen in normal individuals, (b) "definitive" as seen in uneducated people who wish to appear intelligent, (c) "predicative" as seen in older people as a compensation for internal emotional deficit, and (d) "complex" where an unsuccessful attempt is made to conceal a "morbid" complex elicited by the stimulus word.

For Jung, any neurosis involved a persistent, recurrent complex of associations which are identified by a number of "complex indicators."[1] These indicators are as follows: (a) prolonged latency of responses or a failure to respond at all (i.e., an attempt at concealment), (b) multiword response (i.e., a neurotic desire to ignore instructions), (c) repetition of the stimulus word (i.e., neurotics see the stimulus word as a personal question), and (d) repeated responses (i.e., which indicate the neurotic area of concern). Jung also asserted that other indicators of neurotic complexes were the abnormal expression of responses, extra comments, clang responses, as well as large galvanic skin responses accompanying a stimulus word.

Bleuler (Arieti, 1974) considered Jung's interpretation to be inadequate for explaining schizophrenic thought (as opposed to neurotic thought). Others also have criticized dynamic interpretations such as that of Jung because of lack of methodological rigor (cf. Flavell & Draguns, 1957; Hunt, 1945). As a result of Marbe's (1901) observation of a strong relationship between latency of a response and the relative commonness of

the response word (as defined by Kent & Rosanoff, 1910), a new approach to the analysis of schizophrenic thought using the word association technique emerged. This relationship, commonly referred to as Marbe's Law, simply states that the response most rapidly given to a particular stimulus word by an individual will be given most frequently by any reference group. Thus, it became possible to examine the relative "strength" of associative threads. Indeed, Bleuler failed to distinguish the critical difference between responses that are "distant" as opposed to those that are merely "uncommon." He did not quantify the degree of distance of stimulus-response pairs.

Laffal (1955) achieved a quantification of the "commonality"[1] of associates, and was able to extend Marbe's Law to include response faults[1] of the type described by Jung. Laffal related the number of response faults elicited by a stimulus word to its commonality, that is, the lower the commonality value, the higher the "fault" rate. For this study, commonality is defined as the rank of a response among the responses of a reference group.

Another factor that influences fault rate, as reported by Moran, Mefferd, and Kimble (1964), was that of idiodynamic set.[1] People were shown to respond in word association tasks in several characteristic ways: (a) some people respond whenever possible by defining the stimulus (i.e., to respond with a synonym[1] or superordinate,[1] e.g., pull-tug), (b) other people characteristically respond by giving examples or opposites of the stimulus (i.e., subordinate,[1] logical coordinates,[1] contrasts,[1] antonyms,[1] e.g., pull-push), (c) other people respond with syntactic[1] or functional[1] associates (i.e., sentence completion, visual description, functionally related words, e.g., pull-wagon). A person who habitually

responded in the definition mode was shown to exhibit higher fault rates when the stimulus had no common synonym or superordinate associate. Fault rate was related to example and syntactic response sets in a similar manner. Moran, et al. (1964) reported that schizophrenics exhibited somewhat less stability in this response pattern than did matched control subjects. Other semantic relationships also have been shown to influence response patterns, and possible associative processes (Blaney, 1974; Moran & Swartz, 1970; Stern & Riegel, 1970).

The increased emphasis on empirical approaches of recent years remains fraught with logical difficulties. Theorists have often relied heavily on empirical results, such as commonality results, to support as yet undemonstrated theoretical constructs. For example, the "strength" of an associative pair is influenced by many cognitive processes. Dufilhio, Mefferd, and Sadler (1969) found that associative patterns of children were influenced by the grade level in school at which a word was introduced. This effect was particularly evident with homonyms where one written word (e.g., real) was introduced in the second grade and the other word (e.g., reel) was introduced in the sixth grade. In the sixth grade the class record of word associates abruptly shifted to the reel response commonly found in adult populations. This change was found even though real is a much more common word in the vernacular. Such apparent change at one point in time, followed by marked stability thereafter, irrespective of the frequency of exposure to both words in the vernacular, suggests that inferences about associative processes made from commonality alone may be misleading. Further study is needed.

A definitive cognitive mechanism must include constructs which can account for such structural developmental trends. Many concepts in the area of word association have been the result of the study of schizophrenia.

Theories

Six major postulates are currently popular which attempt to define the schizophrenic condition as it relates to the word association task. These postulates, associated measures, and associated methods are presented in Table 1. The postulates are loosely organized by an "information processing" model of cognitive processes (cf. Yates, 1966). The series of postulates is analogous to sequential cognitive stages which mediate between the stimulus words and responses. So ordered, the postulates have some contradictory implications which can be examined to establish the "cognitive depth" of schizophrenic dysfunction.

Perceptual dysfunction. Some authors consider the basis of schizophrenic responses to include a large perceptual component in which perception is defined as the relatively low order process of simple stimulus word recognition. For example, it has been found that an increased frequency of mishearing responses (i.e., those distant words which would be acceptable responses to words phonetically similar to the stimulus words) constituted a major portion of the distant responses of schizophrenic subjects (Moon, Mefferd, Wieland, Pokorny, & Falconer, 1968). In Piercy's (1969) study of the word association responses of an outpatient clinic population sampled over a ten year period, mishearing responses were found to best differentiate the paranoid schizophrenic group from nonschizophrenic diagnostic groups.

Bleuler (1950) contended that schizophrenics lack the focus of attention necessary for stimulus word recognition. Cromwell and Dokecki (1968) suggested that schizophrenics may be unable to "dis-attend" irrelevant stimuli. Similarly, Venables (1964) suggested that acute schizophrenics are unable to selectively attend to relevant stimuli which results in the recognition processes of schizophrenics becoming overburdened. Chronic Schizophrenics were thought to adjust to this problem by becoming preoccupied with extraneous details. With regard to higher order processes, Moon, et al., concluded that the tendency to mishear words was not the result of deficits in auditory acuity, intelligence, or interest. In a later study (Meffered, et al., 1969) general and "selective" attention measures were included in the list of unrelated factors.

Many current studies of perceptual dysfunction have focused on short-term memory. Beyond the early recognition stages there is a later perceptual stage in which perceptual information is retained and consolidated (Yates, 1966). Perceptual information is lost if information is processed too slowly in more central, higher order channels. Further, Broen (1968) contended that as such recognition processes lag, the central associative processes of schizophrenics become increasingly concrete and irrelevant to the stimulus situation. Yates and Korboot (1970) found that schizophrenics do indeed process visual material more slowly than control subjects. However, schizophrenics have not been found to process simple visual recall material (Cash, Neale, & Cromwell, 1972) and word stimuli (Yates & Korboot, 1970) more slowly than do control subjects.

In the area of word association, there is at present no experimental paradigm to incorporate these results. However, a parallel controversy exists concerning the effects of perceptual dysfunction and higher order deficits. While schizophrenic behavior may be entirely due to perceptual dysfunction, it may itself be due to a higher order disruption such as an associative disturbance (Zimmet & Fishman, 1970). It appears likely that in the absence of a basic associative disturbance the repeated presentation of the stimulus words would allow subjects to correct most mistakes made on the basis of mere perceptual error. This is because basic cognitive responses would be intact and allow for the patients to reorient themselves with the assistance of repeated response opportunities. The associative disturbance and other postulates are not compatible with this observation. Schizophrenics should not be able to correct their response faults when given the opportunity by a second presentation of the stimulus words. This is because either basic cognitive responses are disrupted and thus uncorrectable, or the patient is disrupted in other ways, some of which are discussed below.

Further study of the controversy between perceptual and associative postulates has been hindered for lack of a better model of cognitive processes. Basic elements in the cognition of word association are words or word parts (Deese, 1965). Commonality of responses has been used to estimate strength of associations of word elements (Laffal, 1955). Moran (1975) contends that strength of associations are best estimated by a "lens" construct, where probable responses are determined by interaction of semantic as well as commonality potentials. Evidence of the importance of semantic factors has always been stressed (Deese, 1965; Symonds, 1930; Blaney, 1974). However, even here perceptual processes are distinguished

from associative ones in the type of processes involved (Flavell & Draguns, 1957; Yates, 1966). The construct of short-term memory has served as a transition between the two types of processes.

An alternate model has been proposed to account for more general language response patterns than those of the word association method (cf. Chomsky, & Halle, 1968). The elements in this model are phonemes. While the rules which associate are not necessarily on the order of psychological processes, there is some superficial similarity to the perceptual word association processes (cf. Flavell, & Draguns, 1957). For example, perceptual association is partially on the basis of phonemic similarity of sounds. Fay and Cutler (1975) studied speech errors, and found them to be very similar to the proper words. They contend that even intentional, humorous speech errors are made on the basis of mistakes in phonetic similarity of words. The very high degree of similarity of speech errors to proper words led the authors to contend that word perception, word association, and word production are all based on one basic type of association, that of phonetic similarity.

For Fay and Cutler semantic sets limit responses to specific phonetic areas, but are not part of basic perceptual or associative processes, which are purely phonetic. This view is compatible with that of the present study. Semantic sets are a veneer over basic cognitive responses taught by the educational system (Dufilho, Mefferd, & Sadler, 1969). In developmental terms, people first have a purely functional, image related set (cf. Moran, 1966). This is in the absence of education and is often found in subjects who are developmentally disabled (Keilman & Moran, 1967).

Subjects are taught in school to define words and to use words as examples of concepts. Dufilho, et al., found children did this as a direct condition of their educational experiences.

The degree to which perceptual processes are similar in nature to associative ones has not been studied at length. Moon, Mefferd, Wieland, Pokorny, and Falconer (1968) found many so called "distant" responses of schizophrenics were quite acceptable responses to words phonetically similar to the stimulus words. Compelling evidence for the basis of these mishearing responses has not been found. But they are not the result of attention, intelligence, or hearing problems (Mefferd, Lester, Wieland, Falconer, & Pokorny, 1969). Mishearing responses can be studied further for evidence of cognitive processes without heavy reliance on traditional concepts such as commonality.

