SOME ASPECTS OF THE STRUCTURE AND PROPERTIES OF LANGUAGE FACILITATING COMPREHENSION BY SCHIZOPHRENIC PATIENTS

by

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Abstract

A series of experiments was carried out to investigate language comprehension in schizophrenia with the aim of discovering the factors which help or hinder communication with schizophrenics.

In order to examine the receptive side of language, the experiments were designed to vary the stimuli, while the form of response was very simple and kept constant. The comprehension of single words was examined by presenting patients and control subjects with a picture of an object and a number of alternative words from which the name of the object pictured was to be found. The comprehension of speech passages was examined by means of a series of commands instructing subjects to manipulate a number of toys in a specified manner.

It was found that multiple choice word stimuli (rather than open-ended, or single choice word stimuli) aided comprehension in schizophrenia. A large number of alternative words (in contrast to a small number of choices) also helped schizophrenics to understand words. Lists of words to be read and/or discussed by the schizophrenic subjects prior to testing led to better comprehension. Written word stimuli were more readily understood by schizophrenics than oral stimuli. A slow presentation of speech passage stimuli was better comprehended by schizophrenics and patient controls than a fast presentation. It was also found that words associated with the correct word tended to be confused with the correct word by schizophrenic subjects.

A theory involving the formation of word boundaries during word selection is offered as an alternative to existing theories to explain

these results. The experiments support the idea that although their word store is organized in a normal manner, schizophrenics have difficulty in selecting words from the store and confuse associated words whose boundaries are not clearly defined.

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Introduction

Language is an important form of communication between a patient and the persons with whom he comes in contact, and the clinical interview is the major means of diagnosis and prognosis and to determination of treatment and assessment in the psychiatric field. Language defect is a basic symptom of schizophrenic illness, although disorders of speech do not occur in all schizophrenics. The purpose of the series of experiments described in this study was to define more clearly the nature of schizophrenic language disorders, and to show which factors in language aid or hinder communication with schizophrenic patients.

Literature on Language in Schizophrenia

Some investigators have done research into the aberrant nature of schizophrenic speech. These studies fall into four main groups, which will be discussed below. They are (1) attempts to estimate the ability to communicate by schizophrenics with normal persons, and with other schizophrenics; (2) attempts to find out how well or badly schizophrenics can make use of contextual cues in language; (3) attempts to discover how schizophrenics differ in word associations; (4) attempts to demonstrate that schizophrenics include factors which are irrelevant to concepts; (5) attempts at understanding the meaning words have for schizophrenics as opposed to normal subjects.

The ability to communicate

Work in this area began because schizophrenic speech often appears to observers to be unusual, and attempts were then made to measure quantitatively the lack of ability to communicate with and by schizophrenic patients.

Schizophrenic speech has been described as unusual, in that it has been described as including: constriction of vocabulary (Whithorn and Zipf, 1943), concretism (Goldstein, 1948; Reed, 1968), irrelevancies and changes of context or abnormal shift (Meadow et al, 1953), circumlocution, perseveration, stereotypy, echolalic speech, paraphrasias, neologisms, alterations of tempo, cadence and rhythm (Williams, 1965), senseless rhyming (Forest, 1965), and opposite speech, or negation (Laffal et al, 1956). Observation of bizarre speech production by schizophrenics led to attempts by investigators to measure communicability in schizophrenia.

The technique most commonly used to measure the degree of correspondence between one persons system of language habits and another persons system, is the cloze technique. This technique was originally created as a measure of readability (Taylor, 1953) but has since been used to investigate many sorts of communication phenomena.

The cloze technique consists of a sample of speech from some source which is to be evaluated. The sample is then mutilated by systematically deleting every nth word. Subjects are asked to guess the deleted words, and the more words they can guess correctly the more redundant (and communicable) is the speech sample.

Honigfeld (1963) used cloze analysis to investigate the ability of schizophrenics to understand normal, psychotic and pseudopsychotic language. His sample of normal language was from a newspaper article. Psychotic language was drawn from an interview with a schizophrenic, and the sample of pseudo-psychotic language was taken from an interview with a normal person under the influence of an hallucinogenic drug. Thirty schizophrenic and 32 normal persons rated the cloze samples. The normal subjects completed all the samples significantly better than the schizophrenics, giving no support to the belief that schizophrenics are better understood by themselves than by normal persons.

Salzinger _et al_ (1963) also used the cloze procedure to evaluate the differences in communicability between a group of schizophrenic patients and a group of matched non-psychiatric patients. Samples of speech were elicited in interviews with these groups consisting of open-ended questions. The subjects (or judges) who rated the speech samples were undergraduates. The results showed the lower communicability of schizophrenic speech.

An interesting finding in the Salzinger study was that with the schizophrenic speech samples the number of the correct guesses decreased from the first to the second 100 words, but with the normal patients speech samples, the amount of correct guesses increased. Greater length of sample seemed to give more contextual cues in the normal patients sample, but had the opposite effect when the speech sample was from a schizophrenic patient. The authors related this to an earlier finding (Salzinger & Pisoni, 1961) that in conditioning experiments schizophrenics extinguished faster than normal persons, when stimuli were removed. The further the schizophrenic was from the initial stimulus, the more he was likely to deviate from expected behaviour. A similar finding concerning length of passage and contextual cues was found by investigators using techniques of controlled contextual constraint, to be discussed in the next section. Some of these other investigators interpreted this finding in terms of attentional deficit, rather than in terms of faster extinction.

In 1966, Salzinger et al used other techniques for communicability assessment. One technique (reconstitution) involved scrambling the words in sentences derived from normal and from schizophrenic speech samples. Normal judges tried to reconstruct the original structure. Two measures discriminated between the normal and schizophrenic sentence samples: the amount of agreement among judges, and the amount of agreement with the original text. This technique also led to the finding of an increase in the number of errors in the schizophrenic speech sample as the distance from the initiation of speech production increased. The sequential error scores by judges of the second half of the reconstruction task differentiated the schizophrenic samples better than the first half did.

Another technique used in the same study (unitization) involved unpunctuated typescripts of speech samples from normal and schizophrenic subjects. Judges were instructed to insert punctuation, and to divide the material into grammatical sentences, crossing out words only when absolutely necessary. The prediction that the number of words crossed out in the schizophrenic samples would be greater was confirmed.

The authors concluded that the schizophrenic has a greater number of intrusions than the normal person, and this, as well as the results concerning distance from the initiation of speech, led them to an interpretation consistent with those who propose an attentional deficit in schizophrenia as the main deficit. According to the authors, the attentional deficit resulted in the inability of the schizophrenic to react to words he had just uttered, and that an individual who is unable to react to stimuli remote in time or space would have difficulty in communication.

Cohen and Camhi (1968) used a completely different technique to look at word communication in schizophrenia as compared with normal subjects. They used a communication task of speaker and listener skills in which the speaker provides the clue words to distinguish referent from non-referent stimuli, and the listener guesses the speakers' referent from each stimulus array on the basis of the speakers clue words. For example, the speaker is given a card with two words, one of which is underlined (for instance, "<u>warm</u> - pretty"). The speaker then utters a clue word (for instance "sun") so that the listener, who holds a card on which the same two words appear but neither is underlined, can guess the underlined word. There were four groups of speaker-listener pairs; normal speakers and listeners, normal speakers with schizophrenic listeners, schizophrenic speakers with normal listeners, and schizophrenic speakers and listeners. Schizophrenic speakers were significantly inferior to normal speakers, but schizophrenic listeners were no different from normal listeners. The authors suggest that the associative repertoires from which schizophrenics select verbal responses are non-deviant, but the selection process is faulty in schizophrenia.

Contextual effects in schizophrenia

In 1950 Miller and Selfridge devised a recall task for an investigation of the statistical structure of words in context. Contextual constraint is at its highest in a passage of English text, and at its lowest in a passage of unrelated words selected at random. The task requires subjects to listen to seven passages of words (each passage varying in amount of constraint) in turn and at the end of each passage to write down the words he can remember. The following are examples of the 2nd and 7th orders of contextual constraint, respectively:

> "Was he went to the newspaper is in deep and"
>
> "Recognize her abilities in music after he scolded him before"

Miller and Selfridge found that the ability of normal subjects to recall these passages immediately after presentation improved as the order of approximation to English increased.

Lawson et al (1964) presented this task to schizophrenics, other psychiatric patients, and normal subjects. Although the schizophrenics were able to recall sentences of low contextual constraint as well as the control groups, they fared badly in recalling sentences of higher constraint. The authors conclude that schizophrenic patients seem unable to utilize the transitional bonds between words which normally facilitate the perception of passages as an organized whole, and the authors see this failure in terms of an attentional deficit.

In 1965, Triesman conducted a study with normal subjects where the subjects were required to guess the next word in a passage. Triesman found that for passages constructed by normal subjects, the probability of correct guesses increases with the increase in the number of words in the passage being continued. Williams (1966) in one of a series of experiments for assessing the sensitivity of schizophrenics to contextual constraints, used a similar technique. A schizophrenic subject was asked to add a word to a written string (e.g. "The boy went to the ____"). The first word was then deleted and a second subject was asked to add a word to the four words presented. This was continued with a group of schizophrenics until 50 words were collected. A cloze analysis of the list used as a speech sample with normal persons as judges was done. Williams found a different result from Triesman, i.e., an increase in the number of words in the passage made no difference in probability of correct guesses.

In a second experiment, Williams (1966) found that the schizophrenics could guess fewer words in a cloze technique using an artificially constructed sample than a normal group of hospital staff. Williams concluded that schizophrenics tend to make less use of, or to ignore, the usual syntactical constraints, and tend not to increase their performance the greater the amount of material given them.

In a third experiment, Williams constructed a task with lists of words that were ordered in three ways: by sequences (e.g. year, month, week, ____)by opposites (e.g. summer, winter: top,____) and by analogies (e.g. fish, swim; frog, leap; bird,____). A short and a long list were constructed for each type of order. These lists were read to schizophrenics and to two groups of normal subjects. One normal group was tested under time pressure, i.e., they were led to believe that a very quick response was necessary. The other groups were to respond in a leisurely manner. Significant differences in numbers of errors were found between the normal and schizophrenic groups. The interesting finding was that while length of list contributed to improved scores in the normal group under no time pressure, there was no improvement with longer lists for schizophrenics or for the normal group under time pressure. Williams suggests that the difference in the completion of verbal passages may be due to the speed with which incoming auditory stimuli are dealt with.

Two recent experiments involving contextual constraints with schizophrenics were conducted (Levy and Maxwell, 1968; Raeburn and Tong, 1968). Raeburn and Tong repeated the Lawson et al (1964) experiment previously mentioned, and found that only six out of 14 schizophrenics failed to improve with increasing degrees of contextual constraint. Lawson found the lack of improvement to exist mainly with hebephrenic schizophrenics. Raeburn and Tong suggest that inability to benefit from contextual constraint increase is associated with a low vocabulary level and with psychomotor retardation involving a slower written response. These authors argue that slower writing permits greater memory decay. They could not find any evidence that the inability is associated with lack of delusional intensity or length of stay in hospital.

Levy and Maxwell tested the effect of increasing constraints by the same method as Lawson et al (1964) with a group of acute, first admission schizophrenics, a group of severely depressed patients, and a non-psychotic patient control group. These groups were matched for age and score on the Mill Hill Vocabulary Test, and none of the patients were receiving drugs. The results confirmed findings that schizophrenics show impairment in the ability to make use of contextual cues in comparison to non-psychotic patient controls, but not in comparison to the depressive group, who performed similarly to the schizophrenics.

Schizophrenic Word Associations

In 1910 Kent and Rosanoff compared word association responses of various pathological categories with norms established for the normal population. The main finding in 108 cases diagnosed as dementia praecox was more unusual word association responses were given than would be expected by the norms. Types of reactions in this group included clang associations, associations to previous stimuli or to previous responses, and neologisms.

Murphy (1923) tried to categorize schizophrenic associations by relating them with the associations given by children. The Woodrow-Lowell (1916) norms for children indicate that children tend to make use of syntactical relationships in associative responses whereas adults tend to give responses in the same grammatical category. For example, given the stimulus word "black", children more often respond with "cat", and adults more often respond with "white". This finding has also been recently established by Brown and Berko (1960), Ervin (1961) and McNeill (1966). Murphy thought that schizophrenic associations would be more like children's associations, but found negative evidence for this position. Schizophrenics used the same grammatical category even more often than the general population of normal adults.

Numerous studies have confirmed the Kent-Rosanoff finding of uncommon associations by schizophrenics. Moran (1953) controlled for knowledge of the stimulus words by having subjects define the stimulus words prior to the association test. He found schizophrenic associations significantly less related to the stimulus words than were the associations of normals. Johnson et al (1964) found that although schizophrenics produced more uncommon responses in a free association task than normal subjects, the percentage of popular responses given to each of a set of stimulus words by the normal group was highly correlated with the percentage of popular responses given to these stimulus words by the schizophrenic group. The uncommon responses by schizophrenics were additional to the popular responses.

Sommer *et al* (1960) were interested in the idea that schizophrenic associations might be associations to associations, i.e., what appeared as a response was the end link of an associative chain. They searched for responses which would be the common response to the response most frequently expected from the original stimulus word (by normals). They expected schizophrenics to give these words as a response more often than normals, but this expectation was not borne out.

However, they did find that the associations of schizophrenics were not like those of normals, and also that the responses of schizophrenics were less stable from one session to another using the same stimulus words. When schizophrenics and normals were asked whether they believed their own responses were unusual or common, schizophrenics considered their responses unusual more often than normals. Schizophrenics did not believe their responses would be those given by normals, and appear to be aware that they are unusual.

In another study Sommer *et al* (1962) tried to condition schizophrenics to give common word associations, and alcoholics were used as a control group. The schizophrenic group showed little response to conditioning whereas the alcoholics conditioned quickly. Maltzman *et al* (1962) found that normal subjects could not be conditioned to give uncommon associations.

In 1964 Moran *et al* used a factor analytic technique with various classifications of word associations given by schizophrenics and normal subjects. Three predominant factors in the classes of associations were found for both schizophrenics and normals, and these three factors were stable over repeated testing for both groups. The factors were (1) concrete, or functional responses (e.g. chair--sit), (2) conceptual, or synonym responses (e.g. chair--stool) and (3) co-ordinate or contrast responses (e.g. black--white). Moran et al suggest that schizophrenic and normal subjects appear to share a common associative structure.

Work on associations in schizophrenia has shown that schizophrenic responses to association tasks are less common than normal responses and more changeable from one session to another. These results have usually been interpreted by investigators to show that schizophrenics are more likely to allow intrusions of irrelevant or extraneous stimuli influence their performance, and thus have a defect in attention. However, it has also been shown that schizophrenics produce a similar percentage of popular responses as normals, that schizophrenics appear to be aware of the uncommonness of their responses and that schizophrenic and normal subjects seem to share a common associative structure when associations are classified into categories.

Restraint of associations and tests of overinclusion

An hypothesis involving an overly fluent associational flow, rather than an attentional deficit arose out of investigations of methods used to measure "overinclusiveness" in schizophrenia.

In 1944, Cameron first put forward the term "overinclusive thinking" to describe schizophrenic thinking. He conceived of this term as meaning an inability to preserve conceptual boundaries, so that ideas which are only distantly related to a central concept become incorporated into it.

In 1953, Epstein presented a test devised to assess overinclusive thinking. The test is composed of 50 items, each consisting of a key word followed by five response words and the word "none". The subject is instructed to underline all response words which designate things or concepts required for the complete thing described, e.g., MAN: arms shoe hat toes head none. Each correct choice omitted scores one underinclusion; each incorrect choice selected scores one overinclusion. Epstein found that schizophrenics would underline more incorrect response words than a group of normal subjects matched for vocabulary score on the Shipley-Hartford Scale. Since Epstein matched his group of normals with his schizophrenic group on the Shipley-Hartford vocabulary, one might expect the two groups to have understood the instructions equally well. However, the Shipley-Hartford vocabulary test is a test of recognition, like the synonyms test in the Mill Hill Vocabulary Scale. It calls for recognition and there is evidence (Heim and Watts, 1967) that recognition is easier than recall of word meanings. Both recognition and recall are easier than using a word correctly in a sentence. Schizophrenics are often able to show that they have a rough idea of what a word means and so do better on a recognition type of vocabulary test than on more stringent tests of understanding (Gathercole, 1965). This means that the two groups were possibly not matched for the relevant aspect of verbal ability.

