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Introduction

The purpose of this study is to investigate the word association responses of good premorbid schizophrenics, poor premorbid schizophrenics, and non-psychiatric subjects. It also seeks to determine whether schizophrenics who are trained on a superordinate concept word association task will give more common and less idiosyncratic associations than prior to the training and to determine whether their performance on the word association test following training will not differ from that of the non-psychiatric subjects.

Theories of Schizophrenic Deficit

According to the theories of Cameron, Sullivan, and Goldstein, schizophrenia is a reaction to serious interpersonal disturbances in the early formative years of life. The schizophrenic is, therefore, highly sensitive to stimuli that would threaten personal security and consequently is prone to more private ways of thinking. His deficit in verbal conceptual ability to a great extent follows from this high sensitivity to personal cues of a threatening nature. This sensitivity promotes social isolation which restricts opportunities for assessing environmental cues so essential to adequate adjustment.

Cameron (1947) stresses the schizophrenic's withdrawl from interpersonal relations as a result of his inability to play the various roles required of him. Cameron also speaks of "desocialization" and "disorganization" in the schizophrenic. Because he has withdrawn to an extent from social relations, he has evolved highly idiosyncratic ways of thinking and talking about himself and his environment which tend to become increasingly incommunicable and disruptive.

Sullivan (1956) indicates that the schizophrenic has lost control of his "early referential processes" with their subsequent domination of his consciousness. These processes are fundamentally autistic and uncommunicative. In normal development, these primitive processes are superseded by the more consensually validated and logical modes of thinking. One result of this loss of control is that the schizophrenic often displays an inability to perform adequately on tasks where there is a need for conventional conceptual processes. In other words, if these referential processes come to dominate consciousness, as in schizophrenia, his abilities to use these conventional conceptual processes to organize and verbalize about reality will show a deficit.

Goldstein (1959), in a recent formulation of concreteness as the psychological basis of schizophrenia refers

to it as the "protective mechanism against anxiety. . . . It is not the effect of an organ deficit. . .it is an expression of the restriction in the use of the highest mental capacity" (p. 147). The major hypothesis is that both organic brain-damaged patients and schizophrenics have lost the abstract attitude and can function in thought and language only at the concrete level.

Later investigators have demonstrated that schizophrenics are not abnormally concrete. They showed that schizophrenics are capable of responding with abstract concepts, but the concepts are often unusual and idiosyncratic. The problem with schizophrenics, therefore, is not a loss of the abstract attitude but a tendency to use concepts that are deviant and difficult to understand. One way of interpreting these results is to assume a relative inability or reluctance to communicate with others so that deviant and idiosyncratic concepts do not undergo cognitive socialization. The schizophrenic's concepts are bizarre and unacceptable to others because these concepts are in keeping with his withdrawn and asocial environment.

Sullivan views this in terms of language problems and Cameron (1946) in terms of fantasy: "Social communication is gradually crowded out by fantasy; and fantasy itself, because of its nonparticipation in and relation to action,

becomes in turn less and less influenced by social patterns. The result is a progressive loss of organized thinking"(p.51).

Both theorists stress the social disarticulation of the schizophrenic as a major problem. This is consistent with the notion that the schizophrenic's lack of culturally acceptable knowledge about the environment and lack of differentiation between himself and others are the primary bases of his disorganized thinking processes and his inability to organize and communicate his inner experiences so that they make sense.

One speculation that follows from these theories is that the schizophrenic, in his formative years, may not have been secure enough and stimulated enough to acquire the necessary information to accommodate to and to organize his environment realistically and set up workable schemata of reality so important for logical thinking and communication. This social disarticulation--relative isolation from the social environment--affects severely his conceptual, associative, and language performance.

Theories of Schizophrenic Deficit Specific to Association

More recent theoretical approaches to deficit in schizophrenic thinking tend to emphasize the importance of attention, set, and association. Among these are the intrusion of associative responses and distractibility (Chapman, 1956, 1958), overinclusion of irrelevant

stimuli (Cameron, 1946), and associative interference and inability to maintain set and attention (Buss and Lang, 1965).

Buss and Lang, in their interference approach, regard the schizophrenic as being excessively distracted by both incidental, external stimuli and intrusive associations, as failing to maintain proper set or orientation, and as failing to alter the set when such change is appropriate.

Bleuler (1950) first pointed to association as the crucial issue in schizophrenia. He, as well as Arieti (1955) and others, have stated that a disturbance in association is the primary symptom of schizophrenic thought disorder and that "from it can be derived the majority of secondary symptoms" (Bleuler, 1955, p. 355).

The disturbance is in terms of bizarre ideas, loose associations, and irrelevant ideas. This difficulty in association affects performance in psychologically demanding tasks because the schizophrenic subject is not able to maintain a state of readiness to respond to the incoming stimuli. In addition, he is not able to react to stimuli and instructions in a normative manner on the basis of common meanings of stimuli and instructions, since primitive and irrelevant internal associations intrude into his awareness. To the extent that stimuli call forth individual,

idiosyncratic responses in the subject, he will find that his conception will not fit the environment or will not make suitable action possible. The individual needs to be able to control irrelevant distractions and must inhibit responses not only to inappropriate, external stimuli but also to extraneous thoughts and associations that may divert his attention. In view of his massive failure to control and monitor his language and thought in a normative and acceptable manner, the individual may tend toward schizophrenic-type reactions. (Sullivan, 1946)

The Relationship Between Association and Perceptual Readiness

This failure to maintain a state of readiness and accompanying maladjustment just described is explained in a somewhat different but highly pertinent context by Bruner (1957). All perceptual experience, according to Bruner, is necessarily the end product of a categorization process. This is because whatever is perceived is placed in, and achieves its meaning from, a class of percepts with which it is grouped. Also, if perception did not involve categorization into culturally acceptable classes one could not communicate or make public completely unique perceptual experience.

He further explains that adequate perceptual representation involves learning of appropriate categories. Categories vary in accessibility, or readiness, with which

stimulus input with given properties will be coded or identified in terms of category. This perceptual readiness (i.e., accessibility of categories) serves two functions: 1) minimizing the surprise value of the environment by matching category accessibility to the probability of events in the world, and 2) maximizing attainment of sought-after objects or events.

This "readiness" is a necessity for good adjustment. The failure of perceptual readiness comes about: 1) through a failure to learn appropriate categories for sorting (clumping) the environment, and 2) through a process of interference, whereby more accessible categories with wide acceptance limits serve to prevent the use of less accessible categories--but more suitable ones--for the coding of stimulus inputs. Apparently, the schizophrenic learns categories and their accompanying verbal representations that are either inadequate or that are accessible to awareness at inappropriate times. It would seem that greater perceptual readiness for environmental or internal events would be achieved if the schizophrenic acquires more adequate information of what stimuli and response events belong together.

Bruner's approach appears to fit in well with information theory (Miller, 1953) which describes how a certain amount of information reduces the number of possible outcomes in a situation. For example, if an appropriate category or

or concept were available to the schizophrenic, this information might serve to reduce the number of possible alternatives to a stimulus word. Possibly stimulus materials do not tap similar internal representations and generalizing structures in schizophrenics as in normals. Hence, the stimulus materials may be responded to on the basis of their physical characteristics or contiguous external or internal events which may impose on the schizophrenic regardless of their relevance.

The Relationship Between Association and Concept Formation

In discussing the association measure and its relation to concept formation, Rapaport (1946) states that the attitude mobilized by the instructions of the word association test probably leads to response words conceptually related to the stimulus word. Apparently, in the well-adjusted individual an attitude emerges in response to the instructions which prompts the coming to consciousness of ideas related to the stimulus in conventional-conceptual terms. Thus, not only the memory aspect of the thought process, but also its concept formation aspect may play a decisive role for the associative reaction.

A Suggested Approach to Schizophrenic Association Deficit

The intimate relationship between an attitude to associate in some conceptual way to a stimulus and the reduced frequency of idiosyncratic responses points to one approach for understanding deficit in schizophrenic

word association. Possibly, the schizophrenic patient, when confronted with the task of associating to stimulus words, is unable to assume a conceptual attitude. The schizophrenic, on the basis of his past experience, has not established the possibility of response words that bear a meaningful conceptual relationship to the stimulus words. This may be expressed by stating that the schizophrenic has not been programmed to respond to a stimulus event on the basis of its conceptual relationships or to mediate his responses by resorting to these conceptual relationships in reducing or eliminating the number of idiosyncratic associations.

The schizophrenic's inability to communicate adequately and think logically may be due to the lack of development of these conceptual and classificatory skills. The schizophrenic may not have been exposed in his early years of development to a sufficiently stimulating and secure environment to achieve adequate knowledge of the objects of the environment and their class identities. He has not learned the necessary perceptual generalizations nor the appropriate hierarchy of relations to perform the appropriate mental operations of logical thinking and to make the appropriate communication. In short, when placed in a situation which demands these logical skills, the schizophrenic does not know or have available the appropriate

and relevant classification which will give meaning to the situation. Thus, he reaches out for and uses associations and responses that are largely irrelevant, and idiosyncratic, in dealing with a situation. He does not have the appropriate superordinate category into which to place a stimulus object or event and thus to be able to relate other events of this same category with the stimulus when called upon to do so by the task.

This would seem to offer at least a partial explanation of the schizophrenic's inappropriate associations to stimulus items, of his failure to offer relevant and exclude irrelevant stimuli, and to make use of a wider array of related objects or event in his response associations.

Studies of Common-Uncommon Associations with Schizophrenics

Making use of the Kent-Rosanoff Word Association Test, several investigators have shown that schizophrenics have less common associations than normals. Kent and Rosanoff in their original article, "Associations of the Insane"(1910), tested this hypothesis, but they advanced no reason to account for their findings. Cameron (1938) found a tendency to substitute approximate but related terms for more precise ones as characteristic of schizophrenics. For example, "menu" for "meal"--he called this metonymic distortion.

Arieti (1955) found loose associations and identifications. Although normals associate related terms, schizophrenics identify and treat as equivalents things and

symbols which should only be associated. That is, what is to a normal only an associative link, becomes to a schizophrenic an identifying link. However, Eisenson, Auer, and Irwin (1963) criticize Arieti's reasoning and contend that the schizophrenic is not identifying associated words as equivalents but is not bothering or is unable to censor his associations. They believe that the schizophrenic is not using his language to communicate, or for social relations, so he does not need to monitor his words in order to be understood.

Ferreira (1960) holds a somewhat similar view and states that the schizophrenic's bizarre utterances represent his usage of a private language, an idiom arrived at through the development of a code whereby culturally accepted conjunctions between words (symbols) and things (referents) have been altered. In an effort to conceal the existence of certain referents, he mismatches symbols with referents and shuffles their relationship as well as necessary to insure the privacy and safety of a communication considered dangerous. He further theorizes that in the privacy of his language the schizophrenic finds an opportunity to say a piece of his mind about a relationship the nature of which he could not state publicly. His goal is not to communicate his thoughts because he fears to be understood.

Chapman (1958) tested the hypothesis that schizophrenic substitution of associative responses for correct responses

is due to a heightened susceptibility to associative connections as well as the hypothesis that such inappropriate substitution is due to a primary loss of ability to perform correctly. Both hypotheses were supported in that both stimulus variables were found to be related to frequency of association errors for both schizophrenics and normals. The divergence of the error scores of the two groups resulted from a greater susceptibility of the schizophrenics to each of the two independent variables (associative strength, difficulty). He concluded that some aspects of schizophrenic thinking pathology consist of exacerbations of normal response tendencies.

Meadow, Greenblat, and Solomon (1953) devised a test of "free verbalization" to measure the "looseness of association" which they correlated with various measures of impairment in abstraction (proverbs, object sorting, similarities). All but one correlated highly, indicating that looseness of association and impaired conceptualization are closely linked thought disturbances in chronic schizophrenia.

Moran (1953) found that schizophrenic associations were significantly less related to the stimulus words than the associations of normals. His results support the theories of Cameron and Goldstein concerning the nature of schizophrenic understanding and use of words. The hypothesis was that schizophrenics are less able to use words as conceptual

instruments. His ability to form verbal concepts and reason in analogies is impaired.

Johnson, Weiss, and Zelhart (1964) found that schizophrenics produced more idiosyncratic word associations than normals. Wynne (1963) found that the free associations of acute schizophrenics did not differ significantly from those of normals but when given the task to give the associations "most people do", normals gave more common associations but the former did not.

Sommer, Dewar, and Osmond (1960) used the Kent-Rosanoff in order to answer the question "is there a schizophrenic language?" and found that schizophrenics give more uncommon associations, are more variable in associations from one occasion to another, and also that their associations differ from those of other schizophrenics. In addition, they found that schizophrenics were aware of the uncommonness of their associations and they did not necessarily produce associations to their own associations instead of associating to the stimulus word.

Associational Response Hierarchies in Schizophrenia

Another way of looking at the schizophrenic's deficit in association has been in terms of arousal (Broen and Storms, 1961). In their account, arousal and Hull's habit strength are assumed to interact to give response strength. "When more than one tendency to respond is evoked in a situation,

the probability of the dominant response is an increasing function of the difference in response strengths between dominant and competing responses." (Broen and Storms, In Press) They also postulate a response strength ceiling lower than the product of maximum arousal level and maximum habit strength. Thus, if the dominant response is raised to ceiling (by the arousal level and habit strength), competing responses are facilitated because of a decrease in the relative dominance of the dominant response and an increase in the probability of competing responses.