As noted above, Fay and Cutler found a high degree of similarity between speech errors and proper speech. Similarity of the misheard stimulus and the actual stimulus words of the present study can be assessed by noting the number of similar phonemes (e.g., heel-hill share two similar phonemes "h" and "ll"). Fay and Cutler also contended that words were basically associated on the basis of shared phonemes, proceeding from the first of the words. This was because speech errors seldom occurred at the first of the words. Bruner's (1957) concept of perceptual readiness also would predict this. For example, Mefferd, Houck, and Sadler (1970) studied spondaic words (i.e., common compound words composed of two simple words, such as cowboy, mushroom, headlight, and so forth) in comparison with words and sounds which gave patients less perceptual readiness. Patients misheard more of the words with which they were less familiar. But "cowboy" was seldom misheard because "cow"

gave a perceptual readiness to correctly hear the sounds which followed it. Thus, the first phonemes do not have the associative support and readiness that later phonemes have. For the purposes of this study, mishearing the beginning phonemes would be more perceptual in nature than mishearing later phonemes. Also disruption of basic cognitive responses would be consistent with fewer shared phonems between mishearing and actual stimuli. A more perceptual dysfunction would predict more shared phonemes because the words would be closely phonetically associated and not disrupted.

Associative disturbance. The traditional position is that the basic disturbance in schizophrenia is associational (Bleuler, 1950):

> The direction of our associations is determined not by any single force but by an almost infinite number of influences. In the thought process of schizophrenia, however, all the associative threads...whether singly or in haphazard groups, remain totally ineffective (1950, p. 17).

This postulate has been developed in the area of word association by Broen and Storms (1966). For them, the cognitive responses of schizophrenics do not have the primary or most common associate normally found for each stimulus word. Rather, schizophrenics respond by selecting from an abnormally wide range of possible responses. This abnormal response competition, as measured by lack of relative differences of commonality of responses, gives the characteristic distant responses observed in schizophrenics.

Fuller and Kates (1969) tested an expectation based on the above theory; viz., if in a series of stimuli, three responses were

elicited to each stimulus from schizophrenic subjects (i.e., "Give three responses to my word"--continuous association task[1], primary commonality responses would appear as random events. In normal subjects, commonality was expected to decrease systematically as successive responses were produced in continuous association. However, commonality was found to decrease progressively for both groups. The authors interpreted this result in terms of the "editing deficit" postulate (viz., schizophrenic cognitive responses are thought to be normal, but the schizophrenic does not edit the responses appropriately--Smith, 1970). This editing is of a higher order than perceptual and associative processes.

An alternate explanation is that Fuller and Kates (1969) failed to sample sufficient responses to permit definitive testing of the associative disturbance postulate. Breznitz (1969) found that in the chain association method,[1] as applied to college students, more than three responses were necessary before independence from the first stimulus could be established by judges. The instructions for the chain association method are "Give me the first word that comes to mind when you hear my word. You then are to give me the first word that your response makes you think of, and so on." This method approximates a chain of individual associations which are distant from the original stimulus. As such, this chain is like a set of disrupted responses for a stimulus word.

Breznitz's result can be extended to the subject population and word association methods under study only in a very tenuous and speculative way. But it is the only study to predict once a response is made

among disrupted responses, it would still be necessary to elicit more than three responses before a change in the commonality trend of continuous responses would occur. It seems reasonable that five continuous responses would permit an adequate test of the associative disturbance postulate. In this test it would be expected that commonality would progressively decrease in the five responses of control subjects, but it would be random in the five responses of schizophrenics. As mentioned earlier in the discussion, the associative disturbance postulate would also be supported if response faults were not corrected when there was an opportunity to do so, as in continuous association. In general, there would be a "disruption" of commonality measures, so that no consistent trends would be found. However, commonality is only one of many possible estimates of associative structure and cognitive processes.

Fluctuating attention. A number of authors (Moran, et al., 1960; Rapaport, et al., 1946; Shakow, 1962) have noted that the effects of associative disturbance to be more periodic in nature than the studies cited above suggest, since these studies emphasized response patterns to individual stimulus words. For example, Moran, et al., studied response faults and semantic responses to stimulus words over many months and found considerable variation. Response faults did not consistently appear for individual stimulus words, but did appear intermittently within sessions and week-to-week. Shakow interpreted such responses to be related to possible psychophysiological problems of schizophrenics.

In the present model of cognitive processes, it would be possible for basic cognive processes to be normal, except for periodic disruptions. This is a weaker version of the associative disturbance postulate. It also is possible that periodic disruption would occur in the semantic veneer, so that attempts by patients to define word stimuli, for example, would be periodically disrupted while basic cognitive responses would remain intact. Fluctuating attention was studied by temporal series[1] of responses (i.e., two or more consecutive responses of the same semantic category or two or more consecutive responses which were acceptable, non-response fault words). These responses were of global response patterns apart from individual stimulus words, and as such depart from the traditional word association paradigm of commonality measures, so that no consistent trends would be found.

Editing deficit. Investigators favoring an editing deficit postulate assume that the perceptual and associative processes are normal in schizophrenia (cf. Fuller & Kates, 1969; Weingartner & O'Brien, 1970). Rather, this postulate reflects that schizophrenics fail to select and edit their cognitive responses properly. Thus, they are unable to inhibit common responses while they are attempting to make uncommon responses (Boland & Chapman, 1971). However, Cohen, Nachmani, and Rosenberg (1974) contend schizophrenics exhibit such behavior whenever they attempt to follow any specific response restrictions such as adherence to a semantic set (cf. Stern & Riegel, 1970). Several sets which have been studied are idiodynamic set (Moran, et al., 1964) and a set to give common responses (Sommers, Deware, & Osmond, 1960). These results suggest that schizophrenics may inappropriately respond more to

the instructions than to "internal" cognitive problems, or at least free association responses are accessible to them in certain conditions. Stern and Riegel (1970) studied word association responses of schizophrenics to 11 conditions which varied in instructions. They found schizophrenics to be more variable when instructions were given in addition to free association instructions.

The editing deficit is assumed to result from a failure to evaluate responses for a given situation or task (Cohen & Camhi, 1967; Nachmani & Cohen, 1969). For example, Smith (1970) found that schizophrenics had trouble giving clues in the password game.[1] Subjects were given clues for evaluation to help a "listener" guess a target word, but schizophrenics chose those clues which made the best free association response, even when such a response was a poor clue. Suchotliff (1970) extended the game by providing predetermined feedback (i.e., the listener's first guess) and a number of subsequent clues. Again, schizophrenics appeared to free associate and to ignore the context necessary for successful performance.

Insufficient motivation. All of the above postulates could result from a mere lack of desire to respond (Arieti, 1974; Bleuler, 1950), as well as from a lack of word knowledge. Several studies have included measures of task involvement (cf. Lisman & Cohen, 1972; Mefferd, et al., 1969) and no differences between groups were reported. As with previous studies, response latency and productivity can be evaluated to determine the role of motivation in schizophrenic responses. A vocabulary test would measure the degree to which response faults occur because of a lack of familiarity with the stimulus words. The tendency to

repeat a response to several stimulus words also would be compatible with the insufficient motivation postulate (cf. Breznitz, 1972; Rapaport, et al., 1946).

Impression management. Other authors (Braginsky & Braginsky, 1967; Goffman, 1960; Price, 1972; Ryan & Neale, 1973) assumed there is no cognitive deficit in schizophrenia at all. Instead, schizophrenics intentionally search for word responses which give an "unhealthy" impression. Price (1972) found that many schizophrenics search actively for "unhealthy" word responses regardless of whether they were told that their common responses in an earlier word association study were either "sick" or "healthy." Likewise, normal subjects have been found to hold back common responses when searching for more original responses (Masters, Mesibour, & Anderson, 1970). However, Lisman and Cohen (1972) found no evidence that schizophrenics held back common responses when instructed to give original responses. Instead, schizophrenics gave common responses with short latency to such instructions. This result was interpreted by the authors as supporting the editing deficit postulate.

A critical variable relative to schizophrenic behavior would be response latency. If a subject searches for unhealthy responses, this search should be reflected in long response latency. On the other hand, short latency would be more indicative of editing deficit (Lisman & Cohen, 1972). An increase in latency in repeated observations would suggest a covert monitoring of responses (i.e., impression management), provided that the increase in latency were accompanied by "unhealthy" distant responses. Long latency associated with fault responses would

support the associative disturbance or insufficient motivation postulates. Short latency with mishearing responses would support the perceptual postulate.

Subject Variables

Apart from those experimental factors discussed above in more general terms, O'Brien and Weingartner (1970) have shown the importance of controlling the factors of age, sex, race, and education. Differences found for groups of unmatched schizophrenic and control subjects disappeared when subgroups of individuals were paired on the above factors. Additional variables to control are those of intelligence, hospitalization, type and degree of disorder (Cramer, 1968; Zimet & Fishman, 1970). However, Ralph and McCarthy (1967) studied chronic subgroups meeting common criteria of age, intelligence, nonorganicity, and so forth, and found only 11% of the schizophrenic patients on a Veterans Administration male psychiatric ward met the criteria. Thus, efforts at subject control may lead to problems in generalization of results when carried to extreme lengths.

Summary

The literature surveyed is varied. Very seldom have attempts been made to study more than a limited aspect of schizophrenia. In the present study some of the contradictory implications of various postulates were examined together in an attempt to study the problem in a more comprehensive way.

Through a factorial study, a comparison was made of word association patterns of matched chronic nonparanoid schizophrenic and non-

psychiatric patients. This was the first of three factors. Subjects were matched in age, sex, race, education, and verbal fluency. The second factor was a series of ten word association conditions, which varied in instructions. The conditions were in order free association,[1] repeated free association, five continuous associations,[1] popular association,[1] definition of the stimulus, and final free association. The third factor was that of cognitive responses (i.e., initial response quality), the postulated "internal" basis for responses, as opposed to the above conditions which gave an "external" (i.e., instructions) basis. For the purposes of the study, cognitive responses were defined as internal representations of words or words parts fundamentally associated on the basis of a structure estimated by commonality or phonetic similarity. The quality of cognitive responses was studied as levels of disruption estimated by initial responses in condition I (response faults, distant responses, mishearing responses, and acceptable responses).

Response patterns consisted of (a) response quality (judged by the degree to which a response was a quick, meaningful single word), (b) response commonality[1] (judged by response rank of frequency of responses of a reference group), (c) response latency in tenths of seconds, (d) semantic relationships[1] of stimulus-response pairs, and (e) temporal series[1] of two or more responses.