Later studies using Epstein's test have produced data showing schizophrenics having markedly higher overinclusion scores than Epstein's schizophrenics (Payne, et al 1959; Payne and Hewlett, 1960). There may be several reasons for this, e.g. type of patient, tester, etc. One important reason may be that Epstein had matched his schizophrenics with his normals for their ability to underline the relevant word in the Shipley-Hartford vocabulary scale - a test not very different from the inclusion test itself. It may be that the groups were matched on the very variable to be tested.

The results of Payne et al (1959) and Payne and Hewlett (1960) as well as Epstein (1953) are all in the predicted direction. That is, schizophrenics return higher inclusion scores than normals and neurotics. However, a group of patients undergoing spinal operations for various disk lesions tested by Choppy and Eysenck (1963) as well as a group of depressives tested by Payne and Hirst (1957) gave mean inclusion scores greater than the mean of Epstein's schizophrenics and about the same as Payne and Hewlett's schizophrenics.

The performances of schizophrenic patients on this test suggest that some of them, particularly those with disordered thinking, do not concentrate on the task but merely underline indiscriminately (Gathercole 1965). As with the children described by Luria (1961) the impelling aspect of the instructions (to underline) is dominant over the restraining aspect (i.e. not to underline certain words). Luria describes how at a certain stage of development a child assimilates the impelling aspect of an instruction before he takes notice of the restraining aspect. Thus in a situation where the child is required to squeeze a balloon when a light goes on, he merely begins to squeeze whether the light goes on or not. This work shows that the impelling or initiating aspect of the instructions is dominant over the restraining or inhibitory aspect.

It appears that factors other than overinclusion may operate in determining a persons score on the Epstein test, although overinclusion may also be involved.

Payne has conducted a number of experiments on overinclusion. In 1960 (Payne and Hewlett) a study was reported in which a number of tests were administered to groups of normals, neurotics, depressives and schizophrenics. Measures of concreteness, overinclusion, retardation, and psychoticism were derived from the battery of tests. This study set out to determine whether overinclusion was an abnormality specific to schizophrenia, or whether it is a general characteristic of psychotic patients. It also sought to determine whether or not tests of overinclusion intercorrelate significantly, and thus measure some factor in common, and to demonstrate that the factor shared by these tests differentiates schizophrenics from the other groups. The neurotic and normal groups were shown not to be significantly different in terms of factors derived from a factor analysis of the sixty-eight measures obtained from the battery of tests. The two psychotic groups were then combined and shown to differ significantly from the combined normals and neurotics. Finally, the schizophrenic and depressive groups were found to be significantly different.

A factor was then arrived at, which was the best differentiator, and which was regarded as the overinclusion factor. This seems reasonable since those tests which had the highest loadings on this factor were those regarded on theoretical grounds as measures of overinclusive thinking. In a later paper, (Payne and Friedlander, 1962) the three tests which were said to have the highest loadings on the factor of overinclusion were presented as a battery for clinical use.

Gathercole (1965) makes a case for the view that this factor is not one of overinclusion and that the battery of tests do not provide a measure of overinclusive thinking. It seems more appropriate to label the factor one of restraint or inhibition of action. High scores are returned by people who continue to sort the objects in the Object Classification Test, who continue to talk in the Proverbs Test, and who continue to hand over objects in the Goldstein Object Sorting Test. The measure which had the highest saturation on the overinclusion factor was the total number of responses in the Shaw Test, which is again a measure of a person's inability to stop doing something.

The overinclusion factor was defined as one which differentiated between the schizophrenic group and the depressive group. One might expect on clinical grounds that depressed patients would give up responding at an earlier stage than schizophrenics. One might also expect that retarded patients will score low on the overinclusion factor, and this is the case. The ten schizophrenics who had higher retardation scores than the most retarded normal were compared with the rest of the schizophrenics who were within the normal range. The abnormally retarded schizophrenics had a similar mean overinclusion score as the normal subjects, whereas the non-retarded schizophrenic's mean overinclusion score was very high. In a later paper (Payne, et al, 1963) it was found that chronic schizophrenics who are retarded are found to have low overinclusion scores.

In view of the above evidence, Gathercole (1965) concludes that "the basis of a high score on Payne's test seems to be the ability to associate freely to the stimuli presented to the patient. It is this fluency of associations which appears to be measured rather than a failure to maintain conceptual boundaries". Gathercole also offers an alternative description, "strictly speaking it is not the fluency of association which is being measured, but the inability to restrain responses produced by this fluency."

In 1967, Craig revised the Epstein test for overinclusiveness in such a way as to control the choices other than the correct responses or "essentials" as to whether they were close or remote associations as ranked by college students. He found that schizophrenics tended to underline the close far more than the remote associations, as well as the essential (or correct) words, whereas normal subjects underlined mostly the essentials and a few of the close associations. This indicates that the fluency of association, or inability to restrain associations, proposed by Gathercole, may have some limits, i.e. it may be related to associational proximity for schizophrenics.

Schizophrenic choice of meaning

There has been a long tradition, mainly based on proverb interpretation by schizophrenics, that schizophrenics are more concrete and literal in their interpretations than normal subjects (Benjamin, 1944).

In 1960 Chapman devised a task in which schizophrenic subjects and normal subjects chose meanings for words which could be literal or figurative. For example, subjects were required to choose one of the following in each group:

David turned yellow when he faced the enemy.

A. David became cowardly.

B. David became hungry.

C. David's skin became discolored.

Miss Bailey's illness turned her yellow.

A. Miss Bailey became cowardly.

B. Miss Bailey became hungry.

C. Miss Bailey's skin became discolored.

In the first example the appropriate response is figurative, and in the second, literal. Chapman found that schizophrenics made more errors of both types, but that the proportion of literal misinterpretation of words was much greater. Eliseo (1963) replicated Chapmans study but controlled for vocabulary level and length of hospitalization. He found no significant differences between schizophrenics and normal subjects.

In 1964 Chapman et al suggested that schizophrenics make the same types of errors as normals, but to a greater degree, and that schizophrenic errors often involve words which have more than one meaning. Chapman et al conjectured that in such cases a response bias exists for one of the meanings. If a weaker meaning response is appropriate, normal persons can utilize the context to select the weaker but more appropriate response, but schizophrenics are unable to do this due to paying less attention to the contextual cues.

Chapman et al (1964) did two experiments to test this theory. In one, they selected words which had more than one meaning. A measure of the relative strength of the two meanings was obtained by presenting the list to a group of normal judges to rate. A test was then constructed which used these words in context. For example:

When the farmer bought a herd of cattle, he needed a new pen.

A. He needed a new writing implement.

B. He needed a new fenced enclosure.

C. He needed a new pick-up truck.

The professor loaned his pen to Barbara.

A. He loaned her a pick-up truck.

B. He loaned her a writing implement.

C. He loaned her a fenced enclosure.

In the first example the appropriate answer is the weaker meaning, in the second example it is the stronger meaning. Schizophrenics misinterpreted more in situations where the proper response was the weaker. The authors believe that this is because of the response bias to the stronger response.

The second experiment by Chapman et al (1964) explored the possibility that the schizophrenic groups had lost the weaker meaning responses altogether. Subjects were given a multiple choice vocabulary test on double meaning words in which strong and weak meaning were separately tested with three incorrect alternatives. There was no difference between normal and schizophrenic subjects. Both groups made more errors on weak meaning responses.

The above studies have described and investigated some factors in speech production in schizophrenia. With the exception of the Chapman (1960) and Chapman et al (1964) experiments on schizophrenic choice of meaning, nothing could be found in the literature which directly investigates the receptive side of language, which is the approach to be used in this thesis, and which will be described in a further section of the Introduction.

The investigators of language deficiency in schizophrenia described thus far did not delve deeply into the theoretical aspects of the mechanisms underlying the deficiency, although some of the investigators have adopted a theory to explain their data, the most popular current explanation being one involving an impairment in the mechanisms of selective attention.

Other explanations or theories to account for defects in the behaviour of schizophrenics have been: (1) sensory overarousal, (2) speed of the communication process, (3) serial invalidation, derived from continual double-bind non-reinforcement, and (4) faulty logical thinking. These are described below.

Literature on Experiments Designed to Support Theories of Schizophrenic Deficit

Attentional deficit

Work in this area originated from subjective reports of experiences by schizophrenic patients. Two papers (Chapman and McGhie, 1963; McGhie and Chapman, 1961) describe recorded interviews with schizophrenics which suggested to the authors that many of the patient's symptoms arose from an inability to direct their attention focally as required in normal concentration. For example, one patient said, "When people talk to me now it's like a different kind of language. It's too much to hold at once. My head is overloaded and I can't understand what they say. It makes you forget what you've just heard because you can't get hearing it long enough. Just words in the air unless you can figure it out from their faces." (McGhie and Chapman, 1961), and from another patient, "You can hear the word, but what actually the word means takes its time in coming in. You have got to find out the meaning of the sentence. I have to search carefully." (Chapman and McGhie, 1963).

Although the above examples and other examples in these two papers could be interpreted as indicating a defect in the amount of time needed to process incoming stimuli, the authors chose to interpret them in terms of attentional defects involving a deficiency in the "filter mechanisms" discovered by Broadbent (1958), and to investigate the effects of distraction on the performance of schizophrenics and other patients.

The testing techniques used in these investigations can be grouped into two categories. (1) Tests examining the effect of auditory and visual distraction on the patients' psychomotor performance (McGhie, et al 1965b). This involved standard psychomotor tests (key tapping, button pushing, circle maze, punchboard) with and without modifications for visual or auditory distraction (recorded irregular metronomic rhythm fed in through earphones for auditory distraction, or randomly flashing lights around the stimulus for visual distraction). (2) Tests designed to assess the effect of visual and auditory distraction on immediate recall (McGhie _et al_ 1965a). The main technique was to present the patient with information, usually consisting of a series of rapidly presented digits or letters, presented visually or orally, together with a similar series of irrelevant information (such as digits or letters in a different voice for auditory distraction, and digits or letters which appeared on the periphery of the relevant visual item for visual distraction). The patients' task was to observe and report the relevant series, while ignoring the irrelevant information. In some of the tests, the relevant and irrelevant information were both presented in the same auditory modality, while in others, two sensory modalities were involved. Also included was a test where the subject was required to integrate a series of stimuli presented in alternating sensory modalities.

On the psychomotor tests, the schizophrenic group performed worse than the normal controls both in basic performance and under the influence of auditory and visual distraction. The effects of distraction did not differentiate between schizophrenics and other control groups.

On the immediate recall tests which required the subject to attend selectively to auditory information, the schizophrenic patients were clearly distinguished by their vulnerability to both auditory and visual distraction. Where the subjects were required to attend selectively to visual information requiring immediate recall, the effect of distraction was less marked, and did not differentiate the schizophrenics from the other patient control groups. However, McGhie et al (1965a) explain that the data revealed that the negative results of distraction on the visual tests were partially due to the significantly poorer performance of schizophrenic patients on all tasks involving visual perception. The low scores of the schizophrenic patients on the basic task of the visual tests tended to mask the effects of distraction. This difference between the basic auditory and visual performance of the schizophrenic patients was again noticeable in the auditory visual integration test where the subject was required to integrate information presented in two modalities. Although overall performance of the schizophrenics was significantly poorer than that of all other groups, their errors tended to be confined to the visual component of the test.

In 1967, Lawson et al repeated the experiments assessing visual and auditory distraction on short term memory, with normal subjects, epileptics, arteriosclerotics, and schizophrenics. The same results were found for schizophrenics as in 1965, and epileptics and arteriosclerotic patients also proved to be as distractible as schizophrenics and with the same modality difference.

Two other investigations involving distractibility showed a difference between schizophrenics and other control groups. Ludwig et al (1963) measured auditory recognition thresholds for words with and without a distracting noise background (a 20 decibel tone). They found no difference between schizophrenics, other psychiatric patients, and hospital employees without the noise, but under the noise condition, thresholds for both patient groups were significantly higher than for hospital employees. In a similar visual task, presenting words visually with and without visual noise, there was no difference between the three groups without visual noise, but with noise (like snow on television) the schizophrenics showed significantly greater threshold elevation than the other two groups. The non-schizophrenic patients fell between the hospital employees and the schizophrenics in threshold level. Stilson and Kopell (1964) found the same results in a similar visual task.

Selective attention has also been studied in normal subjects. Using tasks of dichotic listening (i.e. different messages played into the two ears by means of earphones) Triesman (1964a) examined the effects of different types of competing messages. When the competing messages were in different languages, she found more difficulty in the shadowing (or repeating back) performance of the relevant message when both languages were known to the subject than when one language was unknown. She also discovered that efficiency of shadowing decreased as the information rate in the passage to be repeated increased (Triesman, 1965). Furthermore, Triesman (1964b) showed that subjects noticed if the irrelevant message was identical to the selected one but a few seconds out of step, and that subjects noticed a change in voice or a change in the language used in the rejected, or irrelevant message. Subjects also noticed if their own name was mentioned in the irrelevant message. Triesman puts forward the hypothesis that the filter mechanism acts by attentuating, rather than blocking out irrelevant signals.

Eagle and Ortoff (1967) gave normal subjects a single presentation of a list of words, with instructions to try to memorize them under two different conditions: (a) focal attention, and (b) while simultaneously performing another (distraction) task of a psychomotor type. Performance under the distraction condition showed more recognition errors based on acoustic similarity (clang errors) than under the focal attention condition. The authors hypothesize that reduced attention tends to block analysis of incoming stimuli, and that stimuli in the distraction condition are stored in memory primarily on the basis of assonance.

To sum up, research in the area of attention has revealed that schizophrenics are more distractible than normal subjects and other patients on tasks involving immediate recall of auditory stimuli, but not on simple psychomotor tasks. Also, the visual recognition threshold by schizophrenic patients is higher than normal subjects and non-psychotic patients when there is a noise background, but no differences are found between the groups when there is no noise background. Research into attention with normal subjects suggests that the filtering mechanism may attenuate or analyze all incoming stimuli before rejecting it, rather than acting as a simple blocking mechanism. Also, auditory stimuli stored under conditions of distraction may be stored on the basis of assonance.

Overarousal

Work in this area began with the suggestion by Pavlov (1941) that the schizophrenic possesses a "weak nervous system". For western readers the features of this type of nervous system are summarized by Gray (1964) as follows:

> "The weak nervous system is more sensitive than the strong: it begins to respond to signals at stimulus intensities which are ineffective for the strong nervous system; throughout the stimulus intensity continuum its responses are closer to its maximum level of responding than the responses of the strong nervous system and it displays its maximum response, or the response decrement which follows this maximum at lower intensities than the strong nervous system".

In the weak nervous system protective inhibition is developed at an early stage and leads to a "breaking of the law of strength" so that strong stimuli elicit weak responses of the same magnitude as weak stimuli (Lynn, 1966). In a reaction time experiment (Venables and Tizard, 1956) visual stimuli over a large range in intensity were presented to chronic non-paranoid schizophrenic patients. On the first occasion of testing, stimuli of moderate intensity produced maximum response speed. There was a decrease in speed when stimuli of maximum intensities were used. The Pavlovian notion of the breaking of the law of strength in a weak nervous system was thus confirmed. However, on the second occasion of testing, there was an over-all slowness of response, but no indication of the reversal of the law of strength.

Gray (1967) has re-interpreted the strength of the nervous system in terms of arousal concepts, and suggests that the weak nervous system displays high arousability. The suggestion which was put forward to explain the lack of reversal of the law of strength on the second occasion of testing by Venables and Tizard (1956) is similar to Gray's interpretation:

> "On the first occasion in an unfamiliar situation subjects were apprehensive and in a state of considerable emotional excitation. The excitation resulting from the stimulus lights superimposed on this general excitation became 'ultra-marginal' in strength and resulted in the paradox observed. On the second occasion of testing the subjects were more familiar with the situation and the total excitation did not reach ultra-marginal strength".