While they feel that normal, appropriate behavior is characterized by dominance of appropriate responses, the schizophrenic is characterized by a partial collapse of appropriate hierarchical ordering of response tendencies. This is due to a higher level of arousal and lower average response strength ceilings than normals. Thus, inappropriate responses which are low in normal response hierarchies are just the kinds of incorrect responses which are increased considerably in frequency in schizophrenia. While schizophrenics may have the same dominant and competing responses as normals, they show relatively fewer dominant and more competing responses.

Specifically related to word association, the above theoretical synthesis implies less stability of responses on repeated presentation of a stimulus due to the reduction

of the relative dominance of the strongest response in schizophrenics. Storms and Broen, (1964) found acute schizophrenics to show a greater instability in their repeated associations to stimulus words than normals. The inference is made that acutes, disturbed by partial collapse of response hierarchies, will give more different associations on a single presentation of the stimulus than will normals.

The above discussion brings up several additional and interesting questions that might also be examined in the process of testing the effect of training on word association. The word association technique may be used in such a way that more than one response is elicited to each stimulus word.

It is commonly realized that the first associational response made by an individual to a stimulus word on a word association test is most likely the most adequate one, and that further responses are not only more difficult to make but are also usually more personal to the individual. That is, there should be a decreasing curve of commonness of response from the first associational response with further responses being less and less common and more idiosyncratic. From the approach developed in this paper, it might be suggested that for both normals and schizophrenics this phenomenon should take place. However, exactly how the responses should decrease in adequacy might be viewed in several different ways.

This paper's approach would suggest that normals, having been exposed to more varied stimulation and better internal matching and are more socialized than schizophrenics, would have relatively more adequate words immediately available to them in their repertoire. Thus, they would show a closer relationship between their first response and each succeeding response. That is, since they have many associations available to them at nearly the same level of commonality, their response curve would drop off less quickly (be flatter) than that of schizophrenics.

However, the schizophrenic, having never learned the proper or adequate responses in his socialization process, will have very few adequate responses that can be immediately called up. In addition, once the schizophrenic has made an associational response, further adequate associations are exceedingly difficult to make as they are just not abundant in his repertoire. Thus, his first response will clearly be his best with each response following it being sharply lower in terms of both commonality and non-personal associative quality.

This view would seem to predict quite different results than those predicted by Broen and Storms account detailed earlier. The partial collapse of hierarchies occuring in schizophrenia explanation, while holding that the hierarchical ordering of responses would not necessarily be different for

schizophrenics and normals, would contend that the probability of competing responses close to or equal that of the dominant is high. That is the second response for the schizophrenic relative to normals should be more adequate--closer to the level of normals in terms of commonality. Thus, a less steep falling off of response adequacy would be postulated in schizophrenics when compared with normals.

In short, while both views are similar in their expectations for the successive response curve for normals, the Broen and Storms account would expect a flatter curve for schizophrenics, and the view which this presentation has expounded would expect steeper curves for schizophrenics when compared to normal subjects. Stated another way, for the Broen and Storm account schizophrenics would become more similar to normals on successive responses, while for the present paper's account schizophrenics would become more dissimilar from normals on successive responses.

Studies on the Teaching of Common and Uncommon Associations

While several investigators have shown that schizophrenics have less common associations, there have been very few systematic investigations of ways to teach schizophrenics to give more common associations. Working with normals, Jenkins (1959) attempted to find out if subjects who normally make uncommon responses produce and identify common responses when instructed to do so. He found that the "popular set" conditions increases

markedly the number of popular responses. Sommer, Witney, and Osmond (1962), adapting Lindsley's methods for motivating regressed patients, attempted to condition common associations. They found that while alcoholics conditioned rapidly, schizophrenics showed very little conditioning. Maltzman, Simon, and Licht (1962) attempted to condition normal subjects to give common or uncommon associations. The subjects learned to give more common associations but did not learn to give more uncommon associations. However, the difficulty here was in reinforcing uncommon responses since they were so rare in the normal population used.

As can be seen, the results of these experiments using both normals and schizophrenics do not point in any one direction in deciding whether subjects can learn to give more common associations. However, none of these studies have attempted to teach their subjects meaningful relationships or in any way produce an organized conceptual pattern on which the subjects could build. A meaningful relationship, for example, may involve the association of a concept word with the stimulus word. Instead, the conditioning techniques merely produced a mechanical connection between the stimulus word and common association; if it even managed to do that. Klein (1958) holds that reinforcement is not necessarily needed in a cognitive-associational task. He states that "cognitive attitudes seem to be purposive without having the character of a drive and thus demanding satisfaction."

Statement of the Problem

Having discussed work done on schizophrenic deficit, its relationship to association, concept formation, response hierarchies, and training, it would seem appropriate to draw all of these related subtheories and studies together in terms of the statement of the problem. Several of the major theories of schizophrenic deficit that are specific to language can be interpreted as related to the notion of lack of verbal knowledge about the environment and the self. However, prevalent opposing views hold that the associations of schizophrenics are idiosyncratic and deviant because the schizophrenic is subject to distraction and interference. The deficit occurs because of interference by these distractions although it is maintained that the schizophrenic might do well if there were no interference.

The relationship of schizophrenic deficit to associational disturbance and subsequent intertwining with perceptual readiness (categorization), information theory, and concept formation has indicated a highly interesting approach to the problem. Are the associations of schizophrenics idiosyncratic due to inappropriate learning or their distractibility? If it is the former, would there be greater perceptual readiness as a result of teaching the appropriate categories so that the schizophrenic's associations are not more idiosyncratic than the rest of the population? The problem can then be formulated

in this way: Can the schizophrenic be trained to respond with more common and less idiosyncratic associations when given a superordinate word upon which he could establish a meaningful conceptual relationship with the stimulus word?

In order to test these questions it is necessary to design a task involving association, preferably in a language context, and to determine to what extent training is a factor. If the schizophrenic is trained to recognize a relevant attribute and associate in a more organized way, can he profit from this and give more appropriate, less idiosyncratic associations to the same and other stimuli? For the association to be meaningful to him this word used in training should belong to the same category or concept, and for this reason a superordinate of the stimulus word appears to be the most appropriate for such training.

Hypotheses

1. Prior to experimental manipulation (i.e., pre-training) poor premorbid schizophrenic subjects will have (a) less common and (b) more idiosyncratic response associations than good premorbid schizophrenic subjects who in turn will perform more poorly than normal subjects.

2. Schizophrenic subjects who are administered conceptual association training on stimulus words will give (a) more common and (b) less idiosyncratic response associations than schizophrenics receiving no training. The normal subjects will show only little, if any, effect of training.

3. Overall, there will be a hierarchy of performance among groups with the normals showing the most common and least idiosyncratic response associations and the least benefit from training; good premorbid schizophrenics showing less common and more idiosyncratic associations and more benefit from training; and the poor premorbid schizophrenics showing the least common and most idiosyncratic associations and the most benefit from training. (The commonality measure constitutes part (a) and the idiosyncratic measure part (b).)

4. There will be a hierarchy of subjects' responses with the first response being better ((a) more common, (b) less idiosyncratic) than the second; and the second, in turn, being better than the third for all groups.

5. There will be a difference between groups on responses, with the normals showing a slower rate of decrement (i.e., flatter curve of responses) than the goods, and with the poors showing the fastest rate of decrement (i.e., steepest curve) from response one to response two to response three. (The commonality measure constitutes part (a) and the idiosyncratic measure part (b).)

Method

Subjects

The subjects consisted of 20 good premorbid and 20 poor premorbid nonparanoid schizophrenics selected from the Northampton Veterans Administration Hospital, and 20 non-hospitalized normal subjects. There were thus three groups of 20 subjects each, making a total of 60 subjects. Each of the three groups were further subdivided equally into "training" and "no-training" subgroups; all subjects being randomly assigned to one or the other subgroup.

The premorbid histories of the schizophrenic subjects were judged by the examiner on the basis of the Phillips Scale (Phillips, 1953). All schizophrenics diagnosed as paranoid or showing significant paranoid features in their case histories were excluded from the study.

Many studies have shown that, as a group, schizophrenics are more variable than normals and that they are not an especially homogeneous population. Several dichotomizations exist such as acute-chronic, reactive-process, good-poor premorbid, and paranoid-nonparanoid. Though these probably overlap to a great extent, it has been suggested by several investigators that the paranoid-nonparanoid dichotomy should be studied more carefully. Further, a definite need exists for studies relating the degree of social and personal withdrawl to deficit behavior, thought, and language in schizophrenics.

Paranoids have been found to show less thought disorder and deterioration over time than have schizophrenics of other subgroups (Payne and Hewlitt, 1960). Johannsen, et. al. (1963) studied correlations between different measures used to describe schizophrenics. High correlations were found among placement on process-reactive, acute-chronic, and good premorbid-poor premorbid scales. Only the paranoid-nonparanoid dimension appeared to be an independent dimension. Buss and Lang (1965) make a special point of indicating that "future investigators must consider paranoid symptoms in selecting experimental samples."

It is as a result of these experimenters' suggestions that it was decided to distinguish the paranoid subjects from the schizophrenic groups while still retaining the good-poor premorbid dichotomy of the Phillips Scale so that their relation to the degree of deficit could be investigated.

Phillips Scale

The Phillips Scale of Premorbid Adjustment provides for ratings in five areas of pre-psychotic life and allows separation of schizophrenics into groups based upon the adequacy of premorbid adjustment. Under each area heading are descriptive statements of various possible levels of adjustment. Scores from zero to six are assigned according to the particular level of adjustment on each criterion, as assessed from the patient's case history. Thus, a total

score of 30 is the maximum that can be obtained. Good premorbids are defined for purposes of this study as those schizophrenics rated between 0 and 12 points, and poor premorbids as those between 18 and 30 points. This allows for less overlap of the two groups than the often used arbitrary division at 15, and thus results in more distinct groups.

Several studies have found that premorbid adjustment is a relevant variable in schizophrenic conceptual behavior. For example, Goldstein (1963) found that pronounced pre-psychotic social inadequacy is directly correlated with inferior conceptual performance. He states that this supports the contention that "as the person becomes increasingly isolated from his community the less will he be able to conceptualize and communicate in conventional terms."

In addition, researchers, including Rodnick and Garmezy (1957), Hellman and Kates (1961), Moriarty and Kates (1962), Buck and Kates (1963), and Phillips (1953), have reported adequate reliability in the use of the Phillips Scale. As an additional reliability check, two independent raters also determined the premorbidity of two random samples of records specific to the schizophrenics in this study. Complete agreement was found among all the raters.

Matching

The criteria used in the selection of schizophrenic patients were as follows: 1) cooperative, attentive males

who were able to understand and conform to the instructions, 2) between the ages of 21 and 60, 3) without other known complicating pathology (e.g., organicity, mental retardation, alcoholism), 4) no lobotomy or ECT within the last six months.

The selection of normal subjects was based on the following criteria: 1) cooperative, attentive males able to understand and conform to the instructions, 2) between the ages of 21 and 60, 3) no severe or disabling emotional disturbance or alcoholism, 4) making an adequate and stable adjustment to the community.

In addition to these limitations in selecting subjects, the three groups were matched on the basis of 1) age, 2) I.Q. (standard scores derived from the Information and Vocabulary subtests of the WAIS), and 3) educational level.

Analysis of Variance shows no significant differences among any of the six subgroups for any of the three matching criteria. Table 1 presents a comparison of the means, standard deviations, and F ratios of the various subgroups for age, I.Q., and education.

Test Materials

Twenty-four words from the Kent-Rosanoff Word Association list were used (See Appendix A). These were chosen on the basis of amenability to a superordinate conceptual association word. That is, those 24 stimulus words from the list

Table 1

Means, Standard Deviations, and F ratios for Matching Criteria

Criteria	Group						F
	Normals		Good Premorbid		Poor Premorbid		
	T*	NT**	T	NT	T	NT	
Age							
Mean	43.8	43.9	44.2	44.7	44.3	43.7	0.02
S. D.	7.6	10.9	9.3	5.8	6.8	7.7	
Education							
Mean	11.3	10.9	10.5	10.7	11.1	11.3	0.16
S. D.	1.7	1.8	2.6	3.2	3.0	2.9	
I. Q.							
Mean	23.2	21.0	20.2	22.0	21.5	23.3	1.36
S. D.	4.4	1.9	1.6	4.2	3.0	3.9	

* T= Training subgroup

** NT= No-training subgroup

to which a suitable superordinate word may be arrived at were chosen for use as the stimulus words in the present study. (See Appendix B for the list of stimulus words and superordinates used.)

Each of the stimulus words were typed in Pica Capitals and centered on plain white three by five cards. For the training procedure, the card following the stimulus word card had both the stimulus word and appropriate superordinate word separated by a dash centered on the card. This superordinate training card was attached to its stimulus card by one taped edge. Thus, the two cards remain together when shuffled and are flipped up to expose the superordinate during training trials.

The Word Association Technique

A comparatively objective instrument for measuring word association is the method originally used by Francis Galton in 1879 and later modified by other researchers. Wundt (1911) experimented with it to study the association process and Kraeplin (1892) adapted it for use in a study on the nature of abnormal behavior. In 1906, Jung applied it to the study of complexes. Thus, Jung's list contained 100 words specifically chosen to sample common or frequent areas of emotional disturbances. This is true of many lists which are designed for specific purposes. The Kent-Rosanoff list of 100 words, on the other hand, was designed to avoid emotionally loaded stimuli (Anderson and Anderson, 1951).