Yates (1966) contended the stimulus word and response word are mediated by an ordered series of sequential cognitive stages which process "information." Each of six postulates can be examined to establish

the "cognitive depth" of schizophrenic dysfunction. This was done by a comparison of response patterns and a study of interactions of the three factors, that is, diagnostic groups, cognitive responses, and word association conditions.

In the present study, the perception stage is defined as an initial, low order process of stimulus word recognition. If no dysfunction of a higher order were involved, then improvement of response faults during repeated opportunities to respond would be consistent with this postulate. However, no improvement would be expected if basic cognitive responses were "disrupted" as suggested in the associative disturbance postulate. Improvement was defined by the degree to which responses became quick, meaningful, common, single words. Response patterns of semantic relationship of stimulus-response pairs also were studied for evidence of disruption or fluctuation.

At a still higher order of the information processing model are editing and attention postulates. Once cognitive responses are made as the result of perception and association stages, then greater inhibitory processes are necessary to monitor cognitive responses so they can be edited to fulfill social requirements whether explicit or implicit. One related postulate is that the responses are edited so that the schizophrenic patient appears "sick." Editing processes were studied by patterns of short latency responses with common responses or with synonym responses. No improvement of response quality was expected. "Sick" responses were defined as long latency responses with distant responses since there would be an effort to produce uncommon (i.e., sick) responses and this effort would take time. There also might

be a general long latency of responses. But the above definition seemed best for the impression management postulate. However, general lack of productivity (i.e., insufficient motivation) and lack of word knowledge were two other postulates which were studied. A vocabulary test of the stimulus words was made, as well as a comparison of patterns of production of responses with response latency.

Thus, the present study was designed to allow a comparison of the hypothesized levels of disturbance in schizophrenic association within a single investigation. Particular data patterns were expected to favor one or more of the postulated bases of the disturbance over others.

CHAPTER III

METHOD

Subjects

Thirty-six hospitalized but ambulatory male patients from the patient population of the Veterans Administration Hospital, Houston, Texas, served as subjects. A sample of 18 chronic, undifferentiated, simple schizophrenic patients was drawn from three male psychiatric wards. They were individually paired with 18 patients from the general medical wards of the hospital, including wards which treat tuberculosis and dermatosis. Hospital records were used to exclude all patients who had a history of alcoholism. Further, those with a record or paranoid behavior were excluded as were control patients with any record of psychiatric problems. Patients with hearing loss were excluded.

Each nonpsychiatric patient was matched with a schizophrenic subject of comparable age, race, education, and verbal intelligence. Verbal intelligence was estimated from scores on the vocabulary subtest of the Wechsler Adult Intelligence Scale (WAIS). Individuals paired in the present study are listed in Appendix B. Group averages on matched factors are presented in Table 2.

Participation in the study was voluntary. Procedures and purposes were briefly explained. While only three of the schizophrenic patients refused to participate, over 60% of the nonpsychiatric patients refused. Two members of the schizophrenic group who initially volunteered refused

TABLE 2

Characteristics of Matched Patients

Characteristic	Schizophrenic (N=18)	Nonpsychiatirc (N=18)
Age		
Mean	42.2	43.2
S. D.	10.9	11.2
Education		
Mean	10.5	10.5
S. D.	2.7	2.7
Verbal IQ		
Mean	91.1	96.7
S. D.	23.0	24.5
Race		
Black	6	6
White	12	12

to complete the procedure; they were omitted from the study. Four additional schizophrenic subjects and three nonpsychiatric patients were omitted due to equipment malfunction or procedural error. In two cases the word association tasks were given in an order other than that defined in the procedure. In the other cases the tape recorder did not record because of an intermittent short circuit, which was not discovered until the recordings were transcribed at a later date. All drop-outs were replaced by other volunteers.

Lists of Stimulus Words

In order to obtain an adequate sample of responses, a stimulus word list was constructed to consist of 120 stimulus words which had elicited "bad responses" in previous studies of 400 stimulus words at the Psychiatric and Psychosomatic Research Laboratory (Mefferd, untitled). The term "bad responses" is used here to include response faults, primary responses[1] with low commonality values, or "repetition failure"[1] responses. Average characteristics of the 120 word list are presented in Table 3.

To control the possible influence of idiodynamic semantic set, equal numbers of stimulus words with primary responses in each of three sets (synonym-superordinate,[1] contrast-coordinate,[1] and functional[1]) were selected for the 120 word list. Thus, a subject with any one of the three sets was presented with a stimulus list that equally facilitated his particular set. Because the list was constructed to elicit response faults, many stimuli had homonyms of the same or different sets. Those words not having homonyms also had a wide range of set-facilitating

TABLE 3

Characteristics of Stimulus List

Set	Mean Responses in Mefferd (Untitled) Study		
	Faults	Distant	High Commonality
Synonym-superordinate	26.7	12.2	18.3
Contrast-coordinate	22.8	9.2	21.4
Functional	24.8	11.9	19.1
Total	24.8	11.1	19.6

responses of different sets. The list did not strictly determine set-facilitation. But its construction did not give it a semantic stimulus character which would then would have over-determined the results. The results were primarily intended to reveal subject factors.

Stimulus words of each semantic set were put in randomized triads and the triads themselves were randomized to minimize any possible effect of a long sequence of set-facilitating stimuli (cf. Moran, 1966). The list also was constructed so that words with a sexual connotation should not appear near each other in the list sequency. This also was done with the words having phonetic similarities. This 120 word stimulus list is presented in Appendix C. Such a list maximized the likelihood of response faults and also lessened the possible influence of idiodynamic set. The list was constructed to maximize response faults by selection of stimuli which had a wide range of possible responses and homonyms of the stimuli. This variability made it more difficult to score responses than would have been the case with a more restricted list. However, the list was acceptable because a large sample of response faults was required in the study.

From the list of 120 stimulus words, a balanced 20 word sublist was constructed during condition I of the procedure based entirely on the performance of each patient in condition I. These stimulus lists were constructed by the selection of ten response fault words and ten nonresponse fault words for each patient. This combined 20 word sublist of stimulus words differed somewhat for the specific words selected for each person. The 20 word list was then administered under the various conditions II-X described below in the procedure, except for the final condition X where it was modified.

In final condition X as part of the procedure, the 20 word lists (one for each patient) were interspersed with another standard 20 word list taken from the original pool of 400 stimulus words (Mefferd, untitled). The individual lists were placed in the spaces programmed into the new 20 word list. The spaces were placed in an intermittent fashion to hinder recall of the previous responses to the original 20 word list of each patient. The new word list with its 20 programmed spaces appears in Appendix D. The combined 40 word list for condition X was constructed during conditions III-VII as patients took time to produce five responses for each stimulus word.

The selection of 20 stimuli was necessarily quick and haphazard. The experimenter had to decide which 20 words to select before the entire 120 word list was administered. Thus, responses were scored as they were produced and the decision made whether to include them in the remainder of the study. To verify the selection, the categories of the selected responses (See Table 4) were scored. As planned, approximately one-half of the selected stimuli for each group elicited response faults.

Procedure

Individuals were taken by the experimenter to a quiet room which had a table and two chairs. Each session was recorded on an audio tape recorder to facilitate an accurate analysis of responses and response latency; all responses were also timed during the session so that a time limit of 20 seconds could be observed for each response. If no response was observed in that time, the next stimulus in the list sequence was presented.

TABLE 4

Initial Quality of Responses

Condition I Responses	Schizophrenic (N = 386)	Nonpsychiatric (N = 423)
Quality I		
response faults[1]	29.27%	21.99%
Quality II		
distant[1]	12.95%	7.09%
Quality III		
mishearing[1]	4.66%	8.27%
Quality IV		
acceptable[1]	48.17%	59.57%

[1]A glossary of terms is included in Appendix A for terms so marked. The scoring system also is defined in the Variables--Word Measures section of the Method chapter (See Table 5). Note: Approximately 4% of responses were unclassified. These responses were prepositions, adverbs, unpopular completions, extreme superordinates, and extreme subordinates.

The following instructions were given at intervals to begin each presentation of stimuli:

Condition I. I am going to read a list of words one at a time. Tell me, as quickly as you can, the first word that occurs to you or that my word makes you think of when you hear my word. I'll be timing you, so answer as quickly as you can.

Condition II. (The 20 word list selected in condition I was repeated without pause or instructions. The same list was used in conditions III-X.)

Condition III. Now when I give you a word I want you to tell me five words that my word makes you think of. Make sure each word is a single word and that each word goes with the word I give you.

Condition IV. (The second response opportunity for the "five words" instructions.)

Condition V. (The third response opportunity for the "five words" instructions.)

Condition VI. (The fourth response opportunity for the "five words" instructions.)

Condition VII. (The fifth response opportunity for the "five words" instructions.)

Condition VIII. Now I want you to tell me what is the most common or popular response to the word I give you. If I were to give my word to a group of people, what would most of them say to my word?

Condition IX. Now I want you to tell me the meanings of these words. Using a phrase or a couple of sentences, tell me what each word means.

For example, what does bed mean? (A written request was included for misheard stimuli.)

Condition X. Now I want you to tell me the first word that occurs to you when you hear my word, just as we did at the beginning.

Condition XI. Now I want you to tell me the meanings of some more words. (The WAIS vocabulary subtest was then administered.)

If during the first part of condition III or condition IV, the subject ignored the instructions (e.g., gave a sentence to condition III), the instructions for that condition were paraphrased and given with subsequent stimuli, up to five stimuli per condition. The paraphrased instructions were "Tell me five single words for ____" and "What would most people say to _____."

Variables--Word Measures

Three variables were included in the factorial design of the study. The three variables were diagnostic patient groups. Word association conditions, and quality of cognitive responses. There were two levels of the diagnostic patient groups, chronic nonparanoid schizophrenic and nonpsychiatric. The nine levels of the word association conditions (described above) were as follows: (a) free association,[1] (b) repeated free association,[1] (c) first continuous associations,[1] (d) second continuous association, (e) third continuous association, (f) fourth continuous association, (g) fifth continuous association, (h) popular association, and (i) final free association. The cognitive responses were identified by responses in free association condition I. The four quality levels of cognitive responses are presented in Table 5.