In a further experiment (Venables and Tizard, 1958) on the reactions of schizophrenic patients to a range of auditory stimuli up to 115 decibels in intensity, and of a large range of frequencies and also white noise, there was no evidence on any occasion of a reversal of the law of strength.

This is related to what has been called "segmental set" by Calloway _et al_ (1968). These authors found that on normal subjects, two slightly different tones (such as 600 cycles per second and 1000 cycles per second) when repeated over and over again in a haphazard series without meaning are quickly treated as background, and that the normal brain treats the tones in the same way, and yields the same evoked scalp response to the two tone stimuli after the first few stimulus presentations. However, non-paranoid schizophrenics continue to evoke different scalp EEG responses to the two tones, although paranoid schizophrenics react like normal subjects. Calloway _et al_ claim that this continued difference in evoked response to two meaningless, similar stimuli indicates the existence of segmental sets, so that different routes of neural processing are being used by the brain, and normal generalization and habituation is reduced.

Experiments using physiological measurements to evaluate arousal to stimuli are in accordance with the neurological measurements, although stimulus intensity has not been varied in these experiments. Bernstein (1967) studied electrodermal arousal at rest and during repetitive stimulation in chronic schizophrenics and normal subjects, and found a greater response in schizophrenics both at rest and during stimulation. Chotlos and Goldstein (1967) measured heart rate and skin resistance during silence and during a recording of everyday sounds in schizophrenics, alcoholics, hypertensives and normal subjects. They found an increase in heart rate for all subjects during silence , and heart rate did not differentiate the groups while listening to the recording. However, the schizophrenic group showed a significantly greater electrodermal arousal than any other group under both conditions.

Zahn *et al* (1968) investigated habituation in schizophrenics and normal subjects by means of continuous electrodermal and heart rate measurements to a series of 40 meaningless auditory stimuli (tones) and 40 meaningless visual stimuli (lights), presented at half-minute intervals. Amplitudes of the specific galvanic skin responses and heart rate responses were both larger in the schizophrenic group to begin with. As the stimulation proceeded, it was found that habituation was extremely slow in the schizophrenic group as compared with the normal group in electrodermal responses, but the difference in rate of habituation was not so great with heart rate.

Venables (1968) has investigated arousal to visual and auditory stimuli, and reports a generally slower response to auditory rather than to visual stimuli by non-paranoid schizophrenic patients. This is in contrast to the widely accepted finding of faster auditory than visual reaction times in normal persons (Teichner, 1954). Venables and O'Connor (1959) revealed that intact paranoid schizophrenics behaved in a very similar way to normal subjects showing faster reactions to auditory than to visual stimuli. On the other hand, all non-paranoid patients and withdrawn paranoid patients showed slower reactions to auditory than to visual stimuli. The stimuli used in these studies were in the moderate range of intensities and did not therefore involve the reversal of strength effects previously discussed.

A similar pattern of reversal of modality effectiveness in reaction time was shown in a study by Sutton *et al* (1961), who found that some paranoid schizophrenics behaved similarly to normal subjects, but all non-paranoid and withdrawn paranoid patients showed slower reaction time to auditory than to visual stimuli. Another study which adds confirmation to the modality pattern shown in the above studies is that of Spain (1966) who showed better eyelid conditioning to a visual conditioned stimulus than to an auditory conditioned stimulus in schizophrenics and the reverse in normals. It has also been shown that in so far as the schizophrenic patient is rated as deteriorated so he tends to have a relatively higher two-click threshold in relation to two-flash threshold (Venables, 1966).

The above research in arousal suggests that schizophrenics have a weak nervous system which is more sensitive, more arousable, and exhibits a slow rate of habituation and generalization. Also, non-paranoid schizophrenics have a slower response to auditory rather than visual stimuli, while the reverse is the case for normal subjects and paranoid schizophrenics.

Speed of the communication process

Although Yates (1966) proposed as an hypothetical conclusion in his review of papers describing deficient behaviour in schizophrenics, that "the abnormally slow rate at which information in the primary channel is processed may be a primary deficit in schizophrenia", little research has been done in this area.

Williams (1966) found that normal subjects under time pressure responded like schizophrenics in a task designed to test the ability to make use of contextual cues. Reed (1968) observed that schizophrenics took longer than normal subjects to respond to proverbs, and were also slower in talking than normal controls. Salzinger and Portnoy (1963) in attempting to condition schizophrenics to increase the amount of verbal material on a specific topic during clinical interviews, found that chronic schizophrenics were characterised by having an abnormally low rate of responding in general. Salzinger et al (1966) had the impression that "the basic deficit in the schizophrenic patient's behaviour consists of his being controlled by stimuli immediate in space or in time" and that "it is for this reason he has difficulty in sorting tests, that he extinguishes faster after conditioning, that he shows loose association and poor ability to communicate, because language requires that the speaker react to long-range stimuli."

Zahn et al (1961) in an experiment which varied the length of preparatory intervals and the inter-trial intervals in a reaction time task, found that schizophrenics have long reaction times as compared with normals when preparatory intervals are long and inter-trial intervals are short. But when preparatory intervals are short and intertrial intervals are long, normal and schizophrenic subjects are identical. The authors conclude that schizophrenics can exhibit normal reaction times when they are given longer intervals between trials.

Serial invalidation

In 1956, Bateson et al described a theory of schizophrenia which involves psychological development. This theory was based on clinical observation. It describes how, in childhood, a great deal of behaviour the child exhibits is responded to by "double bind" - a situation where no matter what the behaviour is, it is wrong. An example of double-bind is given. It describes a situation where the mother of a young schizophrenic was visiting him in hospital, and accused him of no longer loving her. When the patient then tried to kiss his mother, she withdrew saying "Don't touch me". The theory is based on the idea that continual double bind responses lead to a malfunction of the learning process, since positive reinforcement never occurs. No matter what a person does, he can't win, and the only way is to withdraw into a personal world and possibly develop a schizophrenic personality.

Bannister (1960) has reported successful discrimination between thought-disordered schizophrenics, other psychiatric patients, and normal subjects using the Repertory Grid devised by Kelly (1955). The Repertory Grid is basically a sorting test in which the relationships between conceptual categories are measured statistically. It is argued that each individual, during the course of development, builds up a complex of interrelated concepts or constructs which determine his cognitive attitudes to his environment. Bannister's hypothesis (Bannister 1965) is that schizophrenic thought disorder is a direct result of a process of "serial invalidation" by which construct systems are continually invalidated as the expectations they generate are not fulfilled. For example, we might normally link together such constructs as "loving, kind, sincere, affectionate, reliable", in our relationships with others. If, however, experiences such as continual double-bind reactions to one's behaviour invalidates such links between constructs, this would lead to a loosening and weakening of relationships between such constructs, and then to a general breakdown in the individual's responses to his environment. Weakened conceptual structure is shown by thought disordered schizophrenics in the Repertory Grid test as a loss of the correlations between concepts which are apparent in the normal integrated personality (Bannister and Fransella, 1966).

Bannister and Salmon (1966) found that schizophrenic patients operate at a near normal level (in terms of constancy of conceptual structure on the Repertory Grid) in dealing with concepts concerning objects, but that their thought disorder is more evident when they are using concepts about people. The authors interpret this to indicate that schizophrenic thought disorder is initially determined by the patient's interpersonal experience which originate from pathological family dynamics involving double-bind and serial invalidation.

Faulty logical thinking

Von Domarus (1944) observed that schizophrenics may consider two things identical merely because they have some identical properties. The schizophrenic may reason, to quote Arieti (1966 p.37) "The Virgin Mary was a virgin. I am a virgin. Therefore, I am the Virgin Mary". Arieti believes that schizophrenics make use of isolated segments and parts in judging the whole of a concept.

This principle was subjected to empirical testing by Williams (1964) who gave a 96-item syllogistic reasoning test to hospitalized normal and schizophrenic patients who were matched for I.Q. No differences were found between the groups. Gottesman and Chapman (1960) gave a 40-item syllogistic reasoning test to normal subjects and schizophrenic patients and found no differences. These research workers concluded that defects in deductive reasoning play little or no part in schizophrenic thought disorder.

Experimental Approach and Aims of the Study

The literature in the first section dealing with language in schizophrenia showed how schizophrenic patients communicate less well than control subjects, that they tend to make less use of contextual cues in language than controls (although this was found to be also true for depressed patients), that they tend to give uncommon word associations, that schizophrenics exhibit an overly fluent associational flow, and that in cases where a word has more than one meaning, the less frequent meaning is often neglected by schizophrenics. The investigators who revealed these facts about language did not go deeply into the underlying mechanisms which might be regarded as causes for the differences in language behaviour exhibited by schizophrenics, although some hypothesized an attentional defect as the underlying cause, and one proposed speed of stimulus presentation as a determining factor.

The literature in the second section described studies which were meant to reveal mechanisms underlying all schizophrenic deficiencies (disorders of language being only one category of deficient behaviour). Theories of underlying mechanisms included sensory overarousal, defects in attention, defects in the speed of processing stimuli, faulty logical thinking, and serial invalidation. However, these theoretically-oriented experiments did not generally use language as a medium for experimentation. When patients are shown to be easily distractible in a task of remembering a list of digits, or when overarousal to lights or tones is demonstrated, the results can hardly be applied to theoretical arguments regarding deficiencies shown in language per se. One aim of the series of experiments to be described in this thesis is to make some contribution towards a theoretical stand involving the basis of language disorders in schizophrenia.

Since the receptive side of language has been so neglected in past experiments dealing with schizophrenic language, it was thought useful to approach the problem by examining language comprehension in schizophrenia. The main reason for the paucity of experimental literature concerning language comprehension is the difficulty involved in methodology for the study of comprehension. Knowledge of what is involved can only be based on examination of overt behaviour, or a response, which then becomes a study of output rather than input. There is no way of solving this methodoligical problem, but designing the experiments so that the response is of the simplest possible form and so that the variables concerned with the response are held at a constant minimum, is a method of partially solving the methodological problem. Thus, many of the experiments to be described involve variations on the stimuli of a basic task of word comprehension.

The stimuli were varied with the aim of discovering which conditions and factors impede or improve processing and comprehension by schizophrenic patients. This approach is based on the general hypothesis that, given the right conditions, schizophrenic patients can understand language as well or nearly as well as normal persons. That is to say, once the impediments to language processing in schizophrenia (such as slowness, overfluency of associations, stimulus modality, etc.) are discovered and taken into account by experimental controls, conditions could be set up whereby schizophrenics could understand language as well as control subjects. This approach to the study of language may also shed light on the nature of language disturbances in schizophrenia, and to what extent the disorders are a difference in quality or quantity from normals.

The study to be described in this thesis involves the investigation of several aspects of the properties of language found to be relevant in the pilot studies, for comprehension by schizophrenic patients.

More specifically, in the first Section, which describes two pilot experiments, an attempt was made to investigate the extent to which schizophrenic patients differentiate between words as the names for objects, the extent to which schizophrenics as a group differ from other members of the linguistic community, and the extent to which sub-groups of schizophrenics differ from one another in this function.

In order to eliminate as many response variables as possible, a simple task was designed in which the subject was presented with a single picture of an object and one or more words orally with the instructions to match the picture with the name of the object it portrayed. The nouns chosen for the object names were controlled for the properties of words known to have effects on task performance with normal subjects, such as length of words (Kraus and Weinheimer,1964, 1967: Williams, 1965) and frequency of words (Cofer and Shevitz,1962; Gorman,1961; Howes,1964; Johnson _et al_, 1967; Oldfield, 1966; Rochford and Williams,1962, 1965; Solomon and Postman,1952;

Wingfield,1968; Winnick and Kressee, 1965).

The task was presented under two conditions. In the multiple choice condition, the subject was presented with a group of words from which to choose the name of a given picture, and under the single choice condition the subject was presented with one word at a time to which he had to respond "yes" or "no" as to whether it was the name of the object portrayed. These two conditions of testing word comprehension are analagous to the multiple choice technique and open-ended technique used in a vocabulary test given to normal subjects by Heim and Watts (1967) and by Raven (1958) in his Mill Hill Vocabulary test. Raven found no difference in the amount of errors made under the two techniques, but Heim and Watts found that the multiple choice condition was significantly easier for normal subjects. It was thought useful to find out if one or the other condition would be easier for schizophrenic patients.

The pilot task was designed so that eight alternative word choices were attached to the correct object noun. These alternatives were controlled for phonetic similarity and meaningful similarity to the correct name. Thus an analysis was made, not only of the number of errors made, but also of the types of words accepted or rejected by the subjects.

The results of the pilot studies revealed that some of the stimulus variables were irrelevant and did not distinguish between schizophrenic subjects and control groups (such as length and frequency of words) while some variables appeared to have great importance in influencing word comprehension by schizophrenic patients (such as the two conditions and the type of words wrongly accepted).

The series of experiments in Section 11 examines the relationship between incorrectly accepted words and the correct name. Two of the experiments in the second Section involve the same basic task as in the pilot experiments, with the exception that the alternative words are controlled and varied to reveal more exactly which sorts of words are acceptable or unacceptable as names for objects by schizophrenic patients, non-psychotic psychiatric patients, and normal subjects.

Section 111 is an investigation into the differences between the multiple and single choice conditions. Again, the basic task from the pilot experiments was employed with variations in the number of choices given, and in a further experiment, a variation in the procedure involving aids to the formation of "word boundaries" was introduced.

The outcome of the experiments in Sections 11 and 111 led to a theory based on the idea that the main factor underlying schizophrenic language disorder is a difficulty in forming meaningful boundaries between associated words, and that certain factors, such as the type of alternative words offered and the conditions under which the alternative stimuli are given, influence the schizophrenics ability to formulate adequate boundaries.

Section 1V is an investigation into modality differences in language. In the sections describing the literature in this Introduction, experiments involving interesting modality differences in schizophrenia were reviewed. An abnormal difference was found to visual and auditory stimuli in some experiments designed to investigate attention and arousability. However, language was not generally employed for stimuli. In Section 1V, the basic task used in the pilot experiments was presented in written form, and in a second experiment the picture of the object to be named was replaced by a sentence context. A clear modality difference was shown in the multiple, but not in the single choice condition, and one explanation offered is in terms of the theory involving the formation of word boundaries. An alternative explanation involved speed of the presentation of the stimuli. The

The subjects had more time to see a written word, than to hear a spoken word. In another experiment which controlled the speed of presentation, it was shown that speed was an important factor for word comprehension by schizophrenic patients.

Section V is an investigation into the effect of the speed of auditory stimulus presentation on performance. A new task was designed, which involved comprehending whole sentences in the form of commands. The response, however, was kept as simple as possible. The commands were controlled for length and frequency of the words used, and the speed of the commands was varied in four ways. The measurements recorded were the amount of errors made to the commands, and also the amount of repeating of the words in the commands, which subjects did spontaneously while searching for the correct response. The results showed that speed is an important factor in schizophrenic language comprehension, and the results on repetitions shed some light on information processing in schizophrenic patients and non-psychotic patient controls. The results of Section V also helped to elucidate the proposed theory of word boundary formation.

SECTION 1. PILOT STUDIES

Experiment 1. The Identification of Object Nouns

This was an experiment designed to investigate the comprehension of individual words by schizophrenic patients as compared with groups of control subjects selected to represent variability in the linguistic community. Patients suffering from senile dementia and from dysphasia were used as control subjects to represent different language disorders. Five-year old children represented those with underdeveloped language skills. Two of the control groups were regarded as normal in the linguistic community: adults with no mental disabilities, and non-psychotic psychiatric patients.

The comprehension of individual words was tested by matching a picture of an object and its name under two conditions which were compared: one being an open-ended technique, and one involving multiple choice. The correct name was given as one of nine alternative words, and the eight incorrect words were either phonetically similar, meaningfully related, or irrelevant to the correct name. An analysis was made of the types of words incorrectly accepted or rejected by subjects. Long and short words were also compared for comprehensibility as were rare and frequent words.