Several sets of norms exist, including those of Kent and Rosanoff (1927) on 1,000 normals and 247 psychotic patients. Other sets were compiled by O'Conner (1928), Jenkins and Russell (1960), and Russell and Jenkins (1954). The latter investigators find that the 1927 K-R norms are very similar to their own except that the popular responses have become even more popular. Dorken (1956) believes that "this is a test whose norms have 'improved' over a 55-year period!" Sommer, et. al. (1960) go so far as to lament the premature "burial" of the word association test in view of its promise and contribution to psychiatry, to assert that its absence is conspicuous from recent books and articles, and to refer to it as "an instrument par excellence for studying language in schizophrenia."

It was partly due to its usefulness in evaluating the language behavior of schizophrenics that the K-R word association test has been selected as a means of exploring the theoretical approach of this investigation.

Selection of the Superordinate Words

The reasoning behind and theories supporting the choice of superordinate words as the basis of meaningful associational connections have been previously been discussed in earlier parts of this paper.

The behavioral definition of Jenkins and Russell (1960) for superordinate responses to Kent-Rosanoff words was employed. These investigators obtained superordinate

responses for many of the Kent-Rosanoff words by having subjects complete the following sentence for each of the 100 words: "_____ is a member of the class _____." Each sentence began with a K-R word. The most popular superordinates were paired with the 24 selected stimulus words in the training procedure.

Procedure

Each subject was individually tested. Following the administration of the WAIS Information and Vocabulary subtests, the subject was given the following instructions:

> I am going to show you some words one at a time, and I want you to give me the first four words that come to your mind.

Each of the 24 cards (previously randomized by shuffling) was exposed to the subject one at a time, and the subject's responses were recorded on the data sheet by the examiner. The first administration of the 24 K-R words yields a pre-training estimate of the association responses for the training group and an initial estimate of the association responses for the no-training group.

Following the administration of the 24 K-R words, each subject in the training group was trained on the superordinate association chosen for each of the words. These 24 stimulus words paired with its superordinate conceptual training word were divided into three lists of eight words each. The three lists were counterbalanced in their presentation to the subject

so that the first subject received the lists in the order A, B, C, the next in the order B, C, A, etc. All possible permutations of orders were given. In addition, the words in each of the three lists were randomized. (See Appendix B for the three lists used)

The subjects in the training group received the following instructions:

> This time when I show you these words I want you to give me only one word that comes to your mind. Then I will show you a word that I think goes with it. Your word may be a very good one, but I would like you to learn my word. Try to learn the word I have chosen for each of the following cards, okay?

The training words were given to each subject in the following manner:

1) The first stimulus word card was exposed.

2) The subject responded to the card, no responses were recorded.

3) A card with both the stimulus word and its superordinate training word printed on it was exposed.

4) These steps were repeated until all eight superordinate words of the list were learned to the criteria of two successive correct trials. If a subject was not able to respond with the correct superordinates on two successive attempts within ten trials he was eliminated from the experiment.

5) After the subject had learned one list of eight words, he was given the test trial (post-training). This trial

involved having the subject give four associations to each of the eight stimulus words on which he had been trained. He was given the following instructions:

> This time I would again like you to give me the first four words that come to your mind when I show you the words on these cards one at a time. Any four words that you think of will do.

6) Following the test trial, the training procedure was repeated with the next list of eight words until all three lists and its accompanying test trial had been completed.

Each subject in the no-training group was administered the 24 stimulus words and asked to give an association response to each of these words. The exposure time for each word and number of exposures of each list was the same as the training group. The instructions for the no-training group were as follows:

> This time when I show you these words I want you to give me only one word that comes to your mind. We will go through the words a few times; just give me the first word that comes to your mind each time.

Thus, the procedure was identical with that for the training group except that the superordinate conceptual words were not supplied for the no-training group subjects. These steps ensured equivalent familiarity with the 24 stimulus words in both the training and no-training groups.

The research design is presented in Table 2.

Scoring

The response measure used was frequency of the response in a thousand according to the Russell and Jenkins (1954)

Table 2

Research Design

Groups	Training	Parts: I (pre-training) Response 1	I Response 2	I Response 3	II (post-training) Response 1	II Response 2	II Response 3
Normals	T Ss 1-10						
	NT Ss 11-20						
Good Premorbids	T Ss 21-30						
	NT Ss 31-40						
Poor Premorbids	T Ss 41-50						
	NT Ss 51-60						

norms for the Kent-Rosanoff words. Each response word given by the subject that was used was assigned the response frequency which it is given in the word association norms. For part I (pre-training) the first three response words given by the subject were scored. For part II (post-training) the first three responses, excluding the superordinate word if given, were scored. For example, if the superordinate is given as an association in the second response, only responses one, three, and four were scored. If the superordinate happened to have been given before training, it was scored on both part I and part II.

For the analysis of commonality of response the normative frequency of each response word was the measure used for scoring. The frequency totals for the first, second and third response on both pre- and post-training were obtained and analyzed as well as the total frequency over responses for pre-training and total frequency for post-training.

Another important way of looking at the responses to stimulus words is in terms of "individual reactions" which in this study was defined as responses not on the norms (i.e., those having a frequency of zero). This method emphasizes the idiosyncratic nature of the subject's responses and makes it possible to compare the data in absolute, rather than degree, terms. Thus, total number of idiosyncratic (zero score) associations for each of the three responses both pre- and post-training was used in the idiosyncratic analyses.

While it is realized that a response word given may not be in the norms and yet be conceptually related in some way to the stimulus word, it is beyond the scope of this study to make these sorts of judgments or gather norms for this specific purpose. For--as the same problem is handled in psychological testing--although a particular subject's response may actually be better than that given as the answer, he must be evaluated in terms of the test criteria and its specified answers.

Results

The first hypothesis, part (a), was not supported by the results of the analysis of variance for the data. Groups did not differ significantly in commonality of their response associations prior to the training procedure (Tables 3 and 4).

However, as can be seen in Figure 1, the three groups were arranged in the hierarchical order predicted. The mean frequency of the normal group was above that of the good premorbid group, and the good premorbid above that of the poor premorbid group in part one (pre-training). The chances of getting this combination of groups is 1/6. That is, one would expect this arrangement of groups only one out of every six times ($1/n! = 1/3! = 1/6$).

It should be noted that even though no significant difference is obtained between training and no-training subgroups, the training and no-training subgroups of both the normal and the poor premorbid groups show considerable difference (Figure 2).

Part (b) of the first hypothesis was also not supported. The three groups do not differ significantly on number of idiosyncratic response associations (Tables 5 and 6). Again, however, the data show the expected direction which in this case shows the number of idiosyncratic responses to be lower for the good and poor premorbid groups which are almost equal (Figure 3).

Table 3

Analysis of Variance for Commonality Scores (pre-training)

Source	df	SS	MS	F
Total	179	484806748		
Between	59	48478998		
G (Groups)	2	3323100	1661550	2.17
T (Training)	1	116230	116230	.15
G X T	2	3654287	1827143	2.38
S / G X T	54	41385381	766395	
Within	120	436327750		
R (Responses)	2	303403219	151701609	238.20***
G X R	4	345057	86264	.14
T X R	2	2424633	1207316	1.89
G X T X R	4	1388074	347018	.54
S X R/G X T	108	68776766	636821	

*** $p < .001$

Table 4

Means and Standard Deviations for Commonality Scores (pre-training)

Group	Training		Response 1	Response 2	Response 3	Part I Total
Normals	T	Mean	4084	1635	1065	6784
		S.D.	1271	634	410	1391
	NT	Mean	3881	1259	758	5898
		S.D.	1244	458	488	1335
	Both	Mean	3982	1447	911	6341
		S.D.	1228	571	466	1402
Good Premorbids	T	Mean	3664	1325	828	5816
		S.D.	1130	755	647	1741
	NT	Mean	3941	1201	811	5953
		S.D.	1304	470	501	1482
	Both	Mean	3802	1263	819	5884
		S.D.	1196	615	563	1575
Poor Premorbids	T	Mean	2986	1077	678	4740
		S.D.	778	578	430	983
	NT	Mean	4047	1215	686	5947
		S.D.	1349	646	509	1971
	Both	Mean	3516	1146	682	5344
		S.D.	1202	601	459	1638

Table 4 (continued)

Group	Training		Response 1	Response 2	Response 3	Part I total
All Groups	T	Mean	3578	1346	857	5780
		S.D.	1139	678	515	1600
	NT	Mean	3956	1225	751	5934
		S.D.	1256	513	485	1562
	Both	Mean	3767	1285	804	5856
		S.D.	1204	599	499	1570

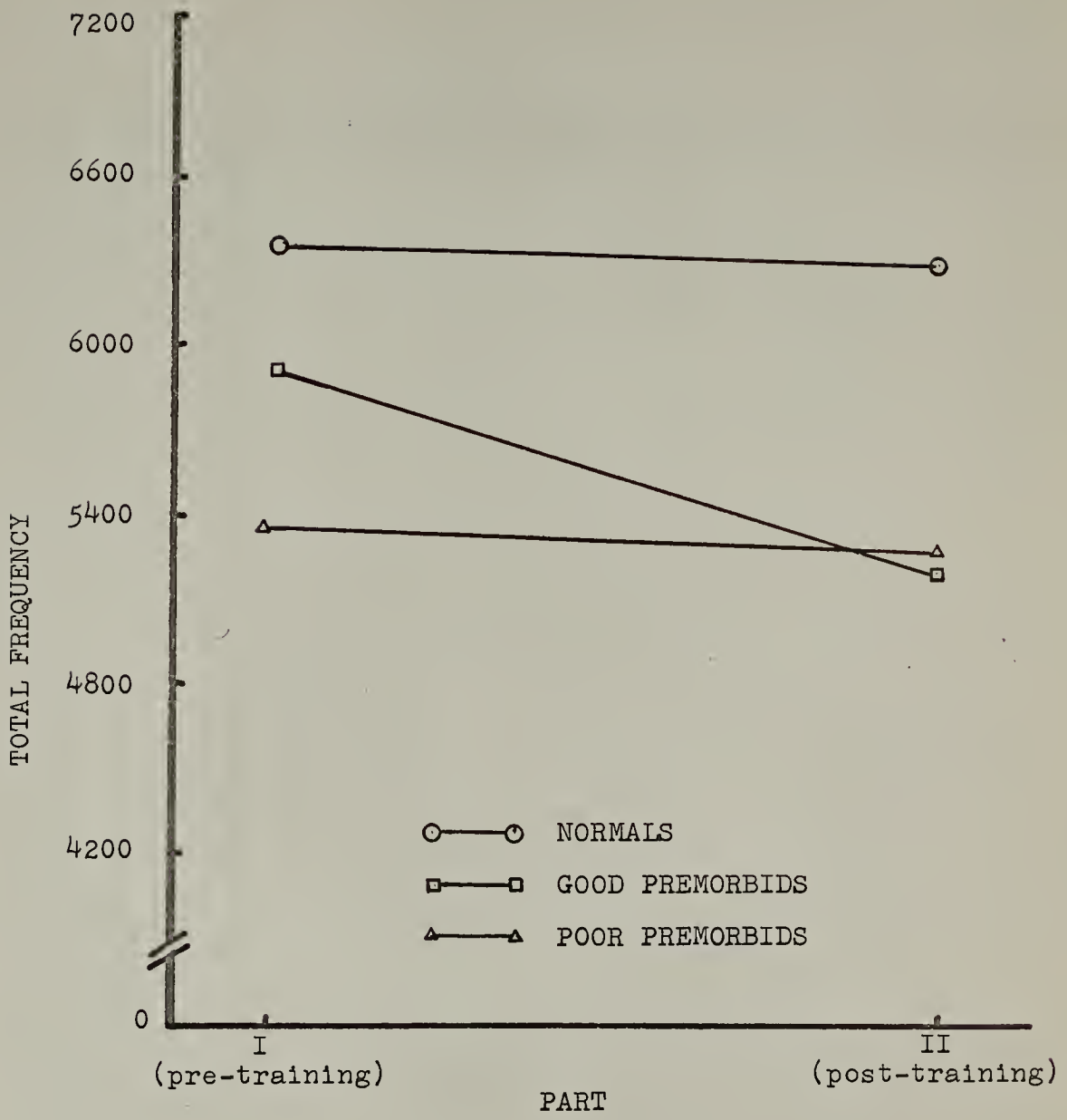

Figure 1. Performance of Groups on Commonality Measure.