TABLE 5

Quality of Cognitive Responses

Levels	Responses
I	no response repetition of the stimulus word without further response perseveration[1] multiword clang response[1] neologism[1]
II	distant[1]
III	mishearing[1]
IV	acceptable[1]

[1]A glossary of terms is included in Appendix A for terms so marked.

The four levels of cognitive response quality are distinct steps between a response fault and non-response fault, that is, a quick, meaningful single word response. A Level II distant response is like a non-response fault word except that its relation to the stimulus is unclear. A Level III mishearing response also is like a non-response fault except that the response is mistakenly assumed to be another stimulus word. Because the stimulus words had many homonyms, it was important that responses be related to all possible homonyms. No responses were scored as mishearing responses if they were judged to be in response to a homonym of the stimulus. Also, no distant response was scored as distant if it could be related to a word phonetically similar to the stimulus. These responses were scored as mishearing responses, and left a sample of words which were truly distant. The distinction between Levels II and III is important because these levels have often been combined in earlier studies. In summary, a factorial study was made of groups, initial response quality (internal cognitive responses), and conditions (external) as they possibly affect word responses.

A separate analysis was made of each of the following word measures: (a) quality of responses (See Table 6), (b) ranked commonality (i.e., ranked group frequency of response from norms of 200 normal, and 200 schizophrenic subjects tested previously at the Houston Veterans Administration Hospital; (Mefferd, untitled), (c) response latency in tenths of seconds, (d) semantic relationship of stimulus response pairs as being of idiodynamic set I (defining responses, synonyms,[1] superordinates,[1] e.g., pull-tug), idiodynamic set II (example responses, antonyms,[1] contrasts,[1]

TABLE 6

Scale of Response Quality

Responses	Quality Values
response faults[1]	1
distant[1]	2
mishearing[1]	3
long latency[1]	4
acceptable[1]	5

[1]A glossary of terms is included in Appendix A for terms so marked.

logical coordinates,[1] e.g., pull-push), and idiodynamic set III (functional relations,[1] sentence completions, descriptions, e.g., pull-wagon), and (e) temporal series[1] of two or more responses of the same idiodynamic set and the acceptable response type.

Special Studies

In the special study of mishearing responses, the number of similar phonemes between actual and misheard stimulus words were scored. Also studied were the number of misheard phonemes in the first versus later syllables of the stimulus words. The number of times the misheard response was of the same idiodynamic semantic set as that of the individual patient, and the number of times the misheard response was of the same semantic set as that most commonly given for the stimulus word were studied as well. The criteria for a patient's idiodynamic semantic set were (a) a percentage of responses over 50% in one set, and (b) fewer than 10% in the alternate sets. A number of patients were found to have a "minor" set (i.e., scores greater than 10% but less than 50%, see Appendix B for a list of each patient's idiodynamic set). Three nonpsychiatric patients and one schizophrenic patient could not be classified as having an idiodynamic set.

A special study was made of word familiarity. The number of words given a denotative definition in condition IX were evaluated. Also studied was the possible effect of the total procedure. This was examined by a comparison of the quality of responses in condition I with the quality of responses to the "new" stimulus words in condition X.

CHAPTER IV

RESULTS

The results were quite complex and require a detailed presentation. In general, the schizophrenic and nonpsychiatric patients did not differ in responses to the degree that one might expect from a reading of the literature. However, certain differences were found. Results are presented for each of the word measures and then for the special studies.

Analysis

The possible effects of the variables were tested by a three-way analysis of variance (ANOVA) model. The data consisted of the average scores of each subject's responses for each diagnostic group x condition x stimulus quality cell. This analysis was made for the variables of response quality, commonality, response latency, and length of temporal series of acceptable responses.

The remaining variables were studied by Chi-square procedures, where 2 x 2 tables (groups x variables) were studied for the following: (a) percentage of responses in temporal series, (b) percentage of responses in set I, set II, and set III in temporal series, (c) percentage of each stimulus word which was misheard, (d) percentage of stimulus words misheard at the first syllable, (e) percentage of misheard responses of the same set as that most commonly given for the stimulus word, and (g) percentage of stimulus words defined. The percentage of responses

in temporal series of either set I, set II, or set III, as well as the average length of temporal series of responses in set I, set II, and set III were studied in 2 x 5 tables (groups x conditions). Note that the nine conditions in ANOVA were reduced to five conditions for the purposes of the Chi-square analyses. This was done by including all continuous association conditions III-VII in one condition.

Response Quality

Response quality results are presented in Table 7. None of the sources of variance attributable to diagnostic groups or to diagnostic groups in combination with other factors attained significance at the .05 level of confidence. The significant sources of variance present in the table were related to the initial level of cognitive response, association conditions, and the interaction of these factors.

The initial response quality (cognitive responses) had a significant effect on the quality of subsequent responses, $F(3,102)=12.29, p<.001$. Stimulus words which elicited acceptable responses, mishearing responses, distant responses, and other response faults had the following mean response qualities; 4.06, 3.24, 3.50, and 3.29, respectively. Thus, acceptable responses were followed in conditions II-X by responses of higher quality than were response faults. Mishearing stimulus words were followed by the lowest quality responses.

The word association conditions also were found to have a significant effect. The mean response qualities for the conditions II-X in order were as follows: 3.43, 3.69, 3.66, 3.52, 3.37, 3.57, 3.80, and 3.95. Note that mean quality of condition I responses were not included

TABLE 7

Summary of the Analysis of

Response Quality Measures

Source	MS	df	F
Groups (G)	18.79	1	2.68
Subjects (S) within G	7.01	34	
Initial Response Quality (IRQ)	22.70	3	12.29*
G x IRQ	1.97	3	1.07
S x IRQ	1.85	102	
Conditions (C)	5.43	7	6.42*
G x C	1.49	7	1.76
S x C	.85	238	
IRQ x C	1.75	21	3.06*
G x IRQ x C	.84	21	1.47
S x IRQ x C	.57	714	

*$p < .001$

in the analysis because quality was predetermined by the procedure, that is, quality of the responses in conditions II-X were examined for each quality of responses selected in condition I. The mean quality of condition I responses was 2.72, and when an analysis was made which included condition I responses, the results were not appreciably altered. Starting above with condition II, response quality increased slightly in condition III and then decreased as the second through fourth responses were produced in continuous association. This trend reversed itself when the fifth of five responses was produced in condition VII. This improvement increased when popular responses were elicited in condition VIII. Response quality continued to improve in final condition X. Note that responses to condition IX were definitions of the stimulus words and were not included in ANOVA, but analyzed using Chi-square.

The interaction of initial response quality (cognitive responses) and conditions was significant. The means are presented in Figure 1. Fault responses, distant responses, and mishearing responses tended to decrease when patients were instructed to produce five responses for each stimulus word. Responses which followed initial acceptable responses tended to decrease in quality, and this trend continued until popular responses were requested. Then quality substantially increased at that point and remained at a high level for the rest of the procedure. The high level represented an overall improvement of acceptable words, comparing conditions II and X. Overall improvement also was found for distant and mishearing responses, although mishearing words remained at a low level throughout the procedure. Fault responses were found to uniquely improve when the last of five continuous responses were elicited. Improve-

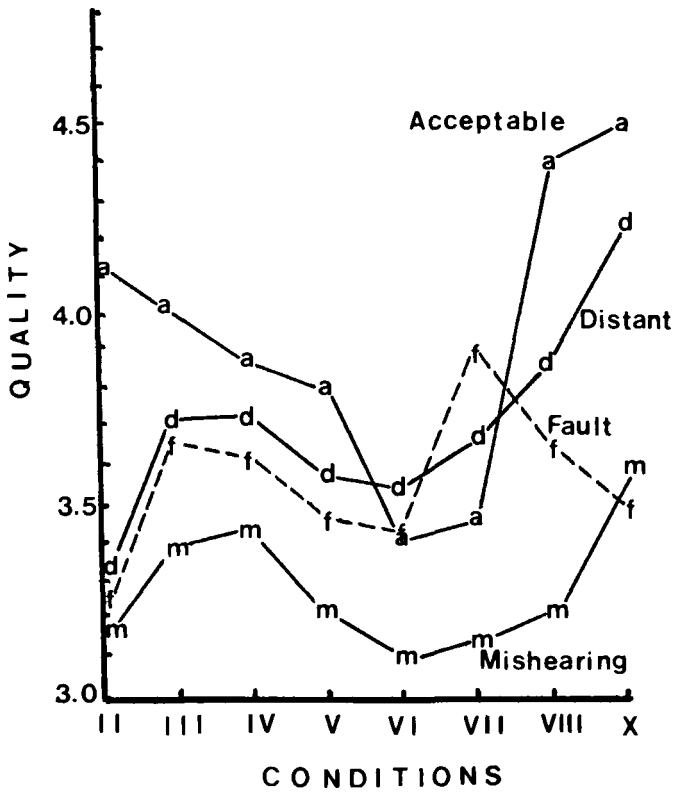

Figure 1. Mean response quality for initial response qualities x conditions.

ment of fault words then reversed itself in the popular and final conditions, returning near the condition II level. Improvement of fault words occured most often when patients were given five response opportunities. Patients were not able to maintain fault improvement when subsequent single response opportunities were given. Note that these results are for patients in general and not schizophrenic patients. But the results do support the contention that cognitive responses are important to word association.

Response Commonality

Commonality sources of variance are presented in Table 8. Differences between the two groups attained significance $F(1,34)=5.02$, $p < .05$. The schizophrenic group had a mean ranked commonality score of 5.44. The nonpsychiatric group had a lower mean ranked score of 5.21. The lower score indicated that more common responses were produced, since the most common response was scored as rank one, and so forth.

Initial response quality (cognitive responses) also attained significance in the overall analysis $F(3,102)=5.98$, $p < .01$. The following mean ranked commonality scores were obtained, starting with acceptable responses: 5.07, 5.54, 5.40, and 5.30. Acceptable cognitive responses elicited the most common responses. Mishearing cognitive responses were next, followed by distant and fault cognitive responses, respectively. In order, the ranked commonality scores of the conditions were 5.53, 5.02, 4.94, 5.44, 5.62, 5.80, 5.86, 4.96, and 4.77. The most common responses were produced at the end of the procedure. This trend was stable, except for a decrease in common responses found as five responses were produced in conditions IV-VII.