Methods

Material

A task was prepared from 12 object nouns and 12 pictures of these nouns. The pictures were outline drawings of the objects in black ink on white 4" x 6" cards*. Each picture had a single, unequivocal name.

Nine of the nouns were divided equally into 1, 2 and 3 syllable words, and into words of AA, 29-49 and 1-10 frequencies according to the Thorndike and Lorge (1944) word count. In addition, three nouns consisted of one composite noun and its two parts. The nouns were:

	AA	29-49	1-10	Composite noun
One-syllable	cup	boot	dice	nail
Two-syllable	window	arrow	hatchet	finger
Three-syllable	newspaper	elephant	gondola	fingernail

Attached to each of these 12 nouns were 8 alternative words. These alternatives formed the choice situation in each item. The 8 words were chosen in each case as follows: 2 were phonetically similar to the object noun at the beginning of the word; 2 were phonetically similar to the object noun at the end of the word; 2 were words related in meaning to the object noun, and 2 were irrelevant to the particular stimulus to which they were offered, although they were the names of the other object nouns in the task. The object nouns and their accompanying alternative words were:

* Photographs of the pictures are shown in Appendix F, part i.

Object noun	Beginning phonetically similar	Ending phonetically similar	Meaning-fully related	Irrelevant
cup	cut come	pup sup	sip saucer	nail boot
boot	boon booze	root loot	foot kick	dice cup
dice	dike dine	price vice	gamble fortune	boot nail
window	wind windsor	meadow rainbow	frames glass	finger hatchet
arrow	arrogant arrowhead	sparrow marrow	bow archery	finger hatchet
hatchet	hatchway hatching	latchet prophet	tree hacking	arrow window
newspaper	newsvendor newsreel	white paper wallpaper	press correspondent	fingernail elephant
elephant	elevate elementary	triumphant infant	hunting enormity	newspaper gondola
gondola	gomorrah gonad	hyperbola parabola	Venice oar	fingernail elephant
nail	name naked	pail tail	iron join	cup dice
finger	finish finial	singer linger	touch contact	hatchet window
fingernail	fingering finicky	cottontail toenail	wash scratch	gondola newspaper

The 8 alternative words together with the object noun made up one item of the 12 item task. The words within each item were arranged in random order. The items were also placed in random order. A list of the items as such was typed, duplicated and used as scoring sheets in the administration of the task. The scoring sheet is shown on the next page.

SCORE SHEET

NAME ______________________________

1.	wind meadow frames arrow glass finger windsor window rainbow	2.	vice price fortune gamble dice dike dine nail boot	3.	fingernail hyperbola parabola gonad oar gondola gomorrah venice elephant
4.	hatchet window touch contact finger finial singer linger finish	5.	press elephant fingernail correspondent news vendor newsreel white paper wallpaper newspaper	6.	infant elevate hunting triumphant newspaper enormity elephant gondola elementary
7.	newspaper scratch fingering cottontail fingernail wash gondola toenail finicky	8.	finger tree prophet hatching latchet hatchet arrow hacking hatchway	9.	arrowhead sparrow window archery hatchet bow marrow arrow arrogant
10.	dice pail cup nail iron join naked name tail	11.	sup cut cup sip nail pup come saucer boot	12.	dice kick root boon loot booze foot boot cup

Naming:

1.	window	2.	dice	3.	gondola
4.	finger	5.	newspaper	6.	elephant
7.	fingernail	8.	hatchet	9.	arrow
10.	nail	11.	cup	12.	boot

A recording of the words in the random order as shown above was made on tape in a standard English female voice at the rate of one word per five seconds.

Procedure

Each subject was tested individually in a quiet room. Before testing, attempts were made to develop rapport during a short conventional conversation. The subject was then given the stimulus pictures and words one at a time, and his responses were recorded on the response sheet.

In order to administer the task under two different conditions the task was divided in half. The two halves were systematically alternated from one subject to another. Under one condition, the "multiple choice" condition, the subject was given the following instruction: "You will hear a list of words on the tape. When you hear the name of this picture, or what this is a picture of, please say 'yes'. For example, if I give you a picture of a dog, and the words 'cat' and 'log' come up on the tape, you should remain silent. But when you hear the word 'dog', which is the name of the picture, you will say 'yes'".

Under the second condition, the "single choice" condition, the subject had to respond with "yes" or "no" to each stimulus word as to whether or not it was the name of the picture, and the following instruction was given: "To each word you hear on the tape recording you will say 'yes' or 'no' as to whether it is the name of the picture or not. If the word you hear is what you see a picture of, say 'yes'. If it is not what you see a picture of, say 'no'. For example, if you are shown a picture of a dog and you hear the word 'cat', say 'no' because it is not a picture of a cat. But when you hear the word 'dog', say 'yes' since it is a picture of a dog."

Each time the subject responded positively to a word which was not the correct name he was asked if the word he responded to was the name of the picture. If the subject once again stated that it was the name, a note indicating an error was made on the response sheet. Subjects often explained why they chose to accept an incorrect word and these reasons for errors were noted.

After testing, schizophrenic subjects were asked to explain the meanings of four proverbs:

1. Don't count your chickens before they hatch.
2. Make hay while the sun shines.
3. A stitch in time saves nine.
4. Still waters run deep.
5. The subject was then asked to answer an open-ended question: "If you were lost in a forest in the daytime, how would you set about finding your way out?" (taken from the WAIS Comprehension Subtest).

The purpose of these questions was to elicit the presence or absence of thought disorder as clinically demonstrated.*

*Although proverbs and open-ended questions may not be considered by all psychologists to be the best measure of thought disorder, it is the most widely used means for assessing the presence of thought disorder by clinicians, and has been the major clinical tool for this purpose for over 40 years (Gregg and Frank, 1967).

Subjects' answers were taken down verbatim. Later, schizophrenic subjects were divided into three groups with regard to thought disorder - "thought disordered", "non-thought disordered", or "undetermined".

After these questions each subject was shown the 12 pictures from the task once again. Each subject was asked to name all the pictures one at a time, and the names the subjects used were noted.

Scoring

Scoring was based on the number of errors made. This was done in two ways. One way (Method A) is to consider an error as any incorrect response made by the subject, so that the subject can have a maximum of nine errors in any one item by accepting the eight incorrect words and rejecting the correct response. The maximum number of errors for one subject in the whole task would then be nine times 12 items, or 108 possible errors.

In Method B, the errors were counted per item. There are 12 items, and no matter how many times the subject makes an incorrect response in any one item it is counted as one error. The maximum number of errors for any one subject is 12. All the scoring is based on Method B except the scoring for "types" of errors made.

Statistics

A combination of parametric and nonparametric methods were used to analyze the results. For presentation purposes, figures utilizing proportions are most often used, although the raw scores, the means and standard deviations are given in the appendices. Only nonparametric methods were used however to compute statistical differences, because the inferences concerning normal distributions needed for parametric methods could not confidently be made.

Interaction analyses was not attempted, as this is not possible using nonparametric techniques. All p-levels of differences are two-tailed.

When there are two appropriate nonparametric tests available for comparing data, they are both used. For instance, the Wilcoxen Matched Pairs Signed Ranks Test (Siegel, 1956) and the Sign Test (Siegel,1956) were often used on the same comparison. The Wilcoxen Test puts more value on the size of individual score deviations while the Sign Test puts more value on the number of subjects who deviate. When both techniques were employed different p-levels often resulted, as can be seen in some of the tables in the appendices.

Subjects

Experimental Subjects

Sixty schizophrenic patients were studied in Fulbourn Hospital, Cambridge. This is a mental hospital containing approximately 800 psychiatric patients about 100 of whom are suffering from senile psychosis.

The schizophrenic subjects collected were of two types, acute schizophrenic patients (N=30) and chronic schizophrenic patients (N=30).

The acute subjects were patients taken from the admissions wards within a week of admission. The diagnosis of acute schizophrenia was clinically determined by the admitting psychiatrists. If upon discharge, the consultant psychiatrist in charge of each case changed the diagnosis, the subject was eliminated from the experiment. Only patients in their first or second admission to a mental hospital were accepted in this group. The 30 subjects were equally divided into 15 men and 15 women. Their mean age was 32.5 years ranging from 16 years to 55 years.

The chronic subjects were drawn from two sources: either they were living in the hospital for at least three years, or they were in the admissions wards being admitted for the fifth time or more with a diagnosis of schizophrenia. Most of the chronic schizophrenic patients were taken from the admissions wards, as too few chronic schizophrenics of a comparable age to the acute subjects live in the hospital for a sizable experimental group to be collected.

It could be argued that the chronic subjects who live in the hospital (10 subjects) are suffering from what has been called "institutionalization" in addition to schizophrenia. If this is the case, it is not derived from a highly institutionalized atmosphere-all the wards at Fulbourn Hospital are open, and all the 10 subjects have jobs in the hospital.

The 20 chronic schizophrenic subjects chosen from the admission wards, on the other hand, could be thought of as having a relapse of acute schizophrenia. However, it was felt that by the fifth admission, the schizophrenia was most probably chronic, and hence no subjects were admitted to the chronic group unless they had been admitted to the hospital five times or more.

The 30 chronic schizophrenic subjects were diagnosed as such by their consultant psychiatrist. They were equally divided into 15 men and 15 women subjects. Their mean age was 38.1 years ranging from 21 years to 62 years.

All the schizophrenic subjects were being treated with phenothiazine tranquilizing drugs (most commonly with chlorpromazine), but none were being given courses of E.C.T.

Pugh (1968) has found that chlorpromazine does not affect judgement or reaction time in schizophrenia, although it reduces anxiety over threatening stimuli, as measured by galvanic skin response amplitude. It also reduces the number of spontaneous GSRs which are common in schizophrenia. As most of the schizophrenic subjects were being treated with chlorpromazine, this evidence must be taken into account when analyzing the data.

After the data had been collected, two subdivisions of the schizophrenic subjects were made, apart from the already existing division into acute and chronic groups. Schizophrenic subjects were divided into categories of paranoid or non-paranoid (on the basis of psychiatric diagnosis) and into groups of thought disordered or non-thought disordered.

The thought disordered/non-thought disordered division was made on the basis of the clinical assessment described in the procedure. Each subject was asked to explain four proverbs and to answer an open-ended question. If any one proverb or the question produced a clearly thought disordered response, the subject was classified in the thought disordered group. Subjects who did not produce clearly thought disordered or clearly non-thought disordered responses were dropped from this part of the analysis, and labelled "undetermined". Simply being concrete in response to the proverbs was not counted as thought disordered, as this phenomenon has been shown in other psychiatric groups (Payne and Hewlett,1960) although Reed (1968) claims it is specific to schizophrenia. Underlined below are some examples of what were taken to be clearly thought disordered responses.

1. Male schizophrenic, aged 45. 1. Don't count your chickens before they hatch. "We cannot see into the future. We must not ask to see into the future." 2. Make hay while the sun shines. "Be content with what you have already. Someone reduced to poverty who is strong enough to keep cheerful." 3. A stitch in time saves nine. "You should ask my wife. A small trifle. Someone who goes in for hire purchase". 4. Still waters run deep. "To keep unruffled.. I have something bottled up in me for years. Now is the time to give it expression. I'm a bit nonplussed. Peace on earth to all good men. It's a.. I have found out in my Austrian holiday that even water still, or even lakes, if you dwell on it, can happen. You can't make water anywhere. You can't relieve them." 5. If you were lost in a forest in the daytime, how would you set about finding your way out? "Scratch your name in a tree, or make tracks."

11. Female schizophrenic. Aged 47. 1. (Chickens) "Don't bank on everything, it may come unstuck". 2. (Hay) "Enjoy life, there might be trouble ahead". 3. (Stitch) "Everything falls apart, mass produced especially, but a fully trained machinist is the best worker". 4. (Still waters) "Not out with what all the plans ought to be". 5. (Forest) "By hook or by crook".

111. Male schizophrenic. Aged 34. 1. (Chickens) "Don't jump before you reach the pit". 2. (Hay) "Be happy while you can". 3. (Stitch) "Time and motion study. It's better to carry two buckets of water when you can carry one big one". 4. (Still) "Beauty is skin deep". 5. (Forest) "Where is the forest?, Kansas, or the Sahara desert?. Look for the nearest road."

1V. Female schizophrenic. Aged 38. 1 (Chickens) "I've forgotten it. Don't go on about things around you know, and don't keep on about them".

2. (Hay) "It's a very common saying. While you have the chance to make some money". 3. (Stitch). "Get in advance so it won't go to rack and ruin". 4. (Still waters) "It's a very pretty one. It's an old one isn't it. I've forgotten it." 5. (Forest) "There's always an outlet. Been in the country all my life. Primrose and bluebell picking in the forests. When they put the trees up they must have made a track."

V. Male schizophrenic. Aged 16. 1. Chickens) "Chickens lay eggs and you mustn't count them. Like mothers having babies." 2. (Hay) "Straw and grass". 3. (Stitch) "You save nine stitches instead of one." 4. (Still waters). "Don't know. God could tell you". 5. (Forest) "Make a fire and the fire brigade would come running. Or shout".

V1. Female schizophrenic. Aged 24. 1. (Chickens) "Don't count on too much." 2. (Hay) "Do a thing when you feel like it". 3.(Stitch) "If you do something in time it saves the article". 4. (Still waters) "Somebody quiet takes a lot of understanding." 5. (Forest) "Take off your clothes, put them on a stick and hope an airplane will see you."

V11. Female schizophrenic. Aged 44. 1. (Chickens) "Don't put all your eggs in one basket". 2. (Hay) "Get lost in the sun, or, live our lives as we may." 3. (Stitch) "You get something done more quickly than if you did it any other way". 4. (Still waters) "You have a certain quality. That you are a reserved person or an enigmatic person." 5. (Forest) "You wouldn't follow the sun because the sun sets in the horizon. Follow the moon."

The numbers of patients who fell into each subgroup were as follows:

	Acute (N=30)	Chronic (N=30)
Paranoid and Thought disordered	5	4
Paranoid and Non-thought disordered	7	0
Paranoid and Undetermined	0	2
Non-paranoid and Thought disordered	10	9
Non-paranoid and Non-thought disordered	4	9
Non-paranoid and Undetermined	4	6

Control Subjects

Control subjects were chosen to represent linguistic variability within the community. They were:

- 10 normal adults, 5 men and 5 women with a mean age of 29.2 years and an age range of 17 years to 63 years;
- 10 children, 5 boys and 5 girls with a mean age of 5.2 years ranging from 4.9 years to 5.9 years;
- 10 expressive dysphasic patients, 4 men and 6 women with a mean age of 52.6 years ranging from 24 years to 71 years;
- 10 patients with senile dementia, 5 men and 5 women, with a mean age of 77.4 years ranging from 63 years to 89 years.
- 10 non-psychotic psychiatric in-patients, 5 men and 5 women with a mean age of 33.0 years ranging from 19 years to 49 years.

The normal adults were patients in the orthopaedic wards of Addenbrooke's Hospital, Cambridge. They were volunteers and none were suffering serious illness or pain at the time of testing. None had a history of psychiatric treatment of any kind.

The children were from an infant school in Cambridge.

The dysphasic patients were taken from the neurological wards of Addenbrooke's Hospital suffering from lesions of various types in the brain. There was a large range in the severity of expressive dysphasia, but none were jargon dysphasics or had severe comprehension defects, as determined by the Rochford and Williams (1964) test for dysphasia which was administered to each subject prior to testing.

Demented patients were taken from the geriatric wards of Fulbourn Hospital. The diagnosis of dementia had been made by the consultant psychiatrist in charge of each case.

The non-psychotic psychiatric patients were from the admission wards of Fulbourn Hospital. They had the following diagnoses: inadequate personality (2 subjects), phobic state (1 subject), reactive depression (3 subjects), obsessionality (1 subject), personality disorder (2 subjects), anxiety neurosis (1 subject). The registrar psychiatrist in charge of each case confirmed that none in this group were suffering from schizophrenia or any form of psychosis.