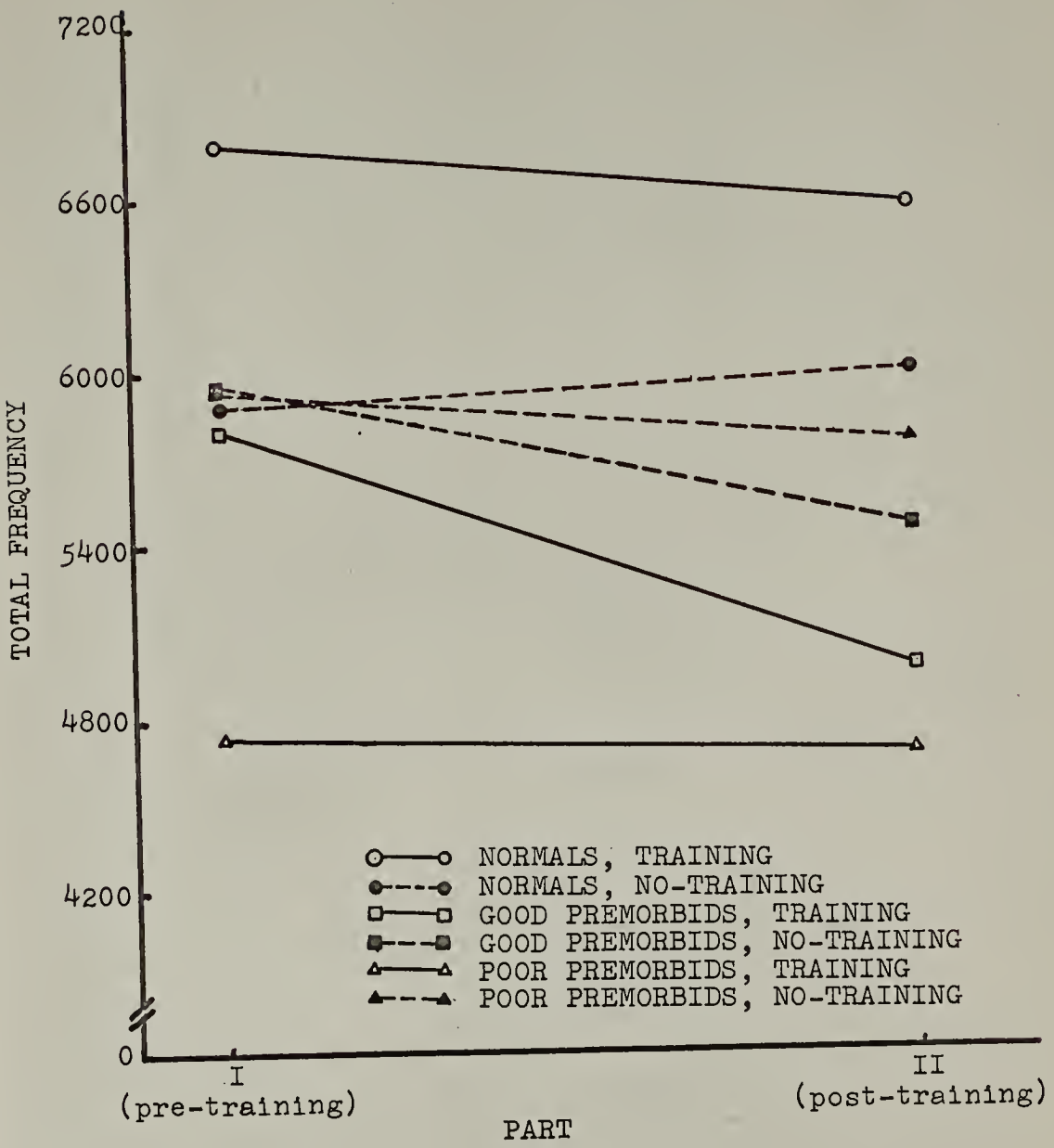

Figure 2. Performance of Subgroups on Commonality Measure.

Table 5

Analysis of Variance for Idiosyncratic Scores (pre-training)

Source	df	SS	MS	F
Total	179	3331.91		
Between	59	1189.90		
G (Groups)	2	29.54	14.77	.78
T (Training)	1	7.20	7.20	.38
G X T	2	130.43	65.21	3.44*
S / G X T	54	1022.73	18.93	
Within	120	2142.01		
R (Responses)	2	1572.04	786.02	179.86***
G X R	4	35.92	8.98	2.05
T X R	2	16.53	8.27	1.89
G X T X R	4	44.63	11.16	2.55*
S X R/G X T	108	472.87	4.37	

* $p < .05$

** $p < .001$

Table 6

Means and Standard Deviations for Idiosyncratic Scores (pre-training)

Group	Training		Response 1	Response 2	Response 3	Part I total
Normals	T	Mean	2.6	5.8	8.8	17.2
		S.D.	2.4	2.4	3.0	7.0
	NT	Mean	3.6	7.4	10.5	21.5
		S.D.	2.0	3.4	2.7	4.9
	Both	Mean	3.1	6.6	9.6	19.4
		S.D.	2.2	3.0	2.9	6.3
Good Premorbids	T	Mean	2.7	8.3	8.2	19.2
		S.D.	1.7	3.3	3.1	6.7
	NT	Mean	3.0	9.3	12.2	24.5
		S.D.	3.5	3.2	4.1	9.6
	Both	Mean	2.8	8.8	10.2	21.8
		S.D.	2.7	3.2	4.1	8.5
Poor Premorbids	T	Mean	3.6	9.5	11.9	25.0
		S.D.	2.3	3.5	3.3	7.6
	NT	Mean	3.1	6.1	9.8	19.0
		S.D.	2.4	3.1	3.9	8.5
	Both	Mean	3.4	7.8	10.8	22.0
		S.D.	2.3	3.7	3.7	8.4

Table 6 (continued)

Group	Training		Response 1	Response 2	Response 3	Part I total
All Groups	T	Mean	3.0	7.9	9.6	20.5
		S.D.	2.1	3.4	3.4	7.6
	NT	Mean	3.2	7.6	10.8	21.7
		S.D.	2.6	3.4	3.6	8.0
	Both	Mean	3.1	7.7	10.2	21.1
		S.D.	2.4	3.4	3.6	7.8

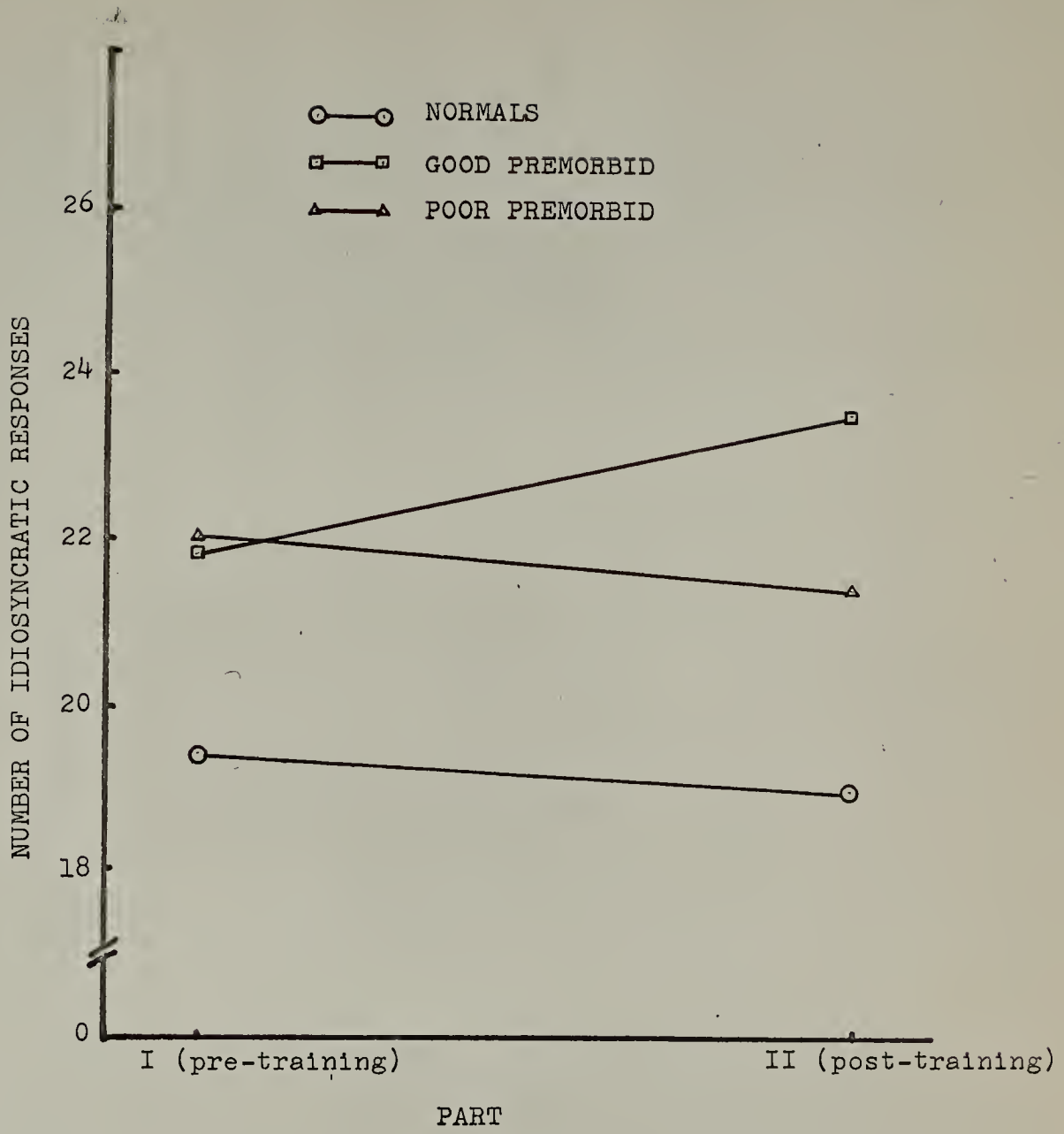

Figure 3. Performance of Groups on Idiosyncratic Measure.

The difference between training and no-training subgroups shows up significantly in the case of the idiosyncratic measure. There is a Groups by training interaction significant at the .05 level. It should be noted that the training here refers to a subgroup, not to the result of an experimental procedure as it does in the post-training analyses. Figure 4 presents the six subgroups.

The second hypothesis, part (a) and (b), was not supported by the data. There were no significant differences between the training and no-training subgroups on either commonality (Tables 7 and 8) or number of idiosyncratic associations (Tables 9 and 10) after the training procedure. In fact, the very low F ratios obtained for the training main effect (F (commonality) = .51, F (idiosyncratic) = .19) would indicate that not only were the differences between the effect of training and no-training not significant, they were negligible. In addition, no significant differences exist among groups as a function of training.

The inferences that can be drawn from these results are confounded by the fact that the training and no-training subgroups were not equal in performance before the training procedure (Figures 2 and 4). The third hypothesis, therefore, will indicate the effect of training, since it will take into account the differences over Parts I and II.

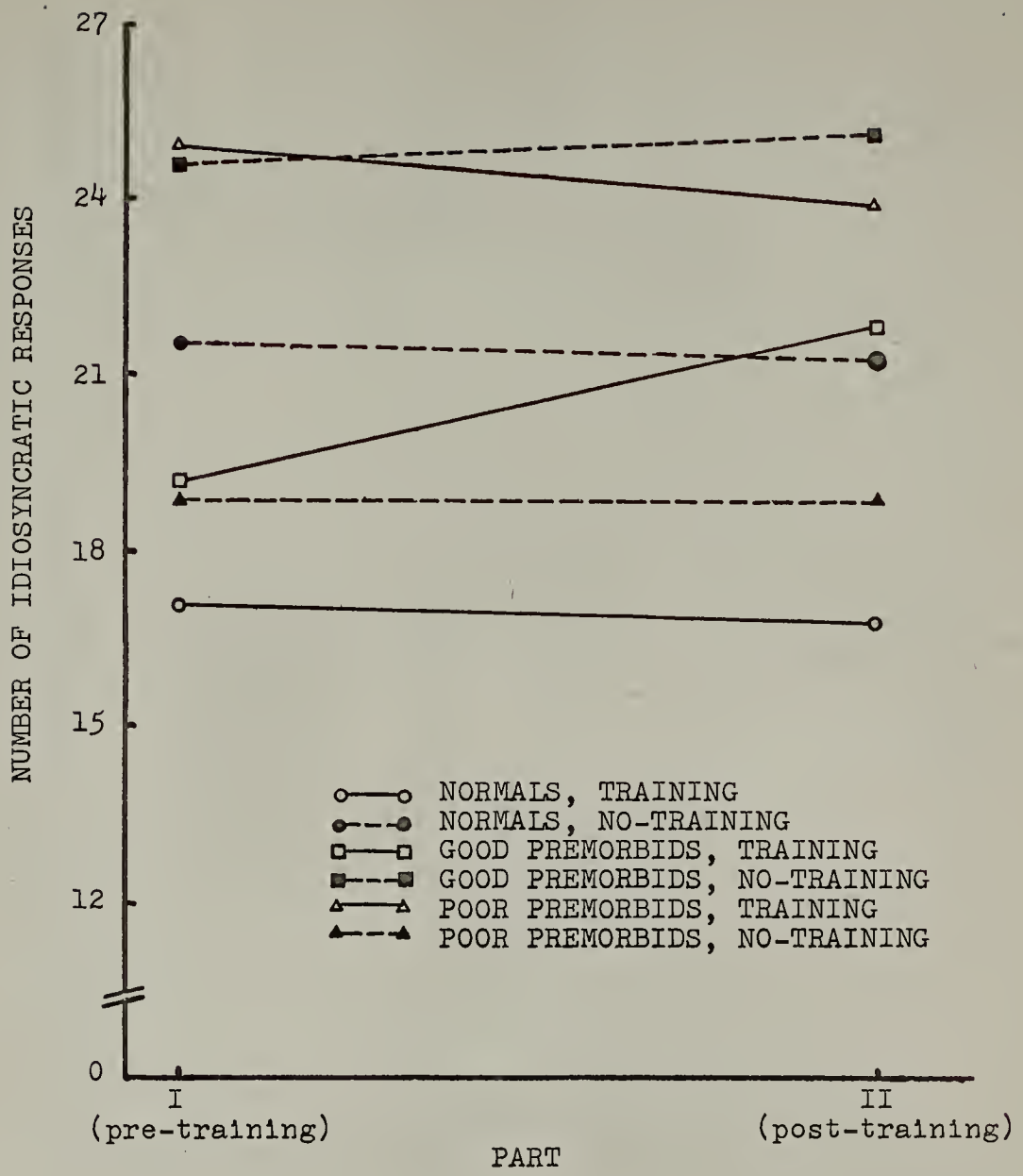

Figure 4. Performance of Subgroups on Idiosyncratic Measure.