TABLE 8

Summary of the Analysis of

Response Commonality Measures

Source	MS	df	F
Groups (G)	16.96	1	5.02*
Subjects (S) within G	3.37	34	
Initial Response Quality (IRQ)	12.88	3	5.98**
G x IRQ	.63	3	.29
S x IRQ	2.16	102	
Conditions (C)	23.94	8	33.62***
G x C	1.42	8	2.00*
S x C	.71	272	
IRQ x C	2.84	24	4.33***
G x IRQ x C	.91	24	1.39
S x IRQ x C	.65	816	

*$p < .05$
**$p < .01$
***$p < .001$

As with the response quality measures, there was a significant interaction of initial response quality (cognitive responses) with conditions $F(24,816)=4.33$, $p < .001$. These data are displayed in Figure 2. Distant and mishearing cognitive responses were less common in conditions II and III. Distant cognitive responses then became more common at the end of the procedure, while mishearing words remained at a low level. Fault words quickly became more common in condition II, and this level decreased in final condition X as did response quality of fault words described above. However, while the quality of response words also increased in condition VII, the response did not become more common. Thus, in this analysis distant and mishearing cognitive responses tended to become more common at a slower rate and quality increases were not necessarily accompanied by increased commonality.

While schizophrenics did not differ at all from control patients in quality of responses, the groups did differ in commonality measures. This was especially true when conditions were studied $F(8,272)=2.00$, $p < .05$. The mean ranked commonality for conditions I-X for the schizophrenics were as follows: 5.61, 5.17, 5.02, 5.59, 5.76, 5.92, 5.75, 5.23, and 4.92, in order. The mean ranked commonality for the nonpsychiatric group was 5.45, 4.86, 4.87, 5.30, 5.48, 5.68, 5.96, 4.69, and 4.62, in order. Simple effects were studied with a critical difference of .28 ($p < .05$). The schizophrenic group was less common in conditions II, IV, V, VIII, and X. This was because nonpsychiatric patients quickly improved commonality in condition II and they did not show as great a commonality decrease as schizophrenics during continuous association. They also dramatically improved commonality in response to the final word condition and the popular instructions, while the schizophrenics did not do so.

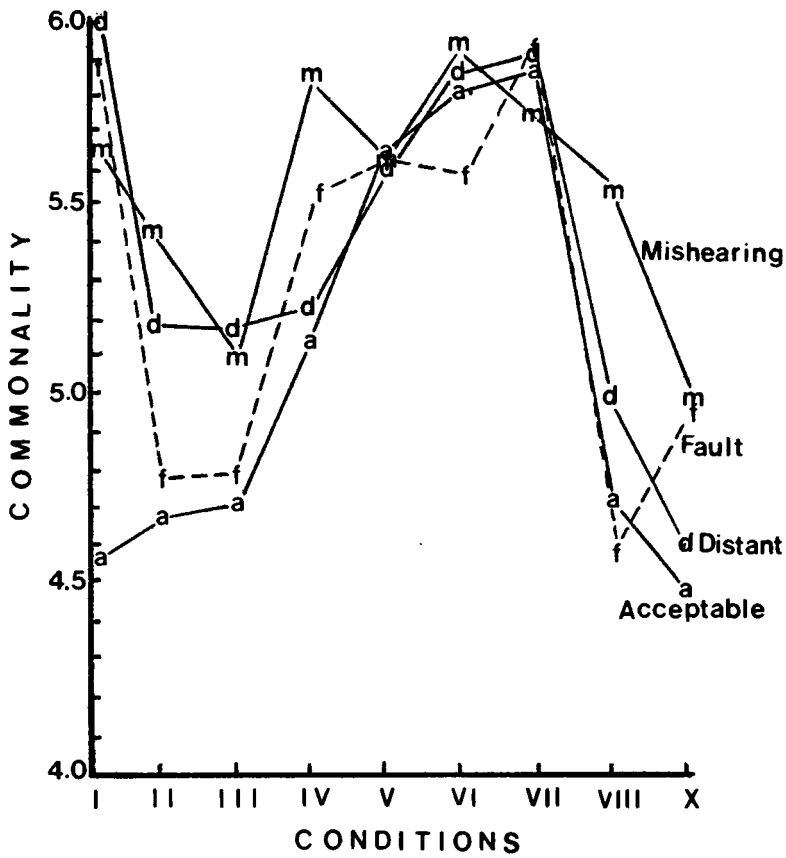

Figure 2. Mean commonality for initial response qualities x conditions.

Still, it appears that nonspychiatric patients were responding less to the instructions and more to the repeated response opportunities.

Response Latency

Sources of variance of the response latency measure are presented in Table 9. Significant differences were found between the nine means for conditions, $F(8,272)=20.03$, $p < .001$. Mean response latency changed with conditions as follows: 4.51, 3.44, 5.75, 4.60, 5.90, 6.55, 5.94, 3.55, and 2.92, in order. There was an initial decrease in latency when the words were regiven in condition II. Then there was a sharp increase to the "five words" instructions and then a burst of speed with subsequent gradual improvement of response latency. The significant results of initial response quality (cognitive responses) x conditions interaction is presented in terms of the groups x initial response quality x conditions interaction (see Figure 3). It appears that it was during the first response to the "five words" instructions that patients became aware that a mishearing was not an acceptable response because there was a substantial increase in latency. Also in continuous association distant words were given quickly, followed by long latency in the last of "five words". Here, distant responses did not appear to be the result of a calculated (i.e., long latency) effort by patients. Rather, distant responses were produced in a quick, "impulsive" way. Fault words were given at a relatively stable latency.

As with commonality, schizophrenics differed from control patients in response latency when conditions were studied $F(8,272)=2.19$, $p < .05$). The mean response latency for the groups is presented in the groups x

TABLE 9

Summary of the Analysis of

Response Latency Measures

Source	MS	df	F
Groups (G)	29639.54	1	3.26
Subjects (S) within G	9089.53	34	
Initial Response Quality (IRQ)	1279.62	3	1.22
G x IRQ	1142.86	3	1.09
S x IRQ	1049.77	102	
Conditions (C)	24348.67	8	20.03***
G x C	2660.40	8	2.19*
S x C	1215.84	272	
IRQ x C	729.76	24	2.02**
G x IRQ x C	632.38	24	1.61*
S x IRQ x C	393.05	816	

*$p < .05$
**$p < .01$
***$p < .001$

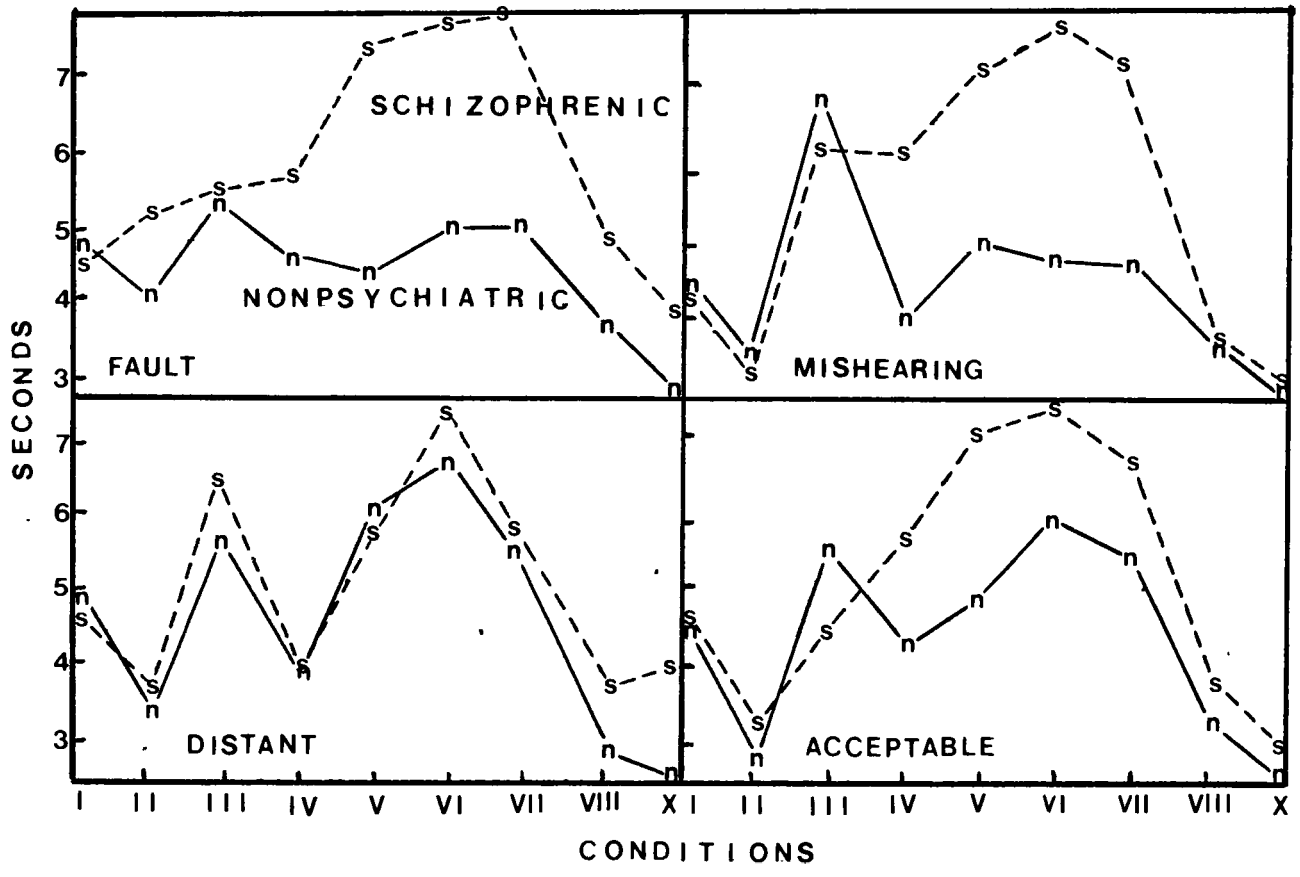

Figure 3. Mean response latency for groups x initial response qualities x conditions.

initial response quality x conditions interaction (See Figure 3). Schizophrenics were slower in continuous association after the first of five responses. They were more similar to nonpsychiatric patients at the start of the procedure compared to the final conditions. The one exception was for distant responses, where schizophrenics and nonpsychiatric patients were similar in response latency in continuous association. Schizophrenics were slower at the end of the procedure for fault and distant words. This result was somewhat consistent with the "impression management" postulate. That is, schizophrenics did not continue at a fast response rate, and this may have been the result of a calculated effort to create a "sick" impression. But this result was found for both distant and fault responses, which indicates that the result was general to many types of responses. It was more likely that the result was similar to that of Stern and Reigel (1970). They studied 11 word association conditions and found schizophrenic responses to become different from the responses of control subjects when instructions were changed as in the present study. Schizophrenics here responded to the instructions with slower, less common responses. The results did not strongly support postulates that schizophrenic responses were the determined by an effort to appear "sick" or an associative disturbance.