Results

Multiple and Single Choice Conditions

Figure 1 shows that more errors were made in the single choice condition than in the multiple choice condition for all groups of subjects except the children and the non-psychotic psychiatric patients. However, the difference is statistically significant only in the case of schizophrenic subjects ($p < .01$) excepting the non-thought disordered group, and demented patients ($p < .01$) (See Table 1, Appendix A).

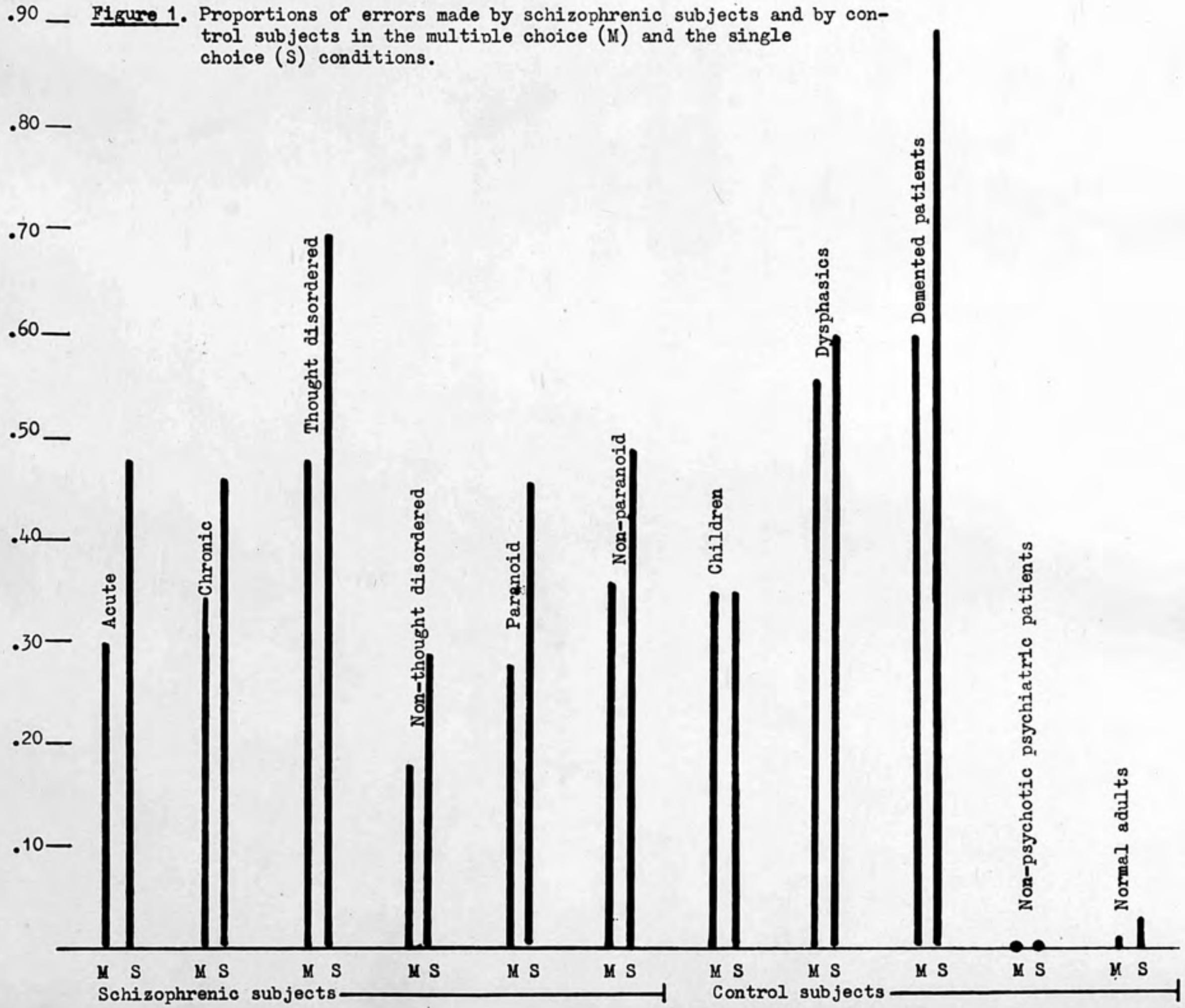


Figure 1. Proportions of errors made by schizophrenic subjects and by control subjects in the multiple choice (M) and the single choice (S) conditions.

Word Length

A general trend for long object nouns to produce more errors than short object nouns was found. The statistical comparisons using the Wilcoxen Test and the Sign Test revealed that the difference between the errors made on one-syllable object nouns and three-syllable object nouns was significant for the chronic schizophrenic subgroup ($p < .01$), for the non-paranoid subgroup ($p < .01$) and for children ($p < .01$) (See Table 2, Appendix A).

Word Frequency

The children were the only group to show a frequency effect, as can be seen in Table 3 (Appendix A) where the errors made on AA and 1-10 object nouns are compared. Five-year old children made more errors on rare words than frequent words ($p < .05$).

Composite Words

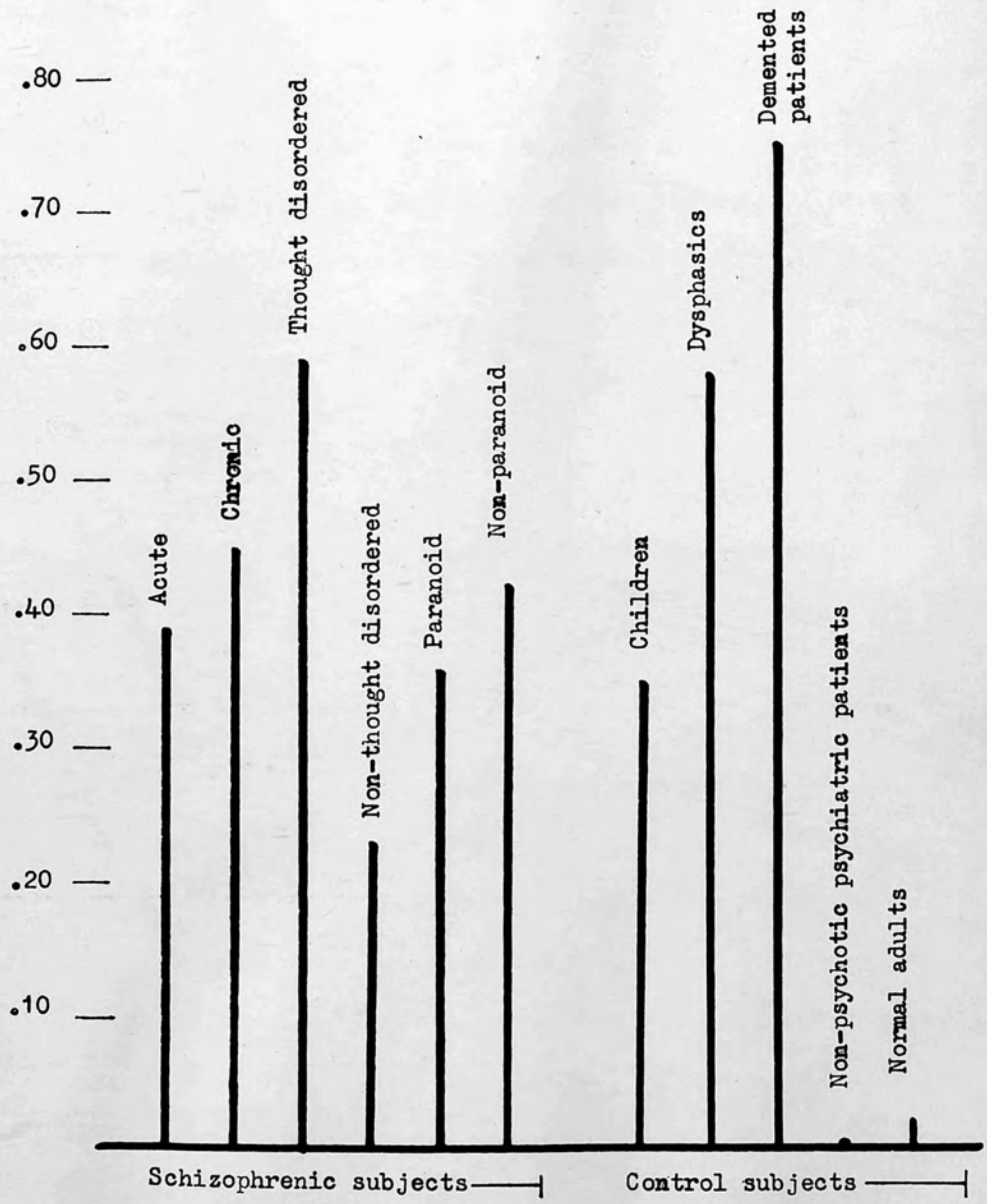
All groups produced less errors when the object noun was a component of a composite word than when it was the composite word, as is shown in Table 4 (Appendix A).

Comparison of Groups of Subjects

These varied groups of subjects differed dramatically on the amount of errors they produced, as can be seen in Figure 2. At one extreme, normal adults' and non-psychotic patients' errors were almost non-existent, whereas demented patients made almost the maximum number of errors possible (see Table 5, Appendix A).

Schizophrenic subjects made significantly more errors than non-psychotic psychiatric patients ($p < .002$) using the Mann Whitney U-Test (Siegel, 1956) and significantly more errors than normal adults

Figure 2. Proportions of overall errors made by schizophrenic subjects and control subjects.



($p < .002$), Mann Whitney U-Test). The demented group made more errors than the schizophrenics ($p < .002$, Mann-Whitney U-Test).

Among the schizophrenic subgroups (see Table 5a, Appendix A), the thought disordered subjects and non-thought disordered subjects were the only ones to differ ($p = .0262$, Mann Whitney U-Test for large groups).

Naming

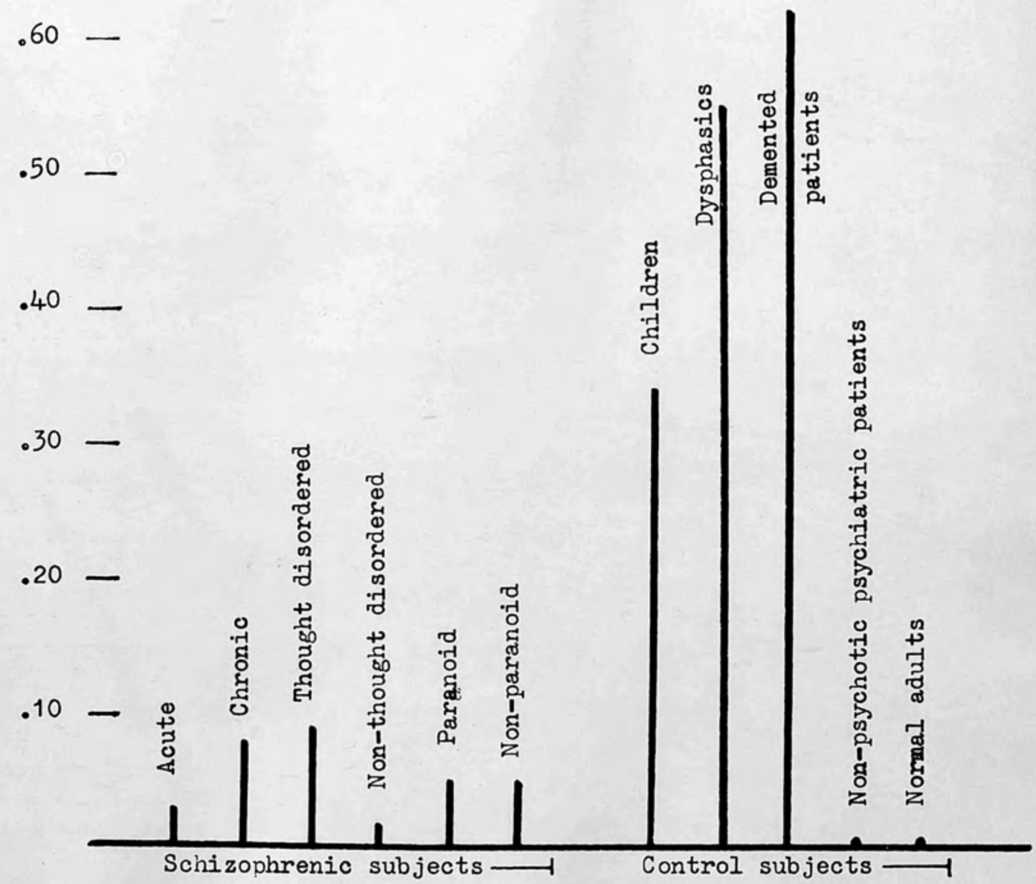
Subjects were given a break between completion of the task and naming the pictures, as has been described in the procedure. Figure 3 gives the proportions of naming errors and Table 6 (Appendix A) shows the incidence of incorrect naming for each group. Compared with the number of errors made in the task, the schizophrenic groups made remarkably few naming errors. Chi-square shows a significant difference ($p < .001$) among the groups in frequency of incorrect naming, although there is no difference among the schizophrenic subgroups in naming errors.

Schizophrenic subjects often elaborated their naming, but as long as the correct name was given, elaborations were not counted as errors. Examples of elaboration often given by schizophrenic patients are: "window with curtains"; "dice with dots"; "elephant with ears and a trunk"; "cup with handle"; "elephant in the zoo"; "drinking cup".

The naming errors made by children were almost entirely the rare and/or long words with which they were unfamiliar. Usually the response was not a genuine error, but one of "I don't know".

Demented patients often appeared to be suffering from visual misperception which accounted for many of their naming errors. Some examples of naming responses by demented patients were: "It is a projecting thing" (to hatchet); "It might be something growing" (to

Figure 3. Proportions of naming errors made by schizophrenic subjects and control subjects.



arrow); "if you took off the trunk it's a man's face" (to elephant); "a tree" (to nail); "church steeple" (to nail).

Types of Errors

Five types of errors could be made by subjects. They could

(a) accept a word phonetically similar at the beginning of the word,

(b) accept a word phonetically similar at the end of the word,

(c) accept a word related in meaning,

(d) accept an irrelevant word,

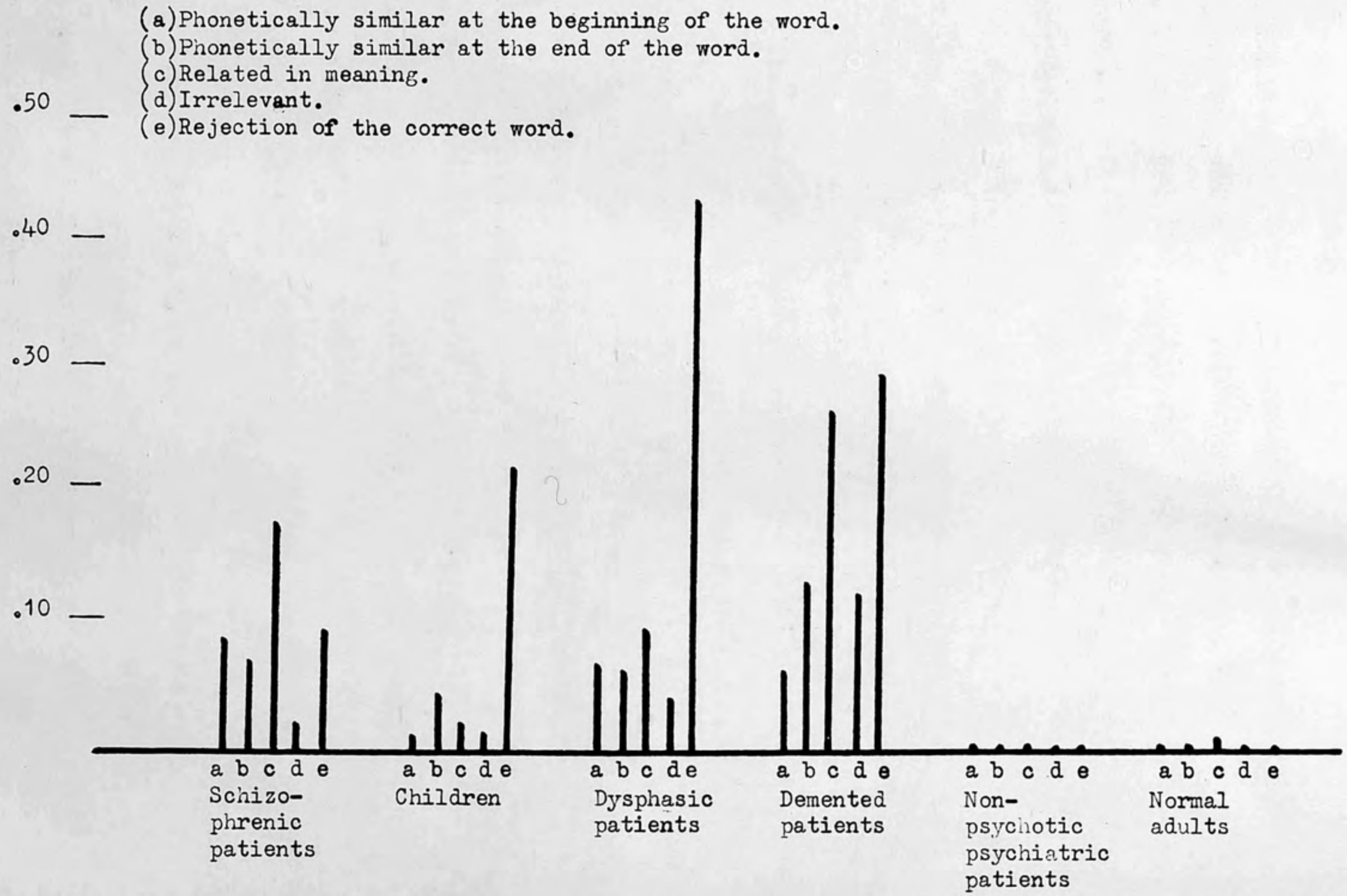
(e) reject the correct word.