Table 7

Analysis of Variance for Commonality Scores (post-training)

Source	df	SS	MS	F
Total	179	392299884		
Between	59	63244731		
G (Groups)	2	5179833	2589926	2.53
T (Training)	1	520892	520892	.51
G X T	2	2343792	1171896	1.15
S / G X T	54	55200214	1022226	
Within	120	329055153		
R (Responses)	2	221835373	110917686	120.90***
G X R	4	5771037	1442759	1.57
T X R	2	31869	15934	.01
G X T X R	4	5334140	1333535	1.45
S X R/G X T	108	99082734	917433	

*** $p < .001$

Table 8

Means and Standard Deviations for Commonality Scores (post-training)

Group	Training		Response 1	Response 2	Response 3	Part II total
Normals	T	Mean	4362	1437	791	6590
		S.D.	1720	444	431	1788
	NT	Mean	3595	1493	921	6010
		S.D.	1603	481	499	1726
	Both	Mean	3978	1465	856	6300
		S.D.	1665	452	458	1736
Good Premorbids	T	Mean	3058	1171	750	4979
		S.D.	1305	708	378	1633
	NT	Mean	3295	1389	766	5451
		S.D.	1533	751	418	1698
	Both	Mean	3177	1280	758	5215
		S.D.	1391	719	388	1640
Poor Premorbids	T	Mean	2544	1400	743	4688
		S.D.	719	710	496	1263
	NT	Mean	3506	1418	840	5764
		S.D.	1708	624	637	2020
	Both	Mean	3026	1409	791	5226
		S.D.	1368	651	558	1730

Table 8 (continued)

Group	Training		Response 1	Response 2	Response 3	Part II total
All Groups	T	Mean	3322	1336	761	5419
		S.D.	1487	623	423	1743
	NT	Mean	3466	1434	842	5742
		S.D.	1565	608	511	1772
	Both	Mean	3394	1385	802	5580
		S.D.	1515	612	467	1751

Table 9

Analysis of Variance for Idiosyncratic Scores (post-training)

Source	df	SS	MS	F
Total	179	3016.99		
Between	59	1422.99		
G (Groups)	2	66.08	33.04	1.41
T (Training)	1	4.67	4.67	.19
G X T	2	90.01	45.00	1.92
S / G X T	54	1262.23	23.38	
Within	120	1594.00		
R (Responses)	2	1034.14	517.07	107.49***
G X R	4	9.02	2.26	.47
T X R	2	7.08	3.54	.74
G X T X R	4	24.49	6.12	1.27
S X R/G X T	108	519.26	4.81	

*** $p < .001$

Table 10

Means and Standard Deviations for Idiosyncratic Scores (post-training)

Groups	Training		Response 1	Response 2	Response 3	Part II total
Normals	T	Mean	2.2	5.4	9.2	16.8
		S.D.	1.7	3.0	3.3	6.8
	NT	Mean	4.2	7.9	9.2	21.3
		S.D.	1.7	3.2	2.8	6.9
	Both	Mean	3.2	6.6	9.2	19.0
		S.D.	1.9	3.3	3.0	7.0
Good Premorbids	T	Mean	4.6	8.0	9.2	21.8
		S.D.	2.5	2.9	3.2	6.7
	NT	Mean	4.9	9.3	11.0	25.2
		S.D.	3.5	4.6	4.3	10.7
	Both	Mean	4.8	8.6	10.1	23.5
		S.D.	3.0	3.8	3.8	8.8
Poor Premorbids	T	Mean	4.3	8.3	11.3	23.9
		S.D.	2.4	4.9	3.3	8.8
	NT	Mean	3.6	6.5	8.8	18.9
		S.D.	3.5	3.1	3.6	9.5
	Both	Mean	4.0	7.4	10.0	21.4
		S.D.	2.9	4.1	3.6	9.3

Table 10 (continued)

Groups	Training		Response 1	Response 2	Response 3	Part II total
All Groups	T	Mean	3.7	7.2	9.9	20.8
		S.D.	2.4	3.8	3.3	7.8
	NT	Mean	4.2	7.9	9.7	21.8
		S.D.	2.9	3.8	3.6	9.2
	Both	Mean	4.0	7.6	9.8	21.3
		S.D.	2.7	3.8	3.5	8.5

The third hypothesis, part (a), was also not confirmed. While there is a significant overall difference (at the .05 level) between Parts (pre-and post-training), this difference is in the opposite direction from that expected as a result of training (Table 11). Instead, there is a general decrease in commonality of response from pre- to post-training. As can be seen in Figure 5, both trained and non-trained subjects of all groups showed a lowering of performance, with the trained groups actually showing the greatest decrease. From Figure 2 it can be seen that for the schizophrenic groups training did not improve commonality of associations as hypothesized, but instead was accompanied by a lowered performance after training. The good premorbid schizophrenic group showed the greatest decrease from pre- to post-training, with the training subgroup decreasing more than the no-training subgroup. The poor premorbid schizophrenic group showed much less of a decrease from pre- to post-training.

For the idiosyncratic measure, hypothesis 3 (b), somewhat different results were obtained. There was no significant difference found between pre- and post-training, nor any significant interaction with groups or training (Table 12). Figure 6 shows parallel findings for both training and no-training subgroups, with an almost equal, though slightly lowered, performance from pre- to post-training.

Examination of Figure 4 reveals a very slight decrease in number of idiosyncratic associations from Part I to Part II

Table 11

Analysis of Variance for Combined Commonality Scores (pre- and post-training)

Source	df	SS	MS	F
Total	359	817869588		
Between	59	99435616		
G (Groups)	2	7718157	3859078	2.44
T (Training)	1	564616	564616	.35
G X T	2	5884554	2942277	1.86
S / G X T	54	85268289	1579042	
Within	300	718434072		
P (Parts)	1	762956	762956	4.95*
G X P	2	784776	392388	2.54
T X P	1	72505	72505	.47
G X T X P	2	113524	56762	.36
S X P/G X T	54	8317305	154024	
R (Responses)	2	521519935	260759967	1653.60***
G X R	4	4171046	1042761	6.61***
T X R	2	1489948	744974	4.72*
G X T X R	4	5747996	1436999	9.11***
S X R/G X T	108	16030837	157692	
R X P	2	3718656	1859328	3.87*
G X R X P	4	1945048	486262	1.01
T X R X P	2	956553	478276	.99
G X T X R X P	4	974217	243554	.50
S X P X R/G X T	108	51828664	479895	

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

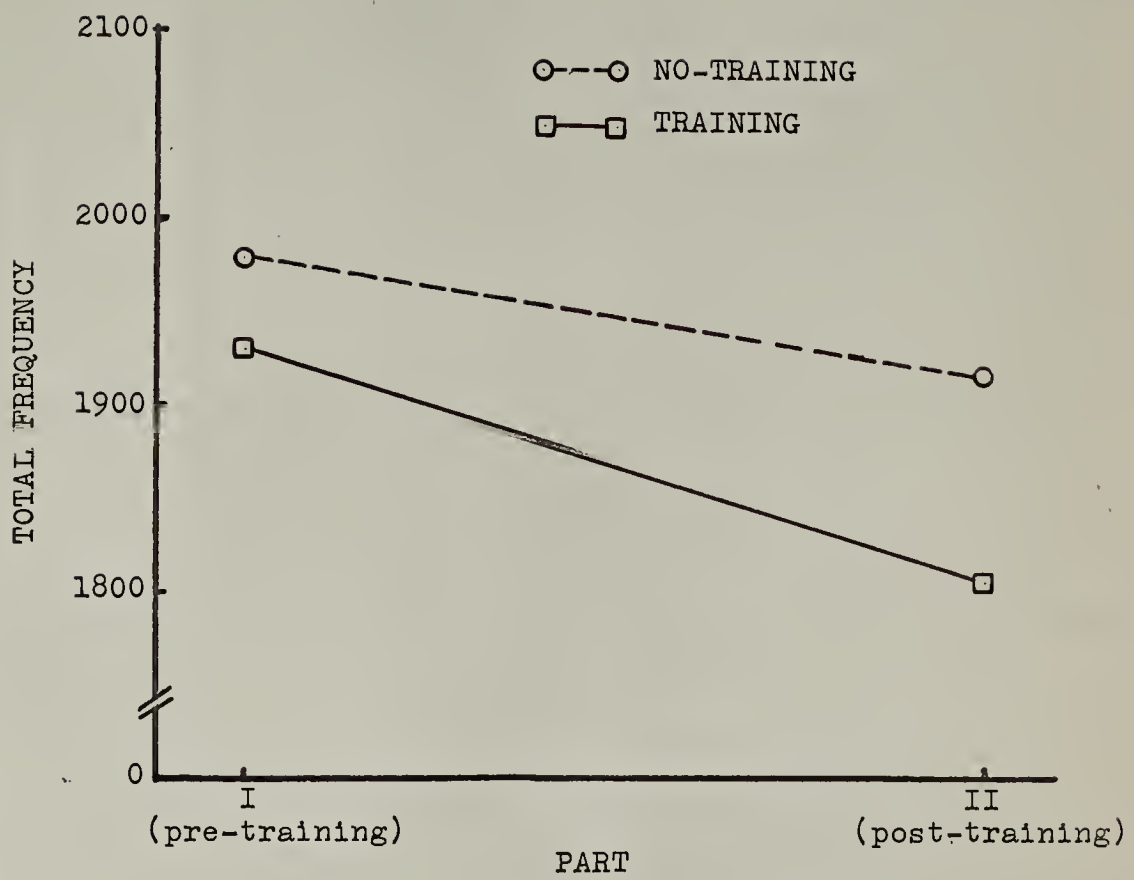

Figure 5. Performance of Training vs. No-training Subgroups on Commonality Measure.

Table 12

Analysis of Variance for Combined Idiosyncratic Scores (pre- and post-training)

Source	df	SS	MS	F
Total	359	6349.53		
Between	59	2371.71		
G (Groups)	2	85.67	42.84	1.12
T (Training)	1	11.74	11.74	.30
G X T	2	216.71	108.35	2.84
S / G X T	54	2057.59	38.10	
Within	300	3977.82		
P (Parts)	1	.62	.62	.14
G X P	2	9.95	4.98	1.16
T X P	1	.14	.14	.03
G X T X P	2	3.74	1.87	.43
S X P/G X T	54	230.37	4.26	
R (Responses)	2	2577.37	1288.69	250.71***
G X R	4	34.16	8.54	1.66
T X R	2	1.27	.63	.12
G X T X R	4	64.36	16.09	3.13*
S X R/G X T	108	555.17	5.14	
R X P	2	28.82	14.41	3.56*
G X R X P	4	10.78	2.70	.66
T X R X P	2	22.34	11.17	2.76
G X T X R X P	4	4.76	1.19	.29
S X P X R/G X T	108	436.96	4.04	

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

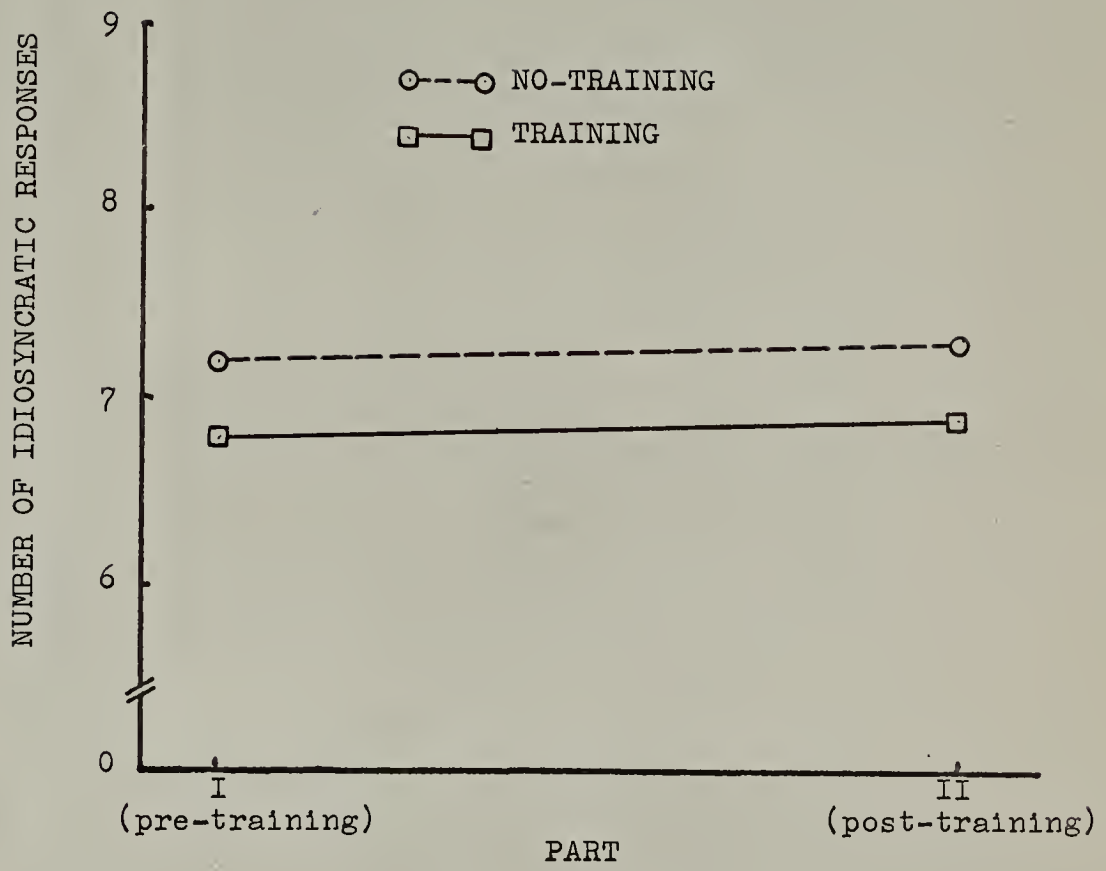

Figure 6. Performance of Training vs. No-training Subgroups on Idiosyncratic Measure.

for all groups with the exception of the good premorbids. Both training and no-training subgroups of the good premorbid group increased in number of idiosyncratic responses with the training group showing the greatest increase. Again, while these differences are not significant, the patterning of the data is presented in Figures 3, 4 and 6 for the idiosyncratic measure.