Idiodynamic Set

The semantic relationships of stimulus-response pairs were analyzed in several 2 x 5 (schizophrenic and nonpsychiatric groups x conditions I, II, III - VII, VIII, and X) tables using Chi-square. Note that the nine conditions in ANOVA were reduced to five conditions for the purposes

of the Chi-square analyses. This was done by including all continuous association conditions III - VII in one condition. A separate table was prepared for each of the three idiodynamic semantic sets. Independence was retained by each of the tables as follows: for Set I, $\chi^2(8) = 8.5$, $p > .05$; for Set II, $\chi^2(8) = 3.89$, $p > .05$; and for Set III, $\chi^2(8) = 5.42$, $p > .05$. Frequency of idiodynamic sets between groups and between conditions was approximately the same.

Temporal Series of Responses

No difference was found for the groups in the percentage of acceptable responses in temporal series, that is, "runs" of two or more responses, $\chi^2(1) = .85$, $> .05$. The groups also did not differ in temporal series of responses in Set I, Set II, or Set III, $\chi^2(2) = .51$, $p > .05$. Between 40% and 43% of the responses of both groups were in temporal series.

The groups however did differ in the mean length of temporal series of acceptable responses, $F(1,170) = 9.03$, $p < .05$. The mean length of a series within a set for the schizophrenic group was 3.99 responses. The average length of a series for the nonpsychiatric group was 5.01. While the nonpsychiatric patients gave no more responses in series than the schizophrenics, those series of acceptable responses which they did give were longer in number.

Series length also was dependent upon the condition under which the series was obtained, $F(4,170) = 5.48$ $p < .05$. The mean length for conditions I, II, III - VII, VIII, and X was 5.56, 4.59, 3.23, 4.42, and 5.24 responses, respectively. There was a decrease in length in

the intermediate conditions. But there was no significant interaction of groups x conditions, $F(4,170) = .69$, $p > .05$.

The result for the mean length of series of Set I responses was significant, χ^2 (4) = 38.9, $p < .05$. The mean lengths for the schizophrenic group in conditions I, II, III - VII, VIII and X were 2.67, 2.12, 3.72, 2.36, and 2.38, respectively. The series of Set I responses were not as long as the series of acceptable responses seen above. Also, the intermediate conditions yielded the longest series. This is in contrast with series of acceptable responses, which in the intermediate conditions, were the shortest in length. The groups did not differ in mean length of Set II and Set III series, χ^2 Set II (4) = 4.13, $p > .05$, and χ^2 Set III (4) = .69, $p > .05$, respectively.

Special Studies

Mishearing responses. Groups did not differ in the proportion of the stimulus word which they misheard, χ^2 (1) = 2.96, $p > .05$. However, they did differ in which phonemes were misheard, χ^2 (1) = 14.99, $p < .05$. Of mishearing responses, schizophrenics misheard the first phonemes 34.4% of the time. Nonpsychiatric patients misheard the first phonemes only 15.5% of the time. Thus, while both groups misheard approximately 50% of a stimulus word, that part which was misheard tended to be located in different phonemes of the word.

The groups also differed in the degree to which the misheard word was of the same semantic set as that commonly given for the word, χ^2 (1) = 79.51, $p < .05$. Schizophrenic patients had 20.3% of their mishearing responses so scored, while nonpsychiatric patients had 29.6%. Thus,

nonpsychiatric patients tended to produce more mishearing responses which were of a semantic set given by most people than was the case for schizophrenic patients. The groups did not differ in mishearing responses to stimuli to which responses were in a patient's habitual idiodynamic set, χ^2 (1) = 3.24, $p > .05$.

Definitions. The groups did not differ in the percentage of stimulus words given a denotative definition when that stimulus word had elicited an acceptable response, χ^2 (1) = .03, $p > .05$. However, they did differ in their ability to define stimuli which had elicited response faults, χ^2 (1) = 8.65, $p < .05$. Schizophrenics defined 78% of response fault stimuli, while nonpsychiatric patients defined 92%. This was higher than the 69% of acceptable stimuli which both groups had successfully defined.

Evaluation of Condition I and Condition X. The groups differed in the average response quality in initial condition I and in final condition X. In condition X there was a list of entirely new stimulus words interspersed with the list which had been repeated throughout the procedure. Thus, the original potential of patients to produce response faults could be compared with their potential after experience with the procedure. After ten word association conditions, a practice effect was likely. One question was whether possible benefits of practice would generalize to new stimulus words. The associative disturbance postulate would predict that it would not because basic cognitive responses would be disrupted. This was true for the stimuli repeated throughout the procedure, $F(21,1088) = 2.86$, $p < .05$, and for "new" stimuli in condition X, $F(1,68) = 19.09$, $p < .05$. Both groups tended

to improve response quality between condition I and condition VI. The mean results for the schizophrenic group were: condition I = 2.70; condition X = 3.29 for the repeated stimuli, and 3.40 for the new stimuli. The mean results for the nonpsychiatric group were: condition I = 3.90; condition X = 3.71 for repeated stimuli, and 4.10 for the new stimuli. Thus, both groups improved response quality in the procedure, and successfully generalized this practice to new stimulus words.

Perseveration. The groups did not differ in the percentage of identical responses given to more than one stimulus word, χ^2 (1) = .028, $p > .05$.

CHAPTER V

DISCUSSION

On several of the word measures the responses of schizophrenic patients were worse than those of nonpsychiatric patients. However, this difference was a matter of a small degree and the groups were quite similar in many of their responses. Especially of note was the absence of a schizophrenic response interaction with cognitive response quality. Quality of cognitive responses have been assumed to be basic to schizophrenic deficit and cognitive responses were of importance in the present study. But it was only to the word association conditions that schizophrenic patients responded in a unique way compared to nonpsychiatric patients. They were slower and less common in their responses and this varied among the conditions. Certainly most studies of schizophrenic language have been aimed at the "essence" of schizophrenia (Buss, 1966). The present results have implications for some of the various postulates of schizophrenic thought processes.

Perceptual Dysfunction

If the postulates were loosely order by an "information processing" model of cognitive processes, then the perceptual postulate is of the earliest, lowest order. In the present study, there was opportunity for correction of response faults in the ten word association conditions.

Both groups were equal in the ability to do this throughout the procedure, excluding continuous association conditions III-VII where the response of both groups became worse as continuous associations were produced. The ability to respond at a higher level also was generalized to completely new word stimuli in final condition X. So the effect of practice and instructions was very significant. These results, as well as the absence of a groups x initial response quality interaction, were not consistent with postulates in which it was suggested that basic cognitive responses are disrupted.

The results also were not consistent with the perceptual postulate. Both groups in condition II became quicker and improved response faults to the same degree. But their responses varied more in the conditions which followed. While nonpsychiatric patients were able to produce more common responses in condition II, this effect also was greater in later conditions. These results suggest that schizophrenic dysfunction were more than mere perceptual mistakes. For responses to change as a function of the number of conditions, associative processes were in effect.

Even for nonpsychiatric patients, perceptual dysfunction would not explain the periodic "bursts" of improvement which were found. A high degree of initial, sustained (i.e., perceptual) improvement was not observed. Acceptable cognitive responses even slightly deteriorated on the word measures.

Also, it cannot be said that mishearing responses, those responses which were acceptable responses to words phonetically similar to the stimulus, were perceptual in nature. Mishearing responses were not

improved to the extent of other response faults. Mishearing words remained at low quality and commonality levels. Thus, the response fault most likely to result from a perceptual mistake was the hardest for patients to improve. Such lack of improvement would be more consistent with associative disturbance than perceptual dysfunction.

Further evidence for an associative basis for mishearing responses was found in the percentage of shared phonemes of actual stimulus word and misheard stimulus. The misheard stimulus word was judged on the basis of the mishearing response, and was a word phonetically similar to the actual stimulus. In a study of speech errors by Fay and Cutler (1975) over 75% of the speech error word was shared with the word judged to be the proper word. In the present study approximately 50% of the two words were the same. This relatively low percentage was more consistent with the associative disturbance postulate. Fay and Cutler contend that cognitive responses are "stored" or structurally associated on the basis of phonetic similarity. Such storage would make words easy to recognize, and would explain the high degree of similarity found in speech errors. For the percentage to be so low in the present study, an associative disturbance would be necessary to disrupt the phonetic similarity. The perceptual postulate would predict a higher percentage of shared phonemes.

The mishearing responses of nonpsychiatric patients seemed to also involve processes of an editing deficit. A high percentage of their mishearing responses were of the same semantic set as that given most commonly for the stimulus word. Response faults have been found to occur when a patient cannot find a response of the same set as his

habitual idiodynamic semantic set (Moran, et al., 1964). While this result was not observed here, it was possible that nonpsychiatric patients misheard stimuli as a mechanism to find common responses. When they did not find a common response, there was an improper generalization of the selection process to "mishear" the stimulus in short-term memory. For the purposes of the present study, the selection process was thought to be a semantic one. Semantic sets are a "veneer" over the basic cognitive responses placed there by educational experiences (cf. Dufilho, et al., 1969). The semantic veneer inhibits basic cognitive responses (cf. Moran, et al., 1964; Cramer, 1968; Fay & Cutler, 1975). In the present study the selection process was not accompanied by long response latency. This would support the idea that inhibitory processes were lacking, which if present would have facilitated common responses. This result is compatible with the editing deficit postulate, and adds information about postulated semantic selection processes.