The types of errors made by schizophrenics differed from any other group of subjects in consisting predominantly of related words (see Figure 4).

Table 7 (Appendix A) shows the differences in actual numbers and the means for errors in each of the five categories. For this analysis it was necessary to count errors by Method A. Whereas the first four types of errors (a,b,c,d) could be made twice in each item by each subject, the rejection type of error (type e) could only be made once. This is taken into account in computing the proportion of errors, but the means of type (e) errors are not comparable with the other means in Table 7 (Appendix A).

A comparison of the highest error scores of each of the types with the second highest error scores, and the second highest errors scores with the third was made using the Wilcoxen Test (see Table 7A, Appendix A). All the schizophrenic subgroups except the paranoid schizophrenics made significantly more related word type errors (type c) than any other kind ($p < .01$ for each subgroup, except $p < .05$ for the non-thought disordered subgroup). The children and dysphasic groups each made more rejection errors (type e) than any other kind at $p < .01$.

Figure 4. Proportions of types of errors made by schizophrenic subjects and control subjects.



The demented patients showed no difference between the amount of type (e) and type (c) errors, although these two types of errors were significantly different from the other types at $p < .01$.

In the procedure the method for scoring an error was described. When the subject accepted a word which was not the correct name he was asked again if the word he had responded to was the name of the picture, or what the picture was called. If the subject again indicated that he accepted the name, an error was scored. In many cases, subjects explained why it was the name of the picture.

Examination of the reasons given by schizophrenic subjects for accepting the wrong words showed that some associational relationship had been found, even if the errors were accepting words designed to be phonetically similar or irrelevant. In this sense, schizophrenics' errors were nearly all related word, or associated word type of errors. This was not true for any other group of subjects.

For example, asked if the word "infant" was the name of the picture of an elephant (this is a phonetically similar word at the end of the word) some schizophrenic subjects accepted it because it was an "infant elephant". The words designed to be related to elephant ("hunting" and "enormity") were also accepted, but for more obvious associative reasons. A few other examples of remote associations given as reasons for accepting phonetically similar words are: "finish" for "finger" because it ends; "meadow" for "window" because it could be seen through a window (although this was not the case in the picture presented); "rainbow" for "window" for a similar reason; "sparrow" for "arrow" because you can shoot them; "triumphant" for "elephant" because when he blows his horn he is triumphant.

When the first responses of this character were elicited from schizophrenic patients, it was thought that they did not understand the instructions properly. Instructions to accept only the name of the object pictured were repeated throughout testing - sometimes as often as before each one of the 12 items. However, this did not seem to have any effect, and schizophrenic subjects persisted with accepting related words as the correct names.

The major proportion of errors made by demented subjects were divided equally between acceptance of related words and rejection of the correct name, although the other types of errors made were also very many compared with schizophrenic subjects.

The character of the reasons offered for accepting incorrect names by demented subjects was quite different from those of schizophrenics. Demented subjects' reasons appeared to be often based on visual misperception of the pictures (as was their naming performance) although some associative reasons were also given.

Some examples of demented patients' reasons for accepting incorrect names were: "Nail" for "dice" because "it looks like nails in a box"; "rainbow" for "window" because "it is an open picture of a rainbow"; "marrow" for "arrow" because "it looks like one"; "pail" for "nail" because "it is an instrument"; "gondola" for "elephant" because "it is the same shape"; "contact" for "finger" because "it is being joined up, but I can't make out what these hooks are" (pointing to a part of the picture of a finger).

The greatest number of errors made by five-year old children was a rejection of the correct name. Acceptance of an incorrect name was rare for children, and when this occurred, reasons could rarely be elicited. If a reason was given it was usually that the subject "liked" that word. The rejected correct names by children were almost entirely rare words (1-10) and/or long words. Children are the only group for whom word frequency and length had a significant effect. The reason for rejecting the correct names in the case of children was quite obviously because they were not acquainted with the given word.

The greatest number of errors made by dysphasic subjects was also rejection of the correct name. Presumably this resulted from word finding difficulty generally exhibited by dysphasics (Rochford and Williams, 1965). Since none of the dysphasic subjects could speak coherently, reasons for making errors could not be elicited.

These findings raise a number of possibilities which are followed up in subsequent experiments. Experiment 2 is designed to confirm the findings of Experiment 1 by repeating the experiment with a new group of schizophrenic subjects using a new task with different object nouns and different alternative words. This new task however, was constructed by the same principles as the task used in Experiment 1.

The problems raised by the last result, concerning the connection between accepted names and the correct object noun are examined in Section 11. The question of the difference between the single choice and multiple choice conditions is followed up in Section 111.

Experiment 2. Replication of Experiment 1, Using Different Stimulus Words

It was thought useful to repeat Experiment 1 using different object nouns, to see if similar results appeared in a new group of schizophrenic patients.

The null hypotheses are as follows:

1. There is no difference between the multiple and single choice conditions.
2. There is no difference between the amount of errors made to long or to short words.
3. There is no difference between the amount of errors made to rare or to frequent words.
4. There is no difference between one schizophrenic subgroup and another on amount of errors made.
5. There is no difference in the proportion of naming errors made in Experiment 2 and in Experiment 1.
6. There is no difference between the amount of errors made on one type of word or another.

Methods

Material

A task of the same type as Experiment 1 was constructed, except 6 object nouns were used instead of 12. Pictures of the nouns were drawn in black ink on white 4" x 6" cards.* The nouns were equally

*Photographs of the pictures are shown in Appendix F, part ii.

divided into 1, 2 and 3 syllable words and into frequencies of AA and 1-10 according to the Thorndike and Lorge (1944) word count. The nouns were:

	AA	1-10
One-syllable	fish	jug
Two-syllable	table	giraffe
Three-syllable	Indian	acrobat

Attached to each of these 6 nouns were 8 alternative words as in Experiment 1. These other words formed the choice situation in each item. The 8 words were chosen in the same way as in Experiment 1; 2 were phonetically similar to the object noun at the beginning of the word; 2 were phonetically similar at the end of the word; 2 were related in meaning to the object noun, and 2 words were completely irrelevant (this is different from Experiment 1, where the "irrelevant" words were drawn from the other object nouns). The object nouns and their alternative words were:

Object noun	Beginning phonetically similar	Ending phonetically similar	Meaningfully related	Irrelevant
fish	fill fix	dish wish	fry swim	sack rust
table	taint taste	label fable	writing chair	censor capsule
Indian	indigo indecent	guardian plebian	wigwam red	obstruction committee
jug	judge jump	rug bug	water glass	knee tear
giraffe	giblets ginger	distaff carrafe	neck spots	diet cripple
acrobat	across acropolis	democrat combat	clown agility	gorilla dictaphone

The object nouns and their 8 accompanying alternative words were put into random order for each of the 6 items. The items were also placed in random order. A list of the words was typed, duplicated and used as scoring sheets in the administration of the task. The scoring sheet was arranged as follows:

SCORE SHEET

NAME ______________________________

1.	2.	3.
fry	bug	fable
sack	jump	censor
rust	water	label
dish	rug	taint
fix	glass	chair
wish	tear	table
swim	jug	writing
fish	judge	capsule
fill	knee	taste

4.	5.	6.
indigo	spots	gorilla
guardian	distaff	clown
red	neck	democrat
committee	ginger	acropolis
plebian	cripple	agility
Indian	caraf	acrobat
wigwam	giraffe	dictaphone
obstruction	giblets	combat
indecent	diet	across

<u>Naming</u>:

1. fish 2. jug 3. table

4. Indian 5. giraffe 6. acrobat

A recording of the words in random order as shown above was made on tape in the same standard English female voice as the tape in Experiment 1. The interval between the words within a single item was 5 seconds as in Experiment 1.

Procedure

The administration of the task was exactly the same as in Experiment 1. Each subject was tested individually in a quiet room. Before testing, attempts were made to develop rapport during a short conventional conversation. The subject was then given the stimulus pictures one at a time, and his responses to the words were recorded on the scoring sheet.

The task was administered under the two conditions: multiple choice condition and single choice condition. In order to have each subject respond under each condition the task was divided in half. The two halves were systematically alternated from one subject to another. The instructions for each condition were the same as in Experiment 1.

As in Experiment 1, each time the subject responded positively to a word which was not the correct name he was asked if the word he responded to was the name of the picture. If the subject once again stated that it was the name, a note indicating an error was made on the response sheet. Often, the subject would explain the reason why he believed an incorrect name to be the correct name. When this occurred these reasons for errors were noted.

After testing the subjects were asked to explain the meanings of the same four proverbs and open-ended question as in Experiment 1. As in the previous experiment, the purpose of these questions was to elicit the presence or absence of thought disorder as clinically demonstrated. Subjects' answers were taken down verbatim. Later the subjects were divided into three groups with regard to thought disorder on the same basis as previously. The subjects were also divided into paranoid or non-paranoid depending on psychiatric diagnosis.

After these questions each subject was shown the six pictures from the word task once again. The subjects were asked to name all the pictures one at a time, and the names the subjects used were noted.

Scoring and Statistics

Scoring was done in the same way as the previous experiment, by counting the number of errors. As before, Method A (all errors counted, maximum number per person being nine alternatives times six items = 54 possible errors) was necessarily used for the counting of "types" of errors made, and Method B (maximum number of errors per person = six) was used in all the other analyses.

As in Experiment 1, non-parametric statistics are used to compute statistical differences, and all p-levels given are two-tailed.

Subjects

The subjects were 20 acute and 20 chronic schizophrenic patients from Fulbourn Hospital, Cambridge. They were selected by the same criteria described in Experiment 1.

The 20 acute subjects were 10 men and 10 women. Their mean age was 32.8 years, ranging from 18 years to 55 years.

The 20 chronic subjects were 10 men and 10 women, with a mean age of 36.6 years ranging from 19 years to 60 years.

None of these subjects had taken part in the previous experiment.

As in Experiment 1, the schizophrenic subjects were divided into subgroups. The numbers of patients who fell into each subgroup was as follows:

	Acute (N=20)	Chronic (N=20)
Paranoid and Thought disordered	4	3
Paranoid and Non-thought disordered	4	0
Paranoid and Undetermined	0	2
Non-paranoid and Thought disordered	4	6
Non-paranoid and Non-thought disordered	4	5
Non-paranoid and Undetermined	4	4

Results

Multiple and Single Choice Conditions

Figure 5 shows that for each schizophrenic subgroup, the single condition produced more errors. As in Experiment 1, this difference reached significant levels ($p < .01$ for each subgroup except chronic schizophrenics, for whom $p < .02$, and paranoid subjects, for whom $p < .02$) except for the non-thought disordered subgroup (see Table 8, Appendix A).

In Figure 6 the proportions of errors in Experiments 1 and 2 for both conditions are shown. In the single condition, similar proportions of errors were made in both experiments. But in the multiple condition, less errors were made in Experiment 2 (see Table 8A, Appendix A).

Word Length

Unlike Experiment 1, where the chronic and nonparanoid schizophrenic subgroups showed a word length effect, no differences in word length were found for any of the subgroups in Experiment 2 (see Table 9, Appendix A).

Figure 5. Proportions of errors made by schizophrenic subjects in the multiple choice (M) and the single choice (S) conditions.