The fourth hypothesis, part (a) was very strongly confirmed. There were large significant differences (at greater than the .001 level) among the three responses in terms of commonality (Tables 3 and 4). This significance was also obtained after training (Table 7) and in the combined analysis (Table 11).

From Figure 7 it can be seen that the response function resembles a j-shaped distribution with the first response being highest in frequency, the second being considerably lower, and the third being even lower but not as much so. The curve is clearly not linear and shows that for all groups, the second response is much less common than the first, and the third is somewhat less common than the second.

Part (b) of the fourth hypothesis was similarly confirmed. There were significant differences (at greater than the .001 level) among the three responses in the number of idiosyncratic associations given (Table 5). Significant differences were also obtained after training (Table 9) and in the

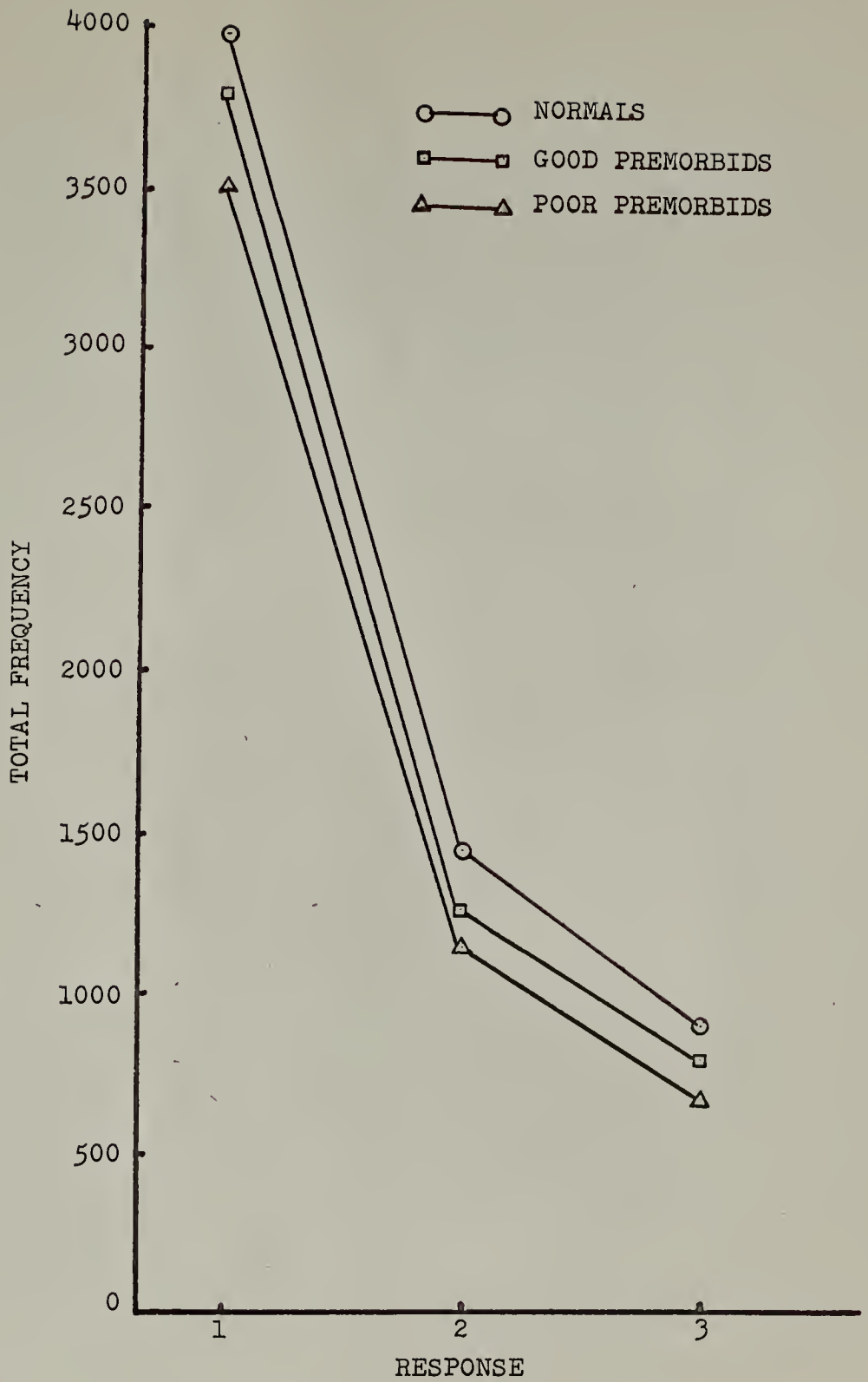

Figure 7. Performance of Groups on Commonality Measure for First Three Responses (pre-training).

combined pre- and post-training analysis (Table 12). From Figure 8 it can be seen that the first response had fewer idiosyncratic response associations than the second and the second fewer than the third response for all groups.

The fifth hypothesis, part (a), was not supported by the data. As can be seen in Tables 3 and 4, no significant differences were found among groups or training subgroups over responses. Post-training analysis also reveals no significant differences (Table 5). Figure 7 shows that the response curves are nearly parallel for all groups and do not evidence the significantly different functions hypothesized for the three groups.

In the combined pre- and post-training analysis (Table 11) groups vary as a function of responses (at the .001 level), training varies as a function of responses (at the .05 level), and groups and training interact to vary as a function of responses (at the .001 level). These results are an artifact of combining both pre- and post-training parts and may be accounted for by the significant differences in responses as a function of parts (at the .05 level).

Part (b) of the fifth hypothesis is also not supported by the data and is confounded by the effect of a significant difference between training and no-training subgroups as a function of groups at the .05 level (Table 5). There are no significant differences among responses as measured by number of idiosyncratic response associations as a function of group.

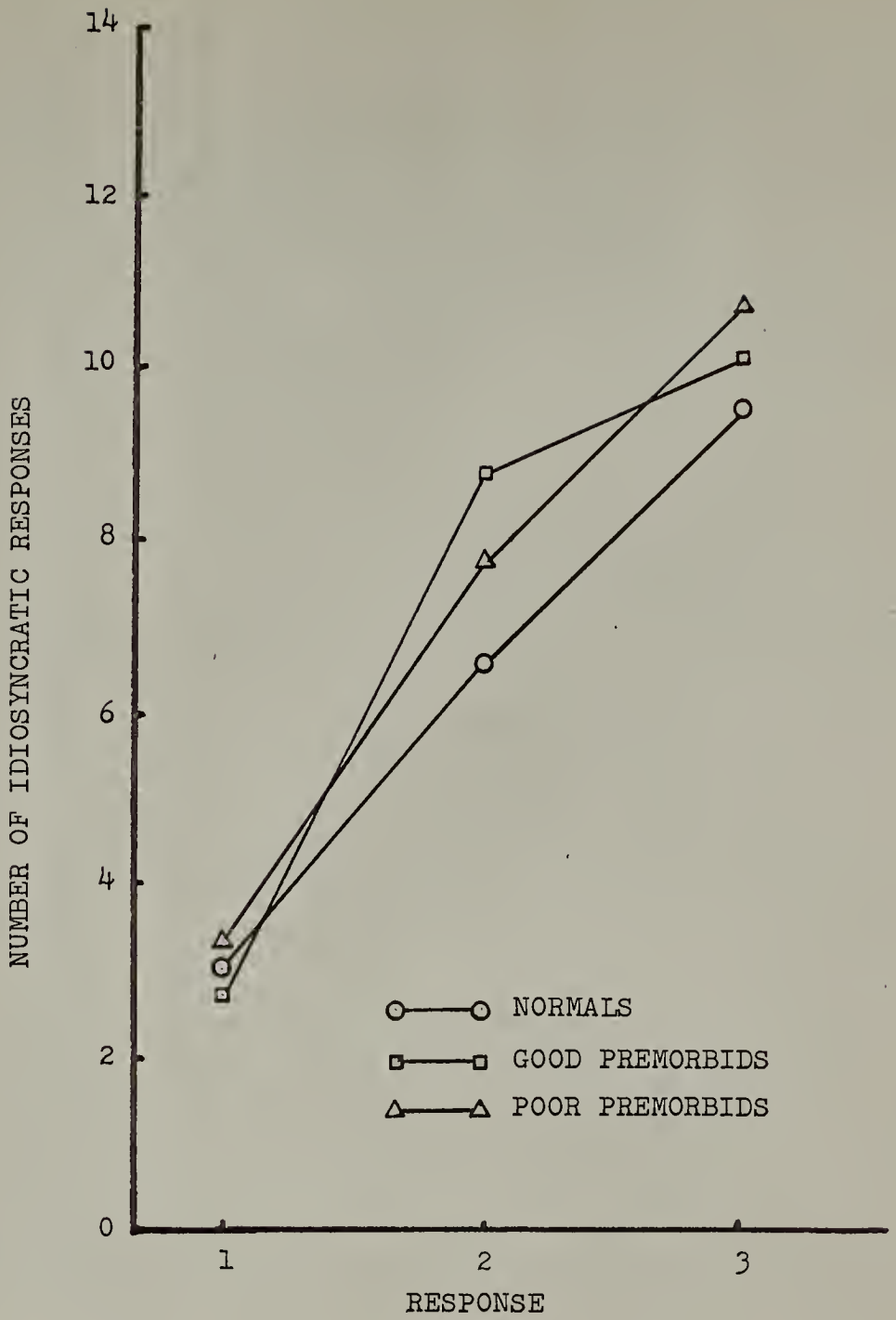

Figure 8. Performance of Groups on Idiosyncratic Measure for First Three Responses (pre-training).

Figure 8 presents the first three responses for the groups and shows that the good premorbid group differs from the normal and poor premorbid groups in that there were a greater number of idiosyncratic associations as the second response. However, the normal and poor premorbid groups' functions were closely similar. The response curves are not as consistent and as clearly parallel as in the case of the commonality measure.

There were also significant differences (at the .05 level) between groups and training as a function of responses (Table 5). This significant second order interaction of groups by training by response becomes non-significant in part II (Table 9). The significant differences among responses as a function of part (at the .05 level) indicates the reason for this difference between pre- and post-training analyses (Table 12).

Since it might be said that, by using the first three responses of each subject, this study cannot be compared with other investigations that obtained only one association to each stimulus word, an additional analysis was performed on only the first response in both pre- and post-training. While it is realized that this does not exactly replicate the "one response per stimulus word" condition, it should be an accurate estimate.

In terms of commonality (using the total frequencies of the first words given as the dependent measure), no significant

Table 13

Analysis of Variance for Commonality Scores for First Response (pre- and post-training)

Source	df	SS	MS	F
Total	119	225208661		
Between	59	181432998		
G (Groups)	2	10561832	5280916	1.80
T (Training)	1	2046241	2046241	.70
G X T	2	11195559	5597779	1.91
S / G X T	54	157629366	2919062	
Within	60	43775663		
R_1 (1st Response)	1	4185968	4185968	6.16*
G X R_1	2	2138809	1069405	1.57
T X R_1	1	411606	411606	.60
G X T X R_1	2	409046	204523	.30
S X R_1/G X T	54	36631135	678354	

* $p < .05$

Table 14

Analysis of Variance for Idiosyncratic Scores for First Response (pre- and post-training)

Source	df	SS	MS	F
Total	119	783.86		
Between	59	595.87		
G (Groups)	2	9.27	4.63	.44
T (Training)	1	4.80	4.80	.46
G X T	2	22.20	11.10	1.07
S / G X T	54	559.60	10.36	
Within	60	187.99		
R_1 (1st Response)	1	22.53	22.53	8.37**
G X R_1	2	17.27	8.63	3.20*
T X R_1	1	.53	.53	.19
G X T X R_1	2	2.07	1.03	.38
S X R_1/G X T	54	145.60	2.69	

* $p < .05$

** $p < .01$

differences were found among groups or for training and their interaction (Table 13). Significance was achieved (at the .05 level) between pre- and post-training parts. That is, the frequency of the first response on pre-training is significantly different from that of the first response on post-training. As can be seen from Tables 4 and 8, the change is in the opposite direction from that expected in that there is a decrease in commonality of response from pre- to post-training. These results are consistent with those found in the earlier analyses of all responses.