Misheard stimuli of schizophrenic patients were more often misheard on the first phonemes versus the later phonemes for nonpsychiatric patients. Traditionally, the first phonemes have aided associative processes by preparing subjects for the rest of the word (i.e., perceptual readiness; Bruner, 1957; Mefferd, Houck, & Sadler, 1970). Because there is little associative information in the first phonemes, mishearing the first phonemes is considered to be perceptual in nature. Thus, schizophrenics avoided associative processes by mishearing first phonemes, perhaps by making a "quick guess" about the stimulus (Broen, 1968; Yates, 1966). Draguns (1963) found schizophrenics to make incorrect identification of visual materials because of over-quick guesses.

Other authors have contended that the problem of perception is not the result of an avoidance of associative disturbance, but is basically perceptual. Cromwell and Dokecki (1968) contended schizophrenics are unable to "dis-attend" stimuli, and Manusco (1970) suggested the concept of "perceptual capture." This controversy can be somewhat avoided if Fay and Cutler (1975) are correct in their assertion that basic cognitive responses are phonetic, and associated most strongly from the beginning of the words. This structure would allow easy recognition of words and has traditionally been postulated as a perceptual process (cf. Flavell, & Draguns, 1957). But as a basic associative process, schizophrenic mishearing of the first phonemes would define an extreme case of associative disturbance. Other authors have contended that the basic cognitive responses are associated on a basis other than response commonality (cf. Moran, 1975; Cohen, Nachamni, & Rosenberg, 1974). In general, there was no strong evidence for a purely perceptual postulate of schizophrenic response.

Associative Disturbance

In the associative disturbance postulate it was suggested that there would be no consistent improvement of responses, since basic cognitive responses were disrupted. However, response quality did improve, as did response latency and response commonality. This was found for both schizophrenic and nonpsychiatric patients. However, schizophrenics did respond at a generally lower level on the measures. Also, if associative disturbance is a disruption of basic cognitive responses, then it is surprising that initial response quality (cognitive responses) did not

have a significant effect in the study. The groups also did not differ in cognitive responses. The results were not consistent with the associative disturbance postulate, although weaker, related postulates of fluctuating attention and editing deficit were supported.

There was one major exception to response improvement. Continuous association (conditions III-VII) has been connected in the literature with the associative disturbance postulate because it elicited a large sample of responses for each stimulus word (cf. Fuller, & Kates, 1969). As in earlier studies, responses became progressively worse as they were produced for both groups. Systematic deterioration was inconsistent with the associative disturbance postulate, since it predicted random responses.

But there was one point (condition VII) at which deterioration was less systematic. This result was a major departure from the literature. The expansion of continuous association from three to five responses aided the production of common responses in the fifth "random" position (cf. Fuller, & Kates, 1969; Breznitz, 1969). However, response quality and response latency also improved in condition VII. Thus, support for the associative disturbance postulate was quite weak. The results show the benefit of expansion of the continuous association task, however, since a reversal of deterioration was found. Most studies have elicited fewer responses, and found no such reversal.

Further support for a weak version of the associative disturbance postulate was found when cognitive fault words were found to deteriorate in quality and commonality in the final condition X. Fault words were of highest quality in condition VII, the fifth of five responses and of

highest commonality in popular association condition VIII. Thus, faults were improved with the aid of instructions and repeated response opportunities. But when the instructions were removed in condition X and new stimulus words were introduced to disrupt any practice effect, responses lessened in quality and commonality. It should be noted that distant, mishearing, and acceptable words had higher levels of improvement in these conditions. Thus, response faults of level I (no response, multi-word, clang response, and so forth) denoted cognitive responses improved only with the support of special word association conditions. This result was for both groups of patients, and does not detract from the improvement found in the rest of the study. But in the most severe cases of disruption, instructions must be maintained to continue improved responses. This result may say more about the effect of instructions than associative disturbance (cf. Stern, & Reigel, 1970).

Condition VIII (popular association) also has been connected in the literature with the associative disturbance postulate (cf. Sommers, Deware, & Osmond, 1960). It was predicted that schizophrenics would not produce common responses to such instructions as "give the most common response" because their cognitive responses were disrupted. Although schizophrenic patients did have a lower condition VIII commonality score, this trend was established in condition II. All patients produced their most common responses in final condition X. It appeared that nonpsychiatric patients responded less to instructions and more to repeated response opportunities. Schizophrenics were less able to do this and their commonality was at a lower, more stable level.

To further test the effect of the popular association condition, a subsample of responses was studied. For the primary commonality responses which were produced by patients in condition I, only 50% were again produced when patients were instructed to "give the most common response." This was found for both groups of patients. Thus, half of the primary commonality responses which were known and easily produced by patients in condition I were not reproduced in condition VIII. While this result might appear to support the associative disturbance postulate, that is, the disruption of responses precluded responses to popular association, it actually brings the efficacy of the commonality measure into question. Even primary responses so accessible as to be produced in condition I failed to be reproduced 50% of the time.

Although the results were similar for both groups, idiodynamic semantic responses were examined across conditions. Set II (contrasts-coordinates) were stable across conditions at a 20% level. Both groups also tended to produce more set III (functional, syntactic) responses during the initial conditions I-II and as the last of five responses (condition VII). Set I (synonym-superordinate) responses were found to increase in conditions III-IV (the first and second of five continuous associations) and in the final free association condition X. From these response patterns, it is suggested that patients started out with syntactic, functional (set III) associates, then attempted to define the stimulus (set I) when instructed to "give five responses" (conditions III-VII). When they failed to produce five responses, they returned to set III responses (cf. Neman & Dixon, 1969). It was probably easier to produce syntactic, functional (i.e., image related) set III responses in

abundance than set I (definition) responses. It should be noted that set I responses were preferred by both groups in final free association condition X. Stern and Riegel (1970) found schizophrenics to have a unique preference for set I (synonym) responses in such free association. Moran, et. al. (1960) reported an ordinal scale of "relatedness" consisting of Set III, Set II, Set I, in order of increased relatedness. The results are consistent with this scale, as opposed to Cramer's (1968) contention that set II responses were the most socialized responses (cf. Dufilho, et al., 1969).

Fluctuating Attention

An extension of the associative disturbance postulate was that the disturbance has a periodic, temporal (i.e., psychophysiological) nature. As with the other results, the schizophrenic patients exhibited more fluctuation than did nonpsychiatric patients. They had shorter "runs" of acceptable responses and Set I (synonym-superordinate) responses. The difference between groups was only one response or less. Still, the result was important since it reflected a difference in the total pattern of responses. The results were consistent with a definition of associative disturbance as weaker than permanent disruption of basic cognitive responses, that is, responses disrupted at one time would not be disrupted at another. But the results were probably more consistent with the editing deficit postulate. Semantic processes which inhibit cognitive responses to edit them for different tasks and conditions appeared to fluctuate more in schizophrenics.

Editing Deficit

In the editing deficit postulate, cognitive responses were assumed to be normal. This was a major finding of the present study. Certainly no major differences were observed in the cognitive responses of schizophrenic and nonpsychiatric patients. In the editing deficit postulate, there is a problem in the expression of cognitive responses. For example, Boland and Chapman (1971) found a failure by schizophrenics to inhibit common responses. In the present study, common responses of schizophrenics were not produced in abundance. Cohen, Nachmani, and Rosenberg (1974) contended that schizophrenics fail to inhibit cognitive whether common or uncommon. They build improper chains of associations rather than edit cognitive responses to fit with task instructions. Stern and Riegel (1970) reported that schizophrenics over-restrict responses to Set I synonym responses. In the present study, there appeared to be a failure to inhibit a semantic selection process with mishearing responses when nonpsychiatric patients attempted to produce common responses. The fluctuation of Set I semantic responses of schizophrenics is consistent with the contention that they were not able to consistently apply the inhibitory semantic veneer used in editing cognitive responses. This is a weak version of the associative disturbance postulate, since it does not apply to basic cognitive responses. In general, schizophrenics responded to the conditions of the study in a way that was different from nonpsychiatric patients. Their responses were less common and less quick. Since Dufilho, et al. (1969) reported the semantic veneer to be a direct function of educational experiences, the present results imply socialization problems.

Impression Management

In the impression management postulate, it also is assumed that cognitive responses of schizophrenics are normal. Response faults result from a calculated effort by schizophrenics to demonstrate "sick" responses. The improvement of responses by schizophrenic patients was not consistent with this postulate. Also, it was predicted that distant responses would be accompanied by long response latency. If cognitive responses were normal, then schizophrenics would search to produce "sick" distant responses and this effort would take time such as occurs when normal subjects are given "originality instructions,"[1] that is, instructions to produce distant responses (Masters, Mesibour, & Anderson, 1970). In the present study, schizophrenic patients took longer to respond with all responses, including acceptable responses (conditions IV-X only). It seems doubtful that impression management would result in long latency acceptable responses.

Instead, it was nonpsychiatric patients who took longer with their distant responses. This was mostly in continuous association, where they were apparently surprised by the distant nature of their responses and had special difficulty producing five responses. It should be noted that this was the only place in the entire study where the groups differed in cognitive responses.

Insufficient Motivation

Although schizophrenic responses were of the same quality as those of nonpsychiatric patients, schizophrenic responses were less common and also less quick in later conditions. Schizophrenic response latency

slowed down in condition IV, at the point the word tasks became more difficult. Schizophrenic patients also did not increase commonality when nonpsychiatric patients did. Rather, schizophrenic commonality remained at a low level regardless of conditions. These results were consistent with the insufficient motivation postulate, especially with regard to lower levels of general brain activity (cf. Bleuler, 1950; Arieti, 1974). However, schizophrenics did improve the quality of their responses, so it was not just a matter of insufficient motivation.

Definitions

While the schizophrenic patients did not define as many words that elicited response faults as did the nonpsychiatric patients, they did define more words that elicited response faults than acceptable responses. Since more response faults were defined than acceptable responses, word knowledge was not a factor in the production of response faults.