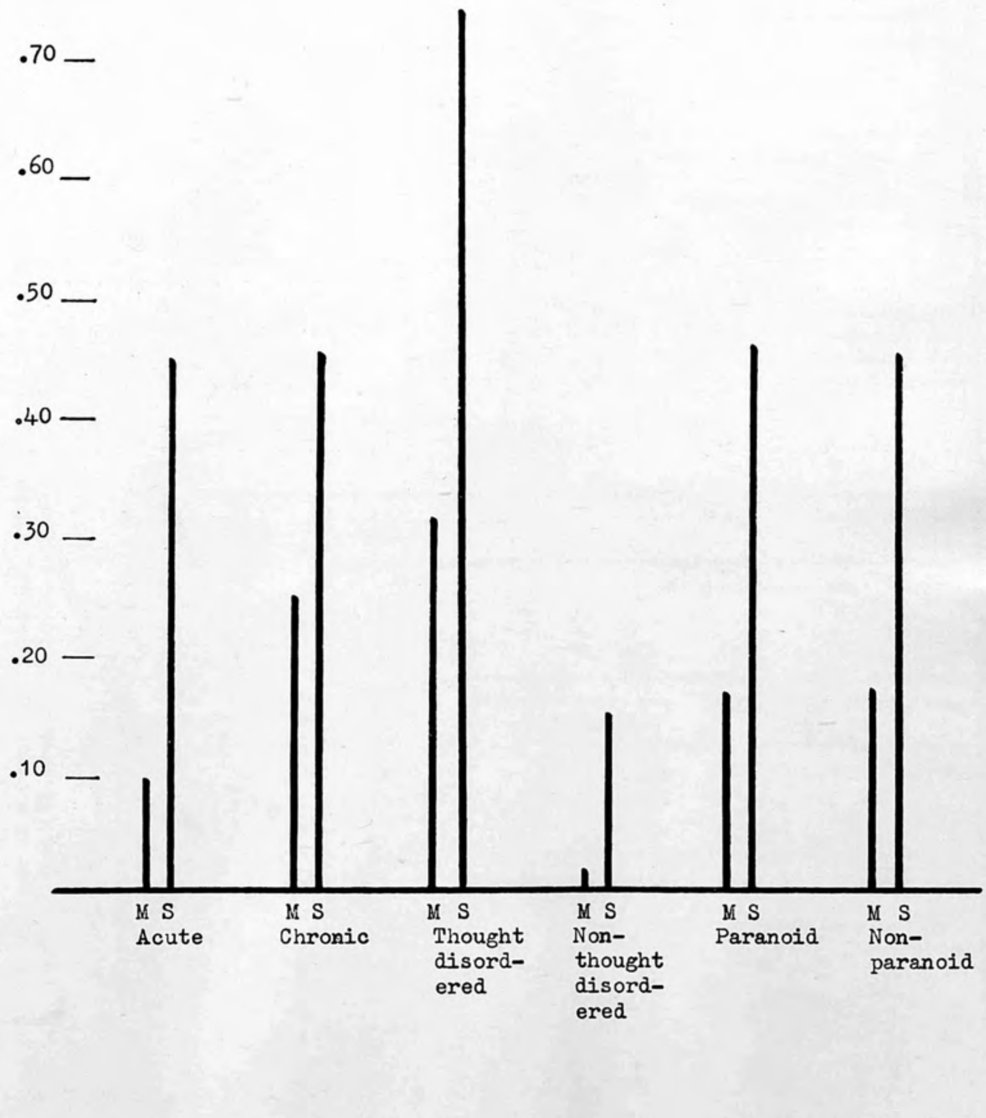
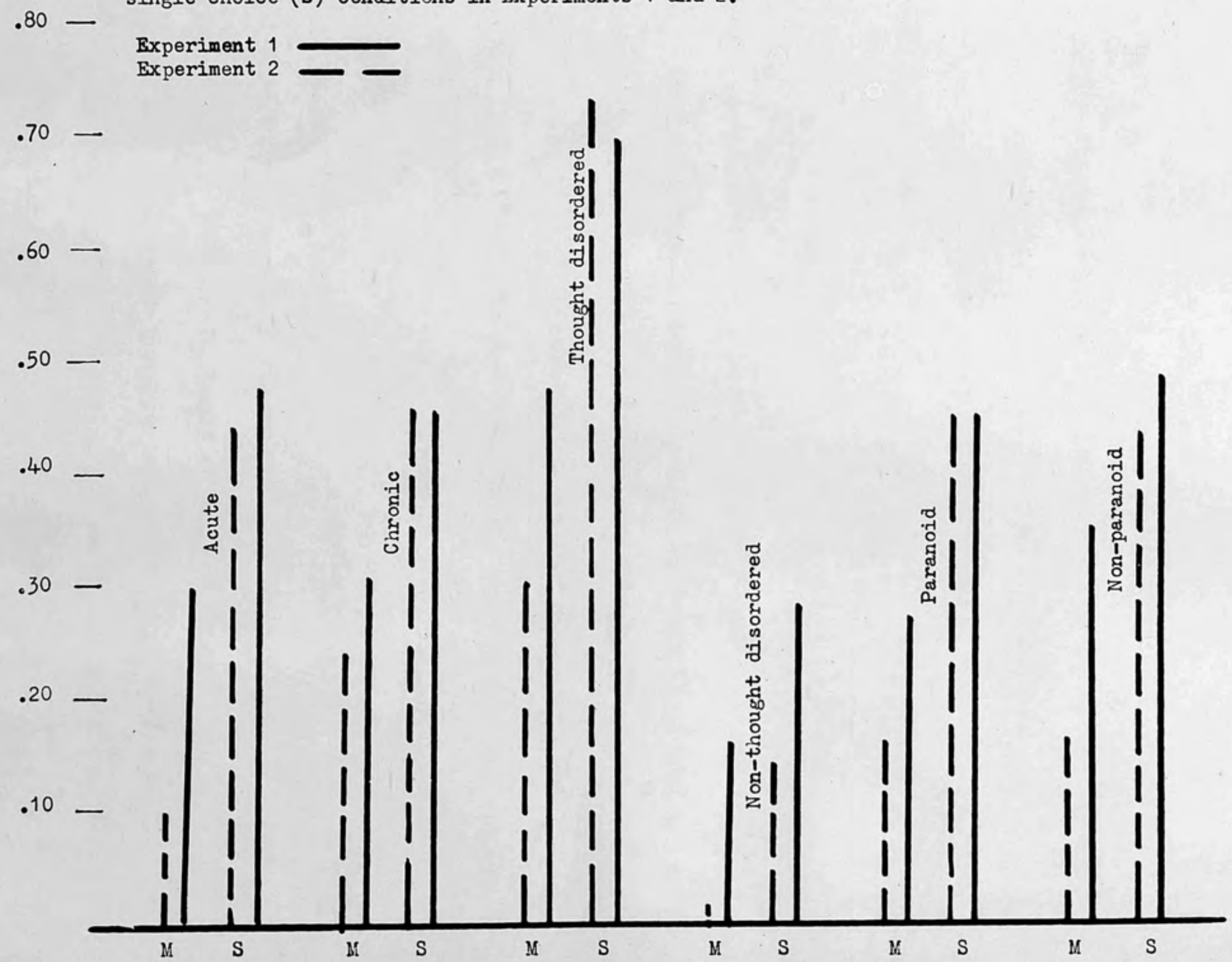


Figure 6. Proportions of errors made by schizophrenic subjects in the multiple choice (M) and the single choice (S) conditions in Experiments 1 and 2.



Word Frequency

As in Experiment 1, no differences were found between rare and frequent object names for schizophrenic subjects (see Table 10, Appendix A).

Subgroups

The Mann-Whitney U-Test was used to compare acute with chronic subjects, thought disordered with non-thought disordered subjects, and paranoid with non-paranoid subjects. As in Experiment 1, only the thought disordered and non-thought disordered differed significantly at $p < .002$.

Naming

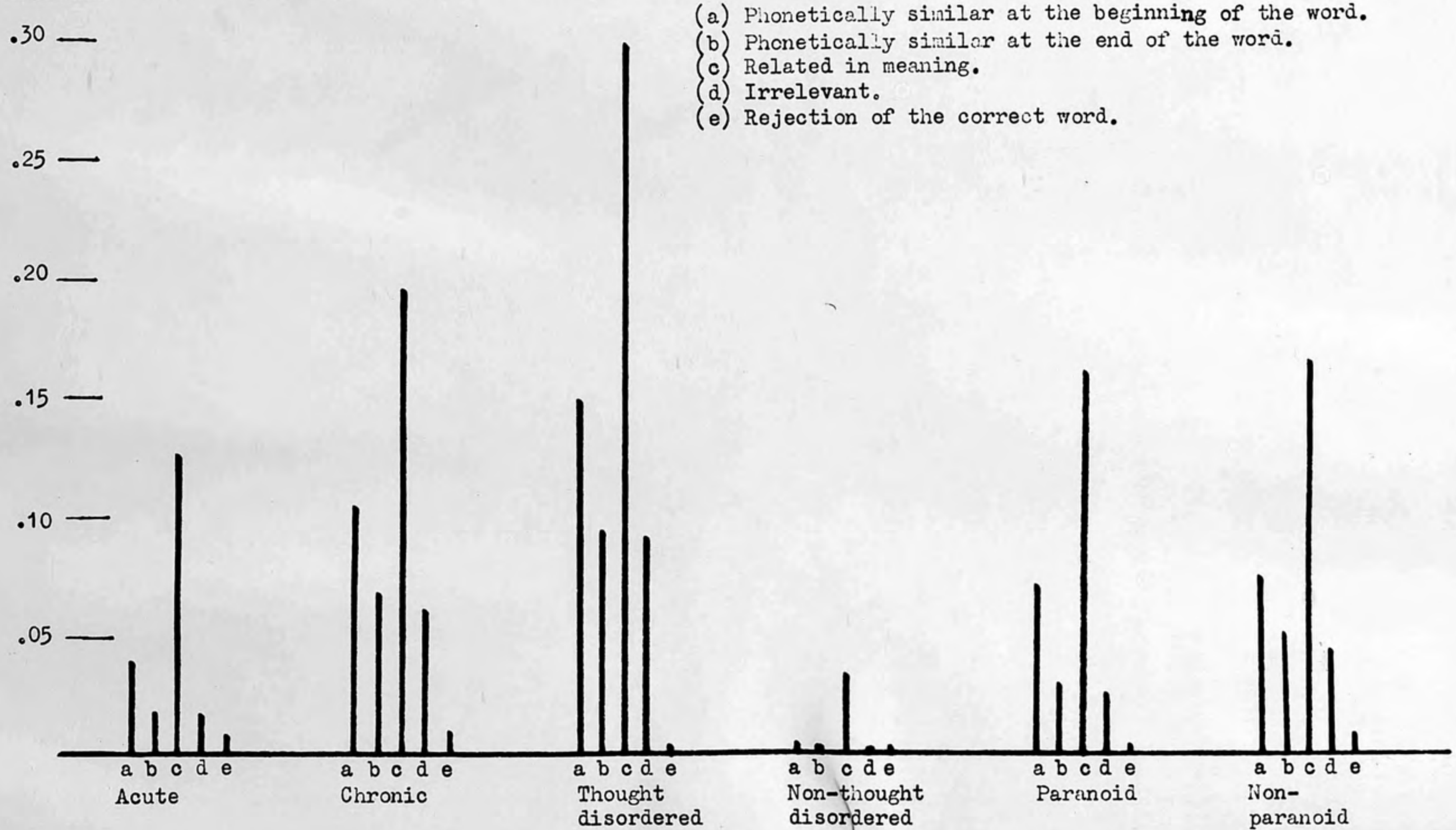
As in the first experiment, there was no difference among the schizophrenic subgroups in incidence of naming errors. There were slightly less naming errors in Experiment 2. (see Table 11, Appendix A). Elaboration as described in Experiment 1 was often exhibited by the subjects in this experiment.

Types of Errors

As in Experiment 1, schizophrenic subjects made more errors by accepting related words than any other type of error (see Figure 7). The Friedman 2-way analysis of variance among the types of errors reached significant levels for chronic subjects ($p < .02$), thought disordered subjects ($p < .001$) and for non-paranoid subjects ($p < .01$) (see Table 12, Appendix A).

In a comparison of the highest error scores of each of the types of error for each subgroup with the second highest error scores of each of the types by using the Wilcoxen Test, all groups

Figure 7. Proportions of types of errors made by schizophrenic subjects.



except the non-thought disordered subgroup had significantly more related type word errors than any other kind (see Table 12A, Appendix A).

As in Experiment 1, the reasons subjects gave for making errors were noted, and reasons involving association between the wrongly accepted word and the correct word were most often given, similar to the examples shown in Experiment 1 by schizophrenics.

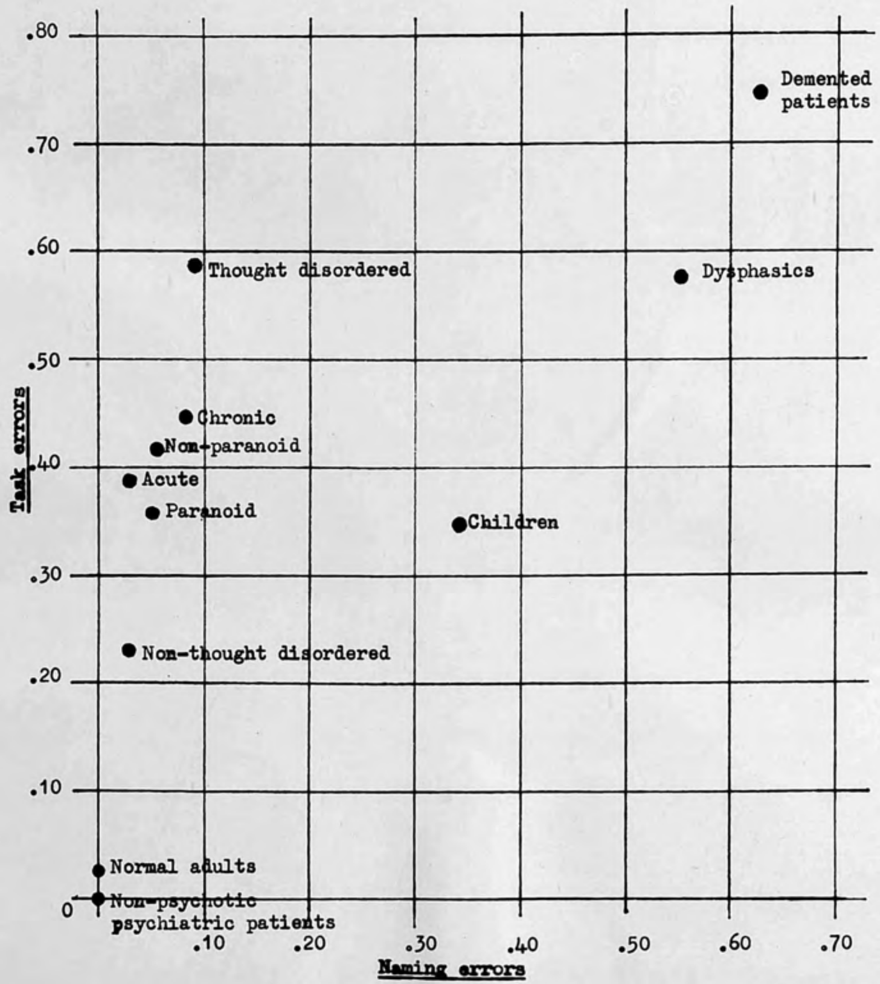
Discussion

Naming Performance and Task Performance: A Case for Examining the Receptive Side of Language in Schizophrenia

One might expect there to be a direct relationship between the amount of errors made in naming the pictures and the amount of errors made in the word identification task. This was the case for all the control groups (compare Figures 2 and 3) but not for the schizophrenic group. The proportion of naming errors for children, dysphasic patients and demented patients follows relatively the proportion of errors made in the task fairly closely, so that the more task errors made, the more naming errors were made. The non-psychotic psychiatric patients and the normal subjects also follow this pattern in that both the proportion of errors made in the task and in naming were extremely small. In comparison with the control groups, the difference between the proportion of errors made in the task and the proportion of naming errors is great for schizophrenic subjects. A considerable proportion of errors was made in the task by schizophrenic subjects, yet the proportion of naming errors was small in comparison (see Figure 8).

If the task can be regarded as a test of comprehension, and the naming as a test of expression, then this difference can be interpreted to indicate more of a comprehension disorder than an expressive disorder to exist in schizophrenia.

Figure 8. Proportions of naming errors and proportions of task errors made by schizophrenic subjects and control subjects in Experiment 1.



The Relationship between Elaboration in Naming and Acceptance of Meaningfully Related Words

Schizophrenic subjects were the only group to exhibit elaboration of the names. Elaboration was not counted as an error, provided the subject gave the correct name, so that "elephant with ears", a typical schizophrenic naming response, was not counted as an error. Elaboration can be regarded as a form of expressive error, but it also may be based on a comprehensive disorder. The subject may be unsure of his understanding of the whole picture or of the words he is using and therefore has a tendency to name the parts. The parts may have more relevance to schizophrenics than to control subjects in such a way that they feel they must be mentioned, however, one could not go so far as to say the parts mentioned were blurring the relevance of the name of the whole picture so that the schizophrenic subject named only the parts and disregarded the whole name.

However, when pictures are more complex, some research has shown gross misperception by schizophrenics of a fragmentary nature. Weckowitz (1960) demonstrated that schizophrenics cannot identify drawings of common objects if overlapping lines are superimposed.

Bemporad (1967) did an experiment using three cards from the Pseudo-Isometric Plates (generally used to test color perception) and one control card. Each of the three cards shows different sized dots in the shape of a number against a field of dots of contrasting colors. The control card was a clearly outlined number. Schizophrenic patients responded mostly to the dots (the part response) while the non-schizophrenic patient control group responded to the numbers (the whole response). The groups both responded to the clearly outlined number in the control card.

Elaboration in naming in Experiments 1 and 2 did not always involve parts of the picture (or fragmentation). Some subjects elaborated by involving phenomena of other types, e.g. "a happy elephant" or "an elephant in the zoo". If this kind of elaboration is to be taken into account, then elaboration cannot be regarded as only fragmentation of the picture, but as something more. Elaboration may in fact be related to the acceptance of meaningfully related words as names for the objects pictured in the task, which was characteristic of the schizophrenic group, and which was their main type of error. Elaboration could be regarded as the expression of a comprehensive disorder, in that schizophrenics are more aware of the meaningfully related words in the task, to the extent of wrongfully accepting them as names, and elaboration is the expression of this greater awareness.

However, in the task, schizophrenics were unable to reject wrong (although meaningfully related) words to a large degree, whereas in naming, they generally had the correct name to express (even if it was elaborated). The disorder was more clearly exhibited in the task (the comprehension test) than in the naming part (the expression test) of the experiments.