Using number of idiosyncratic associations given as the first response as the dependent measure, similar results were obtained (Table 14). No significant differences were found among groups nor its interaction with training. However, significant differences (at the .01 level) were found between the first response on pre-training and the first response on post-training which is again in keeping with the previous analyses. This difference is in the opposite direction from that expected; that is, there is an increase in number of idiosyncratic associations from pre- to post-training (Tables 6 and 10).

A second criticism might be leveled at the analyses in terms of the extreme skewness of the frequency data distribution which is a function of the scoring method used (i.e., word association norms). In order to assess the effect of

this skewness, as well as correct for its possible effect, a log transformation was performed on the frequency data. Each frequency total for each response was transformed into its logarithmic equivalent for each subject. The logarithmic transformation is applicable when the distribution of scores is markedly skewed; however, the difficulty encountered with the procedure is that the inference based on analysis of transformed data must be viewed in the context of the new log scores rather than the original data (Myers, 1966)

The analysis of variance for log frequency data is presented in Table 15. The results of this analysis show a stronger trend for the differences between groups ($F=2.73$) although it is still not significant at the .05 level. The same strong relationship remains among responses, revealing significant differences at greater than the .001 level, and a difference among responses as a function of part significant at the .01 level. All other effects were shown to be non-significant in the log frequency analysis.

Table 15

Analysis of Variance for Log Frequency Transformed Data

Source	df	SS	MS	F
Total	359	55.4676		
Between	59	7.5672		
G (Groups)	2	0.6744	0.3372	2.73
T (Training)	1	0.0078	0.0078	.06
G X T	2	0.2170	0.1084	.88
S / G X T	54	6.6680	0.1234	
Within	300	47.9004		
P (Parts)	1	0.0094	0.0094	.34
G X P	2	0.0314	0.0157	.58
T X P	1	0.0431	0.0431	1.58
G X T X P	2	0.0690	0.0345	1.26
S X P/G X T	54	1.4788	0.0273	
R (Responses)	2	31.1452	15.5726	191.31***
G X R	4	0.0405	0.0101	.12
T X R	2	0.0488	0.0244	.30
G X T X R	4	0.0499	0.0125	.15
S X R/G X T	108	8.8013	0.0814	
R X P	2	0.1554	0.0777	4.86**
G X R X P	4	0.1020	0.0255	1.59
T X R X P	2	0.0612	0.0306	1.91
G X T X R X P	4	0.1359	0.0340	2.12
S X P X R/G X T	108	1.7283	0.0160	

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

Discussion

Hypothesis One

No significant differences were obtained between groups although they were in the hypothesized hierarchical order in terms of both commonality and number of idiosyncratic associations. The fact that no significant differences were found between the normal and two schizophrenic groups would seem to indicate that the word association impairment of schizophrenics reported by previous experimentation is not as adequately shown under as wide a range of conditions as these studies have contended (e.g., Kent and Rosanoff, 1910; Sommer, Dewar, and Osmond, 1960).

The present results support those of Wynne (1963) who found that the free associations of acute schizophrenics did not differ significantly from those of normals. It is interesting also that Moran (1953), in studying word meaning distortions in schizophrenics, found that the differences from normals were not large enough to be diagnostic and noticed an extensive overlap in group performances. Johnson, Weiss, and Zelhart (1964), in studying similarities and differences between normals and psychotic subjects in response to verbal stimuli, note that beneath the apparent differences between the two groups there exists a "surprisingly substantial core of similarity." They feel that this core of similarity suggests that verbal response habits do not break down in psychosis "to as large a degree as is generally believed."

A very recent study by Dokecki, Polidoro, and Cromwell (1965) on the validity of the commonality of response construct found no differences between tuberculosis controls and good premorbid schizophrenics on both commonality of associations and stability of responses. They used words from the Kent-Rosanoff list and concluded that this finding suggests the "inadequacy of the notion of a universal deficiency in schizophrenic associational processes."(p. 312)

Many good as well as poor premorbid schizophrenics, at least in the present study's sample and using the first three associations to the stimulus words, were able to perform at very close to the level of the normal subjects in terms of both commonality of response and number of idiosyncratic associations.

One explanation for the non-significant differences among groups may lie in the matching of subjects on verbal ability. By matching on the basis of vocabulary scores large differences in the subjects' use of words may also have been reduced. In the matching of groups, the more verbal of the schizophrenics as well as the less verbal of the normal population may have been selected. It is possible that partly for this reason the sizeable group differences expected were not obtained. The reservation must be held in this explanation that, had the groups not been matched on verbal intelligence, any differences found among them could then be due to verbal differences rather than psychiatric status.

Another explanation for the non-significant differences among groups may exist in the eliciting of several rather than one response from each subject. Most other studies using the word association technique have had subjects reply with the first word that "comes to their mind" or that "they think of." The present study instructed each subject to "give me the first four words that come to your mind." (Only three words were used in the analysis, the reasons for this having been explained in the procedure section.)

The first four words instructions may give the subject a different set, one that imparts more information about the situation than the set developed by the instructions to give merely the first word one thinks of. Returning to the argument for thought as internal speech described in the introduction may provide a useful way in which to look at what might have been happening for the schizophrenic.

Rather than being able to be loose with a first association, the schizophrenic must now search for four words, not just one. This external situation (the instructions) may replace his internal situation (his own idiosyncratic tendencies to respond on the basis of irrelevant associations). For a person, who is at such a low level of attainment, it may have provided an internal criterion which he has to match and thus raised the standard or commonality of his associations. In short, by giving a set for four words the level of behavior may have been raised because the schizophrenic

now must meet a different criterion, one that may give him a more adequate standard or plan for generating response associations. The necessity to carry on a sequential operation calls forth a more discriminating plan involving the consideration of future responses.

Hypothesis Two

The second hypothesis was not confirmed. No significant differences were found between training and no-training subgroups after the training procedure. However, the post-training differences were confounded by appreciable differences between training and no-training subgroups before the actual training procedure. These subgroups optimally should have had equal means within each group since the subjects were randomly assigned. It was for this reason that a pre- and post- type of design was used as an additional control procedure to the within-group control. This allows inspection of the differences between Part I, when each subject was tested to ascertain a pre-training level of both commonality of response and number of idiosyncratic associations, and Part II, which gave a post-training measure of these same variables.

Thus, because of the pre-training differences, it will be more useful to view the results in terms of a decrease or increase in performance. This notion is handled by the third hypothesis.

Hypothesis Three

The third hypothesis was not confirmed in that the data showed a decrease in adequacy of response association in both training and no-training groups. In the case of the commonality measure there was a greater decrease for the training than the no-training subgroup. In the case of the idiosyncratic measure there was little change from pre- to post-training with both subgroups doing slightly more poorly in Part II.

This result is in direct contrast to the intent of this study in its attempt to improve the commonality of response of schizophrenic subjects. This improvement was seen to be possible by providing the schizophrenic subjects with a meaningful conceptual framework on which to base their responses. By establishing more systematic and adequate relationships between stimulus words and conceptual words, it was hoped that their associations might become more adequate.

Instead, the training procedure appeared to hinder the calling up of more common and less idiosyncratic associations. This occurred for all groups but appeared to especially hinder the good premorbid schizophrenics.

An explanation for these results brings up several possibilities. First to be considered is the effect of re-testing the subject on the same words to which he had previously been tested. One expectation could be that on the

second administration (Part II), in which the subject was asked again to give four responses to the stimulus words, he might be prone to give different associations from those which he had given on the first administration (Part I) even though he was not instructed to do so. This tendency is borne out by the finding that indeed the no-training groups decreased in level of performance from Part I to Part II.

The second consideration involves the greater decrease in commonality of response of those subjects receiving training, an occurrence most apparent in the good premorbid schizophrenic group.

If the set derived from the instructions is one which carries over from pre- to post-training, it may be that post-training is perceived as a continuation of the previous task. What this would mean is that implicit in the task is the giving of different or new associations when the stimulus word is again presented. This generalized effect to rule out words given beforehand could be understood in the sense of an inhibition of previous responses. The decrement in post-training may thus be the result of this inhibiting effect.

If the inhibiting effect in fact did exist, commonality would be expected to be inhibited more than idiosyncrasy. The only inhibiting effect of the training was a commonality inhibitor, and both schizophrenic and normal groups gave more

common than idiosyncratic responses. Extending the general inhibition effects under the instructions, there would have been the expectation of a greater decrease in commonality than idiosyncrasy of association, since the difference between training and no-training groups was that one had met more common responses (training on conceptual words). Neither had been given more idiosyncratic responses, so as great an inhibition of the idiosyncratic responses would not have been expected.

In short, these two groups do not differ on the number of idiosyncratic responses they gave in Part I, and were not given more idiosyncratic responses during training, so there should be very little difference pre- to post-training. The explanation only appears valid when considering common responses. Both groups gave many common responses, and the training group was introduced to additional common (i.e., superordinate conceptual as opposed to personal idiosyncratic) response associations, thus greater inhibition effects could be expected in the latter.

This post hoc explanation describes the trends that were observed in the data, although it must be remembered that these differences were not great enough to meet the criteria for statistical significance.

Another possible explanation for the results of the test of the third hypothesis is suggested by the interference

theory of Lang and Buss (1965). They state that the schizophrenic's idiosyncratic and deviant associations serve as distractors and make it difficult to focus on relevant and exclude irrelevant stimuli. The superordinate concept word, although learned to criterion by the schizophrenic so that he might use it to mediate more adequate responses, might actually be an additional distractor. Because the superordinate concept word may not have been grasped in its relation to the stimulus word, it could have interfered with common associations although not with idiosyncratic associations.

Since, according to Lang and Buss, the schizophrenic has difficulty in focusing on relevant stimuli, he may be taking the superordinate as irrelevant to the task at hand. If this were the case, the superordinate would not be useful for the meaning it might give to improve association, but merely becomes an irrelevant word that serves as just another distractor , hindering rather than facilitating performance. The training to criterion may have established a mechanical and relatively meaningless association between the stimulus word and its training superordinate. This training word may have disrupted the process of delivering response associations that were contiguously related because the training word competes with such related responses.

Two suggestions of possible ways of improving the procedure for training follow from the analysis presented above.

If it is true that only a mechanical connection was learned by the subject, then possibly a different type of training procedure may have offset this mechanical and interfering learning. By putting the stimulus word in a more full context with the training superordinate word, the relationship might have been more easily grasped and have resulted in more related associations. For example, "A table is a piece of furniture which has four legs" gives greater information to the schizophrenic which might help him in reorganizing his associations so that they are more meaningful.

The other suggestion involves the use of a conceptual superordinate training word to make significant changes in response associations according to the word association norms. The possibility is that meaningful responses are not the more frequent responses according to the norms. Thus, conceptual superordinate training, although it may produce more related response associations may not lead to the more frequent responses.

Hypothesis Four

Significant differences in the predicted directions were obtained among the three responses. This confirms the fourth hypothesis which predicted a hierarchy of associations in which the first response should be more common and less idiosyncratic than the second, and that the second would be better than the third.

This outcome supports theory as to the patterning of repeated associations to the same stimulus word. Rosen and Russel (1957) investigated the relation between the hierarchy of responses obtained by getting successive associations within individuals and the hierarchy of responses obtained by eliciting a single response across many individuals (cultural frequency) and concluded that cultural frequency of an association may be taken as an index of the strength of a response. That is, an individual tends to respond in successive association with the same sequence that composes cultural frequency hierarchies for single associations.

The point of considerable interest in the pattern of the response hierarchy exists more in terms of how groups differ rather than of the responses themselves. The similarity of normal and schizophrenic curves of responses is striking. This point is covered in the discussion of the fifth hypothesis.

Hypothesis Five

The fifth hypothesis, that there would be a difference among groups in terms of response curves, was not supported by the data. Since no significant differences were found among groups over levels of training, the results are equivocal as to their support of either the pattern of response hypothesized in the present investigation or that predicted by the Broen and Storms account.

The analysis of number of idiosyncratic responses was found to be more complex than analysis of commonality of response in that there were significant differences between subgroups within groups before the training procedure. The commonality measure revealed parallel response curves for the three groups. The response curves resulting from the idiosyncratic measure show less consistency and also were not significant in terms of a difference of groups over responses.

Perhaps the most prominent finding in the test of hypothesis five is not how different the groups are but how very similar they are. The normal and both schizophrenic groups show strikingly similar response curves. It would appear that one important factor influencing the results obtained lies in the matching of groups. Each subgroup, as pointed out previously, was matched on WAIS Vocabulary and Information subtests, age, and education to control for the effects of these variables in studying the effect of training. However, the predictions of hypothesis five might best have been tested with groups not equated on vocabulary. This matching reduces differences in verbal ability among groups, possibly leading to non-significant differences between the groups and responses as a function of group. It is likely that better than average schizophrenics (more similar to normals in their verbal ability) were chosen. On the other hand, such matching

was seen as vital for the investigation of the effect of training aspect in the present study. Had group differences been significant, it could only then have been said with some certainty that association and training were the attributive factors.

Implications and Suggestions for Further Research

The overall findings of the present study pose a number of interesting implications. On the training aspect, it would seem that merely having schizophrenic subjects know (i.e., learn to criterion) the conceptual bases of a stimulus word is not sufficient for bringing about noticeable change in associational response. Several possibilities exist in altering the procedure to achieve this purpose.

One possibility involves putting the conceptual word to be linked with the stimulus word in a context rather than having them linked contiguously. This might solve both the problem of immediacy of the training to the response and the matter of providing structural information so that the relationship could be easily grasped.