Conclusions

In general, the schizophrenic patients did somewhat worse on several of the word measures than did nonpsychiatric patients. The responses of schizophrenic patients were less common and less quick, especially after the first continuous association response was produced. This was not because of an associative disturbance in which basic cognitive responses were disrupted. Both groups were quite comparable in their cognitive responses and response quality measures.

What was unique about schizophrenic responses was a result of the way in which they responded to the word association conditions. As words

that elicited response faults were followed through the procedure, schizophrenics did not improve responses to the degree that nonpsychiatric patients did. This was more than mere insufficient motivation. In the total patterns of responses, the schizophrenic patients tended to change from one semantic set to another to a greater extent than did nonpsychiatric patients. The results were more compatible with the fluctuating attention and editing deficit postulates.

CHAPTER VI

SUMMARY

This study was a comparison of word association patterns of matched schizophrenic and nonpsychiatric patients. Patients were matched in age, sex, race, education, and verbal fluency. A series of ten word association conditions was administered which varied in instructions. The conditions were free association, repeated free association, five continuous associations, popular association, definition of the stimulus, and final free association. Response patterns consisted of (a) response quality (judged by the degree to which a response was a quick, meaningful, single word), (b) response commonality (judged by response rank among responses of a reference group to the same stimulus words), (c) response latency in tenths of seconds, (d) semantic relationship of stimulus-response pairs, and (e) temporal series of two or more responses. These patterns were more compatible with several of the many postulated causes of the schizophrenic condition.

It was found that the basic cognitive responses of schizophrenics were not disrupted. Rather, schizophrenic patients tended to change more from one semantic set to another than did nonpsychiatric patients. Schizophrenic responses were less common and less quick, especially after the first continuous association response was produced. The acceptable responses of schizophrenic patients varied more than those of

nonpsychiatric patients. Response faults were not fully explained by perceptual mistakes, lack of stimulus word knowledge, motivation, or a calculated effort to appear "sick." The results were more compatible with fluctuating attention and editing deficit postulates.

In addition, a special study was made of mishearing responses. When nonpsychiatric patients misheard the stimulus word, the response they gave was of the same semantic set and response quality as their other responses but to an erroneous stimulus. The schizophrenic patients tended to respond in another way. They more often misheard the first phonemes of the stimulus. Perhaps they made a "quick guess" at the stimulus word.

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APPENDIX A

Glossary

APPENDIX A

Glossary

acceptable responses: those responses which were quick, meaningful (i.e., obviously related) single word responses in free association.

antonym: a word with a meaning opposite that of another word (e.g., sad-happy).

associative disturbance: a postulated cause of schizophrenia where it is asserted that basic cognitive responses are disrupted.

chain association: a word association technique where one is instructed to give a response and then that response is given as the next stimulus word. The procedure is repeated to obtain a chain of associations.

clang response: a response fault which is a meaningless rhyming response.

cognition: "internal behaviors" such as ideas and images.

commonality: a value given a response on the basis of its frequency of occurence among the responses of a reference group. In the present study, the value assigned is the responses rank. The lower the value, the lower the rank, and the more common a response is.

complexes: clusters of cognitive responses. "Morbid" complexes were thought to motivate neurotic behavior.

complex indicators: response faults thought to indicate complexes.

continuous association: a word association technique in which one is instructed to give a number of responses (e.g., five responses) at one time to a stimulus word.

contrast-coordinate: two semantic relationships in which the words are both examples of some concept (e.g., red-blue for color).

distant response: a response which has no obviously shared meaning with the stimulus. It is often possible to postulate a mediating association which makes the response more meaningful (e.g., broad-white--field of snow).

editing deficit: a postulated cause of schizophrenia of a higher order in cognitive processes than associative and perceptual postulates. Cognitive responses are not disrupted, but there is a deficit in the inhibitory and selection processes which monitor and express basic cognitive responses.

fluctuating attention: a postulated cause of schizophrenia which is an extension of the associative disturbance postulate. The disruption has a temporal, periodic nature.

free association: a word association technique in which the subject is instructed to "give the first word that occurs to you when you hear my word." It is "free" in that no explicit constraints are placed on the responses.

functional: a semantic relationship in which one describes another (e.g., tree-green).

idiodynamic set: the tendency to give only one semantic class of responses in word association (See functional, contrast-coordinate, synonym-superordinate).

impression management: a postulated cause of schizophrenia which assumes that there is no cognitive deficit, only an attempt to create an unhealthy impression in order to maintain hospital status.

insufficient motivation: a postulated cause of schizophrenia where it is stated that frequency of responses will be lower because of lower general brain activity.

logical accordinate: See contrast-coordinate.

mishearing response: a response fault which is distant to the stimulus word in shared meaning, but it is a good meaningful response to a word phonetically similar to the stimulus word.

nelogism: an "invented" new word.

neurosis: a psychiatric condition in which a behavior syndrome is caused by internal conflict or complexes.

originality instructions: part of a word association method which explicitly limits responses to those one considers to be original.

password game: a word association technique in which one partner helps a listener to guess a target word by suggesting a stimulus word to the listener.

perceptual dysfunction: a postulated cause of schizophrenia in which it is asserted that there is a deficit in the ability to recognize and process information used in more developed cognitive processes.

perseveration: a response which is similar or identical to another response. In this study, the same response to several different stimuli defined perseveration.

popular association: a word association technique in which one is instructed to give the response most people would give to the stimulus word.

productivity: measure of motivation which assumes a positive correlation with frequency of responses.

repeated free association: In the present study, a word association technique where the list of stimulus words are regiven without any pause or instructions.

repetition failure: a type of response fault where there has been special instruction to repeat the responses given in previous word association tasks to the same stimuli.

response fault: a word association response which is not a quick, meaningful single word response (e.g., no response, multiword response, clang response, and so on).

response latency: the temporal duration between the ending of the stimulus word presentation and the response.

response quality: the degree to which a response is a quick, meaningful single word.

semantic set: See idiodynamic set.

subordinate: a word conceptually part of another (e.g., color-red).

superordinate: See synonym-superordinate.

synonym-superordinate: two semantic relationships which generally define the words so related, although each may be of the same or different logical levels) e.g., door-house, door-opening).

syntactic: the order of elements of a sentence.

temporal series: "runs" of two or more responses of the same type (e.g., blue-red and pull-push are both contrast-coordinate responses and were scored as a temporal "run" of two).

APPENDIX B

Patient Pairs

APPENDIX B

Patient Pairs

Chronological number	Group	Set	Matched Factors Age	Education	Verbal IQ	Race
1	S	1&3	23	13	95	W
39	N	1&3	24	14	106	W
2	S	3	49	11	90	B
38	N	1&3	43	13	106	B
4	S	1&3	48	15	102	W
49	N	123	45	12	94	W
5	S	3	53	7	78	W
31	N	1&3	51	8	84	W
6	S	1	42	6	100	W
30	N	3	53	5	102	W
7	S	1&3	44	12	100	W
32	N	1&3	55	12	104	W
8	S	123	47	11	90	W
50	N	2&3	46	11	102	W
9	S	1&3	46	12	90	W
33	N	1&3	52	11	90	W
11	S	1&2	43	7	88	W
42	N	123	49	8	96	W
14	S	1&3	53	12	114	W
37	N	1&3	49	12	108	W
15	S	1&3	63	8	110	W
45	N	1&3	62	8	140	W
17	S	3	38	11	52	B
48	N	123	35	10	67	B
18	S	1&3	34	12	93	B
35	N	1&3	26	12	99	B
19	S	1&3	36	12	88	B
47	N	1&2	50	12	85	B
21	S	1&3	24	12	95	B
34	N	1&3	27	12	99	B

Chronological number	Group	Set	Matched Factors Age	Education	Verbal IQ	Race
24	S	3	50	6	90	W
44	N	1	53	7	87	W
27	S	1&2	23	12	101	W
46	N	1&2	24	15	106	W
29	S	3	43	10	64	B
36	N	3	50	7	66	B

APPENDIX C

Word Association Stimulus List for Condition I with Semantic Set of Primary Response as Set I, Set II, or Set III

APPENDIX C

Word Association Stimulus List for Condition I with Semantic Set of Primary Response as Set I, Set II, or Set III

blue 2	vessel 1	square 2	course 1	stump 3
pull 1	dull 2	end 1	stern 3	bat 2
pest 1	sink 3	switch 3	come 2	glare 3
heel 3	sickness 2	rock 3	frigid 1	pore 2
stroke 1	promise 3	shout 1	dive 2	relish 1
cheese 2	pea 1	trouble 2	fit 3	mug 1
erection 3	quartz 2	beam 3	louse 1	pound 1
dream 2	piece 1	weak 2	rubber 3	screen 3
amount 1	union 3	spice 1	hear 2	sap 3
minor 1	passed 2	prints 2	faint 2	pan 2
milk 3	loaf 3	prick 1	order 1	upset 1
pride 2	exhaust 1	operation 3	lure 3	spoil 1
stomach 1	lion 1	set 2	ream 1	stool 2
flush 3	wait 3	stem 3	swallow 3	game 3
king 2	jam 2	chicken 1	bore 3	steel 3
mountain 2	tough 2	cross 3	ail 2	peak 1
hall 1	bitch 1	seat 1	taut 2	moon 2
spring 3	window 3	die 2	march 1	arm 2
beat 1	needle 3	discharge 3	naval 3	flu 1
climax 2	attempt 1	smile 2	aim 2	race 3
yarn 3	scab 3	queer 1	scale 3	question 2
loose 2	axe 3	bull 2	miss 2	whip 1
sponge 3	priest 2	fire 3	charge 1	comfort 3
nuts 1	rough 1	sac 1	attack 1	rag 2

APPENDIX D

Stimulus Word List for Condition X

with Programmed Spaces

APPENDIX D

Stimulus Word List for Condition X

with Programmed Spaces

sty	_____	_____
broad	fiddle	wish
_____	sucker	tense
goose	paste	spell
_____	_____	_____
_____	vain	express
peer	cell	_____
chair	_____	_____
well	_____	_____
hoary	slice	_____
dope	_____	_____
_____	working	
uniform	soul	
_____	earth	
face	_____	
street	_____	
bread	catch	
_____	neck	