Another factor lies in the dependent measure. It appears that with this sort of training procedure, analysis of responses in terms of conceptual relationship rather than in terms of commonality or idiosyncrasy may provide more definite and fruitful results. A suggested procedure would be to score each response word given as to its degree of relatedness (i.e., related, somewhat related, poorly related, or not related).

A third suggestion also involves the scoring aspect and deals with the concept words themselves and their relationship to the stimulus words. It could be that further internal analysis of the raw data may reveal that some stimulus-concept word combinations promote definite increases in performance while other combinations decrease performance. These relationships should be investigated in order to understand more exactly what variables might be acting to produce altering of associations.

Other possibilities exist with the gathering of more adequate normative data on successive responding in word association for both schizophrenics and normals. Differences in conditions (e.g., motivation vs. no reward), instructions (e.g., free vs. pressure), and retesting set should be carefully investigated.

Thus, it is clear that further research should be accomplished before the effects of conceptual training are to be understood. The present study is certainly only a first step in attempting to see how schizophrenics' associations might be beneficially altered and to understand the nature of schizophrenic deficit.

Summary

The purpose of the present study was to investigate the word association responses of good and poor premorbid nonparanoid schizophrenics and non-psychiatric subjects and to determine whether schizophrenics who were trained on a superordinate conceptual word association task would give more common and less idiosyncratic associations compared with non-psychiatric subjects.

Sixty subjects in three groups (good premorbid schizophrenics, poor premorbid schizophrenics, and normal subjects) were matched on age, I.Q. (WAIS Vocabulary and Information), and educational level, and divided evenly into training and no-training subgroups. All subjects were instructed to give four associations to 24 selected words of the Kent-Rosanoff Word Association List. The training subjects were then presented superordinate conceptual words paired with each stimulus word which they learned to criterion. The no-training subjects received the same exposure to the stimulus words as the training group, but differed in that they did not receive the superordinate conceptual word. All subjects were then asked to again give four associations to the 24 stimulus words, which were divided into three lists of eight words each. Testing was done individually, and all paranoid schizophrenics were excluded from the patient groups.

The groups were compared on (a) commonality (total frequency as scored by the Russell-Jenkins Norms) and (b) number of idiosyncratic responses (those having a frequency of zero in the norms). The first, second, and third responses were compared separately.

The following results were obtained for the five hypotheses:

1. Both good and poor premorbid schizophrenics were found not to be significantly different from normals in terms of both commonality of response and number of idiosyncratic associations.

2. Training on a superordinate conceptual word linked to a stimulus word had no effect.

3. Commonality of response was found to decrease significantly for all groups from pre- to post-training. There were trends toward a greater decrease in the training subgroups. No significant differences were found for the idiosyncratic measure from pre- to post-training.

4. A distinct and clearly significant hierarchy of responses was found for all groups, in which the first association was more common and less idiosyncratic than the second and the second in turn better than the third.

5. Groups did not differ in terms of response hierarchy. Both schizophrenic groups and the normal group had closely parallel response curves. This was more distinct for the commonality than idiosyncratic measure.

These results were explained in terms of the different set acquired as a result of instruction to give four responses to each stimulus. Schizophrenic subjects may benefit by the added information provided by the four response instructions compared to instructions to give the first word that comes to mind.

The significant decrease in commonality from pre- to post-training and apparently even greater decrease in the training subgroups were explained in terms of the implicit instructions to give new or different responses upon repeated testing, and the possible accompanying inhibition effects. Another explanation in terms of interference produced by the mechanical connection of the superordinate to stimulus word was also offered.

Similar hierarchies of response among the groups indicated that that the associational deficit postulated by many writers is not as firmly established, and do not apply in as wide a range of conditions, as was formerly thought. The matching of subjects on vocabulary was discussed as an important factor leading to non-significant differences between the schizophrenic and normal groups.

Implications of this study in terms of altering associational thinking of schizophrenics as well as problems existing in the present procedure and suggestions for further research were discussed.

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Appendix A

Selected Kent-Rosanoff Stimulus Words Used

1. Table
2. House
3. Mutton
4. Woman
5. Cold
6. Spider
7. Bed
8. Anger
9. Sour
10. Cabbage
11. Eagle
12. Stomach
13. Bread
14. Bible
15. Swift
16. Priest
17. Ocean
18. Stove
19. Whiskey
20. Hammer
21. Doctor
22. Lion
23. Heavy
24. Flower

Appendix B

Stimulus Words and Their Respective Superordinate Conceptual Words Divided into the Three Lists Used In the Training Procedure

List I	List II	List III
Red - Color	Bread - Food	Lion - Animal
Sour - Taste	Hammer - Tool	Eagle - Bird
Table - Furniture	Mutton - Meat	Swift - Speed
Spider - Insect	Ocean - Water	Heavy - Weight
Bible - Book	Cabbage - Vegetable	Stomach - Organ
Anger - Emotion	Cold - Temperature	House - Building
Blossom - Flower	Woman - Person	Stove - Appliance
Whiskey - Liquor	Doctor - Profession	Priest - Clergy

Appendix C

Raw Data for Commonality Measure

NORMAL GROUP (Training) S #	Part I (pre-training) Response 1	2	3	Total	Part II (post-training) Response 1	2	3	Total
1	5006	2627	535	8168	6547	1338	651	8536
2	3371	1699	506	5576	3609	676	489	4774
3	4197	1624	1209	7030	3397	1538	1463	6398
4	2904	1802	1314	6020	2977	2015	1171	6163
5	5622	968	762	7352	5165	1060	964	7189
6	4511	2512	961	7987	7091	890	1133	9114
7	4297	1190	794	6281	3914	1636	680	6230
8	1634	774	1505	3913	1823	1573	171	3567
9	3520	2050	1403	6973	3199	1976	181	5356
10	5777	1105	1660	8542	5894	1671	1009	8574
(No-Training)	1	2	3	Total	1	2	3	Total
11	4839	1997	265	7101	4632	940	1106	6678
12	2230	1683	788	4701	1875	1140	1662	4677
13	3994	1011	143	5148	2811	1192	132	4135
14	3621	629	987	5237	3137	1381	1775	6293
15	2692	833	1331	4856	4236	1110	478	5824
16	2389	1225	1263	4877	1937	2317	762	5016
17	4170	1286	535	5991	3133	1350	822	5305
18	3563	796	636	4995	2046	1354	997	4397
19	5861	1806	175	7842	5742	2010	737	8489
20	5447	1328	1452	8227	6403	2137	743	9283

Appendix C (continued)

GOOD PREMORBIDS (Training) S#	Part I Response 1	2	3	Total	Part II Response 1	2	3	Total
21	4858	1642	1149	7649	4859	994	696	6549
22	1885	214	1349	3448	922	264	1577	2763
23	2587	772	118	3477	1549	605	754	2908
24	4471	2796	376	7643	4063	2677	398	7138
25	3578	1879	1991	7448	3422	1637	999	6058
26	3838	1787	566	6191	4391	1574	472	6437
27	4792	553	1581	6926	4062	899	759	5720
28	4880	1328	526	6734	2286	1100	192	3578
29	2146	1405	490	4041	2249	460	899	3608
30	3602	876	129	4607	2781	1498	751	5030
(No-Training)	1	2	3	Total	1	2	3	Total
31	5116	1221	191	6528	3476	1711	538	5725
32	2398	932	863	4193	1889	909	199	2997
33	4265	1565	675	6505	2409	2021	557	4987
34	4311	1681	582	6574	6651	1108	371	8130
35	2697	840	1395	4932	1891	2869	901	5661
36	2864	639	1797	5300	2977	115	1424	4516
37	2265	865	955	4085	1571	906	498	2975
38	5169	1297	413	6879	3774	1330	1245	6349
39	4363	846	275	5484	3749	1148	677	5574
40	5964	2127	962	9053	4565	1777	1254	7596

Appendix C (continued)

POOR PREMORBIDS	Part I				Part II			
(Training)	Response				Response			
S#	1	2	3	Total	1	2	3	Total
41	2238	1013	355	3606	2250	401	631	3282
42	3298	1716	645	5659	3233	1869	641	5743
43	4745	856	302	5903	2241	1620	807	4668
44	2222	649	707	3578	896	1404	222	2522
45	2464	607	1412	4483	2920	2146	246	5312
46	3438	710	592	4740	2471	1641	822	4934
47	2811	288	317	3416	3067	81	401	3549
48	2571	1811	160	4542	2990	920	1407	5317
49	3499	1121	1004	5624	2133	2138	487	4758
50	2572	1995	1282	5849	3245	1781	1764	6790
(No-Training)	1	2	3	Total	1	2	3	Total
51	4839	445	961	6245	5179	1156	798	7133
52	3582	730	559	4871	1565	2410	566	4541
53	3200	428	95	3723	3122	571	399	4092
54	6949	1639	688	9276	5222	1946	1999	9167
55	2317	1727	757	4801	4733	1121	546	6400
56	4098	1315	325	5738	798	2249	1191	4238
57	5007	2444	1688	9139	3327	1573	1762	6662
58	4512	1091	1289	6892	5959	1389	853	8201
59	2944	763	220	3927	2621	1080	188	3889
60	3020	1567	273	4860	2537	687	94	3318

Appendix D

Raw Data for Idiosyncratic Measure

NORMAL GROUP	Part I				Part II			
(Training) S#	Response 1	2	3	T	Response 1	2	3	T
1	1	3	6	10	1	4	6	11
2	4	6	12	22	1	7	13	21
3	1	6	8	15	4	6	6	16
4	2	6	9	17	4	5	10	19
5	2	6	9	17	1	3	11	15
6	5	4	11	20	2	5	11	18
7	2	6	4	12	1	4	5	10
8	8	12	14	34	5	13	13	31
9	1	4	9	14	3	5	12	20
10	0	5	6	11	0	2	5	7
(No-Training)	1	2	3	T	1	2	3	T
11	1	6	15	22	4	8	10	22
12	3	10	9	22	7	9	9	25
13	5	9	11	25	5	13	14	32
14	6	11	13	30	5	10	11	26
15	7	11	7	25	4	12	11	27
16	2	5	12	19	4	4	4	12
17	3	4	11	18	3	6	8	17
18	4	10	10	24	6	8	11	25
19	1	1	11	13	1	3	8	12
20	4	7	6	17	3	6	6	15

Appendix D (continued)

GOOD PREMORBIDS	Part I				Part II			
(Training) S#	Response 1	2	3	T	Response 1	2	3	T
21	2	7	4	13	2	10	6	18
22	2	11	11	24	9	11	13	33
23	5	8	12	25	6	6	7	19
24	2	2	4	8	4	7	5	16
25	1	5	6	12	0	5	6	11
26	5	8	9	22	4	6	10	20
27	1	9	6	16	7	3	10	20
28	3	8	8	19	4	11	15	30
29	1	11	12	24	6	10	10	26
30	5	14	10	29	4	11	10	25
(No-Training)	1	2	3	T	1	2	3	T
31	1	8	14	23	3	13	10	26
32	2	11	13	26	5	10	14	29
33	2	6	8	16	7	5	6	18
34	3	11	9	23	2	8	9	19
35	3	6	8	17	4	11	8	23
361	11	14	20	45	9	18	19	46
37	7	12	15	34	12	10	15	37
38	0	12	15	27	1	5	9	15
39	1	9	13	23	4	11	14	29
40	0	4	7	11	2	2	6	10

Appendix D (continued)

POOR PREMORBIDS	Part I				Part II			
(Training) S#	Response 1	2	3	T	Response 1	2	3	T
41	2	3	10	15	4	9	8	21
42	2	6	12	20	2	11	13	26
43	3	9	11	23	4	5	14	23
44	7	10	11	28	9	8	16	33
45	4	11	13	28	5	4	11	20
46	6	13	9	28	3	6	9	18
47	7	15	17	39	8	19	16	43
48	3	12	18	33	2	13	11	26
49	1	9	8	18	4	3	8	15
50	1	7	10	18	2	5	7	14
(No-Training)	1	2	3	T	1	2	3	T
51	1	6	9	16	1	7	6	14
52	2	6	8	16	1	5	7	13
53	4	6	12	22	5	10	7	22
54	1	3	11	15	2	5	9	16
55	6	9	11	26	3	3	7	13
56	3	11	12	26	9	9	13	31
57	1	1	4	6	1	3	5	9
58	1	3	6	10	0	3	6	9
59	4	7	7	18	4	9	12	25
60	8	9	18	35	10	11	16	37

Appendix E

Vocabulary and Information (WAIS Standard Scores) for Each Subject

NORMALS	Training		No-Training	
	S#	Score	S#	Score
	1	23	11	22
	2	17	12	22
	3	18	13	23
	4	22	14	21
	5	23	15	22
	6	27	16	21
	7	26	17	17
	8	31	18	23
	9	19	19	19
	10	26	20	20

GOOD PREMORBIDS	Training		No-Training	
	S#	Score	S#	Score
	21	21	31	17
	22	19	32	22
	23	20	33	19
	24	22	34	23
	25	22	35	18
	26	19	36	22
	27	18	37	22
	28	18	38	19
	29	21	39	30
	30	22	40	28

Appendix E (continued)

POOR PREMORBIDS	Training		No-Training	
	Ss	Score	Ss	Score
	41	23	51	28
	42	27	52	23
	43	20	53	26
	44	25	54	21
	45	23	55	18
	46	19	56	21
	47	17	57	26
	48	19	58	29
	49	22	59	18
	50	20	60	23

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