Rejection of the Correct Name versus Acceptance of Wrong Names

One of the most interesting results to come out of Experiment 1 was that unlike other members of the linguistic community, who tended to reject the correct word as their main form of error (except for those suffering from senile psychosis, who equally rejected the correct word and accepted wrong names), schizophrenics accepted wrong words as names as their main form of error.

This result is somewhat analagous to a result found by Spence and Lair (1964) where in a verbal learning task of a paired associate list the only difference between normal and schizophrenic subjects was that the errors of schizophrenics contained a significantly higher proportion of overt responses, as opposed to errors of ommission by normal subjects. Although the task in Experiment 1 was too easy for the normal subjects to make a substantial amount of errors, there was this contrast between schizophrenic patients on the one hand, making errors of acceptance, and the other control groups, on the other hand, making rejection errors.

Accepting wrong names may be regarded as stemming from the theory of "associational flow" and lack of restraint, suggested by Gathercole (1965) and described in the Introduction. Gathercole put forward the view that tests of overinclusion were in fact measuring a person's inability to stop associating, together with an inability to stop responding, and that it is this factor, rather than a failure in maintaining conceptual boundaries, which accounts for high overinclusion scores by schizophrenics. Some of the evidence in support of this theory is that chronic schizophrenics, who are typically reported to be retarded (Weaver, 1964) are found to score low on tests of overinclusion (Payne _et al_, 1963), and retardation is believed to reduce associational activity. This is not consistent, however, with the results from Experiments 1 and 2, where chronic schizophrenics accepted as many wrong names as acute schizophrenics. The only difference between subgroups of schizophrenics in these Experiments was the difference between the thought disordered and non-thought disordered subgroups. The thought disordered subjects accepted more wrong words as names than the non-thought disordered subjects.

Acceptance of Meaningfully Related Words

Not only did schizophrenic subjects accept wrong words rather than reject correct words, also they tended to accept words related in meaning to the object noun as its name more often than accepting phonetically similar or irrelevant words.

Degree of meaningfulness in words is an important factor in learning with normal subjects. This was shown by Epstein et al (1960) and by Heim et al (1966). Epstein et al demonstrated that learning of meaningful word combinations is easier than learning just familiar combinations. In learning word pairs with varying degrees of association, Heim et al showed that degree of association plays a greater role than frequency of repetition, both in learning and recall, for normal subjects.

Although meaningfulness is an extremely important factor in learning and recall, normal subjects are able to reject incorrect words for names. The difference between normal control subjects and schizophrenics appears to have to do with the ability to reject meaningfully related words. The schizophrenic seems to have difficulty in drawing clear boundaries around a word, thereby delineating its meaning and giving it specific identity. The ability to form such delineations help normal persons to understand what a word is not.

Overacceptance of the type described in Experiments 1 and 2 could be attributed to defects in the mechanisms of selective attention and filtering. However, experiments into attentional deficiencies in schizophrenia report an over-all distractibility factor as the main evidence to support a theory of attentional defects (Lawson, et al 1967; Ludwig et al, 1963; McGhie et al 1965a, 1965b; Stilson and Kopell, 1964). However, in Experiments 1 and 2 overacceptance was not universal by schizophrenic subjects. They did not generally accept irrelevant words, and their acceptance of phonetically related words was small compared with the acceptances of meaningfully related words. If an interpretation involving defects in the mechanism of attention and filtering is to be made, it must be appreciated that breakdown of the filter mechanism is not complete. Irrelevant words are still filtered out quite adequately.

Similarly, if one attempts to attribute overacceptance to an underlying theory of overarousal, which hypothesizes a generally hightened arousal in non-paranoid schizophrenia, one must take into account that overacceptance is not a general all-inclusive phenomena, as some types of words are not overaroused while others are. Also, overarousal was generally found in non-paranoid or very withdrawn paranoid schizophrenics (Venables, 1968). In Experiments 1 and 2, there was no difference between paranoid and non-paranoid schizophrenic subjects in over-acceptance, although in Experiment 1, paranoids did not accept as many meaningfully related words as non-paranoid schizophrenics.

An investigation of the result concerning the types of words accepted as names by schizophrenics is made in Section 11, where the relationship of a wrongly accepted word and the correct object name is examined. In Experiments 3 and 4, variations on the alternative word choices in the task replace the alternatives of Experiments 1 and 2; these alternatives being controlled for associational proximity. Experiment 5 examines the acceptances of the names of parts of objects for a category name. Experiment 6, using the Semantic Differential, shows the extent of semantic distance with different types of words for schizophrenics as compared with normal subjects.

The Multiple and Single Conditions

For schizophrenic and demented patients, the single choice condition produced significantly more errors than the multiple choice condition. In the case of demented patients, both conditions produced a very high proportion of errors as compared with schizophrenic patients. In both experiments, the non-thought disordered subgroup did not reach a significant level of difference between the two conditions. In Experiment 2, although the amount of errors in the single condition was similar to the amount of single errors in Experiment 1, the amount of errors under the multiple condition was reduced.

Although the difference between the amount of errors made by schizophrenic subjects in the multiple condition in the two experiments cannot be explained except by the fact that the words and subjects were different, the consistently significant difference between the multiple and single choice conditions in both experiments might be explained in terms of the nature of the two conditions.

Under the multiple choice condition the subject has more opportunity to compare one word with another, as the alternatives are presented in a list with no responses required until the "correct" name is heard. Under the single condition, the subject is asked to respond to each alternative word. The opportunity in the multiple condition to compare one word with another without interruption for response requirements helps the schizophrenic to make more appropriate judgements concerning which words to reject. It appears to aid the formation of word boundaries which delineate the meaning of individual words.

The results regarding the difference between the multiple and single conditions are analagous to the difference between the multiple and open-ended answering in Raven's (1958) Mill Hill Vocabulary test investigated with normal subjects. Raven found that the difference between multiple choice and open-ended answering in his test was extremely small - usually a difference of only one or two points. Heim and Watts (1967) on the other hand, found a multiple choice technique to be significantly easier than an open-ended technique on a vocabulary test given to normal adults.

This result is followed up in Section 111, where an investigation of the difference between the multiple and single conditions is made. In Experiment 7, the form of response is varied, and in Experiment 8, the number of alternative word choices is varied. In Experiment 9, aids to the formation of word boundaries intervene between items, making the single condition more like the multiple condition, in some respects.

Frequency and Length of Object Nouns

Whether the object noun was a rare word or a frequent word did not make any difference to any of the groups of subjects except the children, in Experiment 1. One would expect this result from the children, since it is well known that children learn frequent words earlier than rare words (Rochford and Williams, 1962). One might also have expected the frequency of the object nouns to affect the dysphasic subjects, since Rochford and Williams (1962, 1965) found that expressive dysphasics tend to have difficulty finding rare words more than frequent words, however, this was not the case in the task given in Experiment 1.

Some research with normal subjects has shown frequency to have an effect with certain tasks. Cofer and Shevitz (1962) showed frequent words to occur more readily as responses in free association. Oldfield and Wingfield (1964) showed that it takes longer to name an object with a rare name than one with a common name. Solomon and Postman (1952) demonstrated that frequent words are easier to perceive on a tachistoscope. Winnick and Kressel (1965) showed that high frequency words lowered tachistoscopic recognition threshold and facilitated paired-associate learning, but had no effect on free recall, although Gorman (1961) found very frequent nouns to be less well remembered than somewhat rarer nouns.

More errors were made when the object noun was a long word than when it was a short word for children, and for chronic and non-paranoid schizophrenic subjects in Experiment 1. However, no difference was found between long and short words for any schizophrenic subgroup or for schizophrenics as a whole, in Experiment 2.

Although no studies could be found relating length of stimuli and speed of delivery of stimuli, it seems as if these factors may have some effect on one another since it may take longer to encode a long stimulus. Speed and its relationship to length was not investigated in Experiments 1 and 2, but is controlled in Experiment 12 using individual words as stimuli, and in Experiment 14 using whole sentences as stimuli. Variations of speed is seen to have an effect on length more clearly in these subsequent investigations.

SECTION 11. THE RELATIONSHIP BETWEEN WORDS ACCEPTED BY SCHIZOPHRENIC SUBJECTS AND THE CORRECT OBJECT NAME

Experiment 3. The Replacement of Stimulus Alternative Words with Controlled Associated Words

Experiments 1 and 2 showed that more errors were made by schizophrenic subjects by accepting words related in meaning to the object noun, than any other type of error. (This was confirmed in further experiments in Sections 111 and 1V.)

Examination of the wrongly accepted related words revealed that the majority could be regarded as associations to the correct object noun. Furthermore, the reasons schizophrenic subjects gave for accepting wrong words were associative in character. However, no attempt had been made to control the alternative words for associational strength or proximity to the correct object noun. In Experiment 3, associations of varying proximity were collected from normal subjects and these replaced the alternative words used in the pilot experiments. Experiment 3 was undertaken mainly to see if there was a positive relationship between associational proximity and the likelihood of a word being accepted by schizophrenic patients.

The null hypotheses in this experiment are:

1. There is no difference between the amount of errors made to closely associated words and rarely associated words.
2. There is no difference in the amount of errors made by normal subjects, non-psychotic psychiatric patients, and schizophrenic subjects.
3. There is no difference between the amount of errors in the single and multiple choice conditions.

Methods

Material

Eighty-five normal subjects were asked to write down their first associations to each of the 18 object nouns used in the previous experiments (12 object nouns from Experiment 1, and 6 object nouns from Experiment 2). The subjects were 30 members of hospital staff (11 nurses, 9 occupational therapists, 5 secretaries and 5 psychologists), 30 undergraduates and 25 orthopaedic patients.

The associations were drawn up in tables which showed how many times each association occurred to each of the 18 object nouns. The first, second, third and fourth most popular associations to each object noun were noted. Four rare associations to each of the nouns were also chosen. The rare associations were words given by not more than one person of the sample of 85 subjects.

The New Task

The four closely associated words and the four rarely associated words (in addition to the object noun) made up the alternative words for the task. The close and rare associations for each item were put into random order. The same random order for the 18 items used in Experiments 1 and 2 was preserved. The closely and rarely associated words for each object noun is given in a list, and the score sheet with the random order of presentation are shown on the next two pages. The numbers 1, 2, 3 and 4 before words on the score sheet correspond to associational proximity.

Object noun	First Association	Second association	Third association	Fourth association	Rare associations	
nail	hammer	finger	wood	varnish	shoe toe	clip teeth
cup	saucer	tea	drink	handle	egg lip	spoon water
fish	sea	chips	water	swim	scale month	cake hook
boot	shoe	feet	lace	car	sock winter	hill game
dice	game	throw	six	gambling	square money	monopoly knife
jug	milk	water	toby	drink	bowl cup	ale tea
window	pane	glass	sill	frame	latch sky	clean summer
finger	nail	hand	thumb	cut	accusation glove	pie bowl
table	chair	wood	food	cloth	floor knife	room oak
arrow	bow	head	indian	sheet	fly apple	smith fire
hatchet	axe	wood	chopper	indian	man log	hammer mallet
giraffe	neck	tall	zoo	spots	legs tortoise	texture zebra
news-paper	print	read	news	article	advert propaganda	bus world
Indian	red	chief	curry	turban	rope fight	cowboy empire
elephant	trunk	castle	zoo	tusks	jungle memory	grass pagoda
gondola	Venice	boat	Italy	water	romance curve	flowers lights
finger-nail	varnish	finger	bite	polish	grime scissors	paint smile
acrobat	circus	swing	juggler	hoop	fly head	fractures ladder

SCORE SHEET

NAME ______________________________

1. latch
2.glass
clean
sky
1.pane
summer
4.frame
window
3.sill

2. square
monopoly
money
3.six
dice
4.gambling
knife
1.game
2.throw

3. 4.water
romance
flowers
3.Italy
2.boat
gondola
1.Venice
curve
lights

4. accusation
1.nail
pie
2.hand
finger
3.thumb
glove
bowl
4.cut

5. advert
1.print
3.news
bus
propaganda
world
4.article
2.read
newspaper

6. jungle
grass
memory
pagoda
4.tusks
3.zoo
elephant
2.castle
1.trunk

7. 1.varnish
grime
3.bite
2.finger
fingernail
4.polish
paint
scissors
smile

8. 4.indian
man
hammer
3.chopper
mallet
hatchet
2.wood
log
1.axe

9. fly
4.shoot
3.indian
smith
apple
2.head
arrow
fire
1.bow

10. shoe
1.hammer
teeth
nail
2.finger
3.wood
clip
4.varnish
toe

11. egg
1.saucer
cup
3.drink
4.handle
spoon
lip
2.tea
water

12. sock
4.car
3.lace
hill
winter
2.foot
1.shoe
boot
game

13. 4.swim
3.water
scale
cake
1.sea
month
hook
fish
2.chips

14. bowl
3.toby
2.water
ale
1.milk
4.drink
jug
cup
tea

15. 1.chair
floor
room
2.wood
3.food
table
4.cloth
knife
oak

16. rope
cowboy
2.chief
1.red
fight
Indian
empire
4.turban
3.curry

17. 2.tall
3.zoo
legs
texture
tortoise
zebra
giraffe
4.spots
1.neck

18. 2.swing
3.juggler
fly
fractures
head
acrobat
1.circus
4.hoop
ladder

Procedure

The task was administered in the same way as Experiments 1 and 2. Before testing an attempt to develop rapport with the subject was made by a short conversation. After testing, the clinical assessment for thought disorder was given, as previously described.

This 18-item task was divided in half, as in Experments 1 and 2, so that 9 items were given under the single choice condition and 9 items under the multiple choice condition. The 9 items in each condition were systematically varied from one subject to another. The instructions were exactly the same as in Experiments 1 and 2. Errors were scored in the same way as the previous experiments.

Scoring

To measure the differences in associational proximity it was necessary to count the errors by Method A, as described in Experiment 1. For the scoring of errors under different conditions and between groups, Method B was used.

Subjects

Schizophrenic Subjects

The experimental subjects were 20 schizophrenic patients from Fulbourn Hospital. They were drawn from chronic and acute cases by the same criteria as described in Experiment 1. These subjects did not take part in previous experiments. All the subjects were being treated with phenothiazine tranquilizing drugs, and none were being given courses of E.C.T.

The 10 acute cases were 5 men and 5 women with a mean age of 36.5 years ranging from 19 years to 57 years.

The 10 chronic subjects were 5 men and 5 women with a mean age of 37.8 years ranging from 22 years to 57 years.

These subjects were later subdivided into groups of thought disordered/ non-thought disordered/ undetermined on the basis of the clinical assessment for thought disorder described in Experiment 1. The schizophrenic subjects were also subdivided into paranoid/non-paranoid on the basis of clinical diagnosis by the consultant psychiatrist involved. The numbers of subjects occurring in each subgroup were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	1	2
Paranoid and Non-thought disordered	0	1
Paranoid and Undetermined	1	0
Non-paranoid and Thought disordered	5	6
Non-paranoid and Non-thought disordered	1	1
Non-paranoid and Undetermined	2	0

Control Subjects

The control subjects were 15 non-psychotic psychiatric patients at Fulbourn Hospital and 20 normal adults.

The non-psychotic psychiatric patients were chosen from the admission wards. Their diagnoses were as follows. Seven suffered from reactive depression, four from inadequate personality, two were obsessional personalities, one had anxiety neurosis and one had a personality disorder. There were 8 women and 7 men in this group, with a mean age of 34.1 years, ranging from 20 years to 48 years.

The 20 normal adults were from two sources. Twelve were orthopaedic patients in Addenbrooke's Hospital, Cambridge. These twelve were recouperating, and none were suffering pain at the time of testing. Eight were university undergraduates. The mean age of the 20 normal subjects was 34.6 years, ranging from 19 years to 59 years. Ten were men and ten were women. These 20 subjects had never been treated psychiatrically. None of the control subjects had taken part in Experiment 1.

Results

Associational Proximity

There was a close relationship between the strength of an association (as measured by its popularity) and its likelihood of acceptance by schizophrenic patients (see Figure 9).

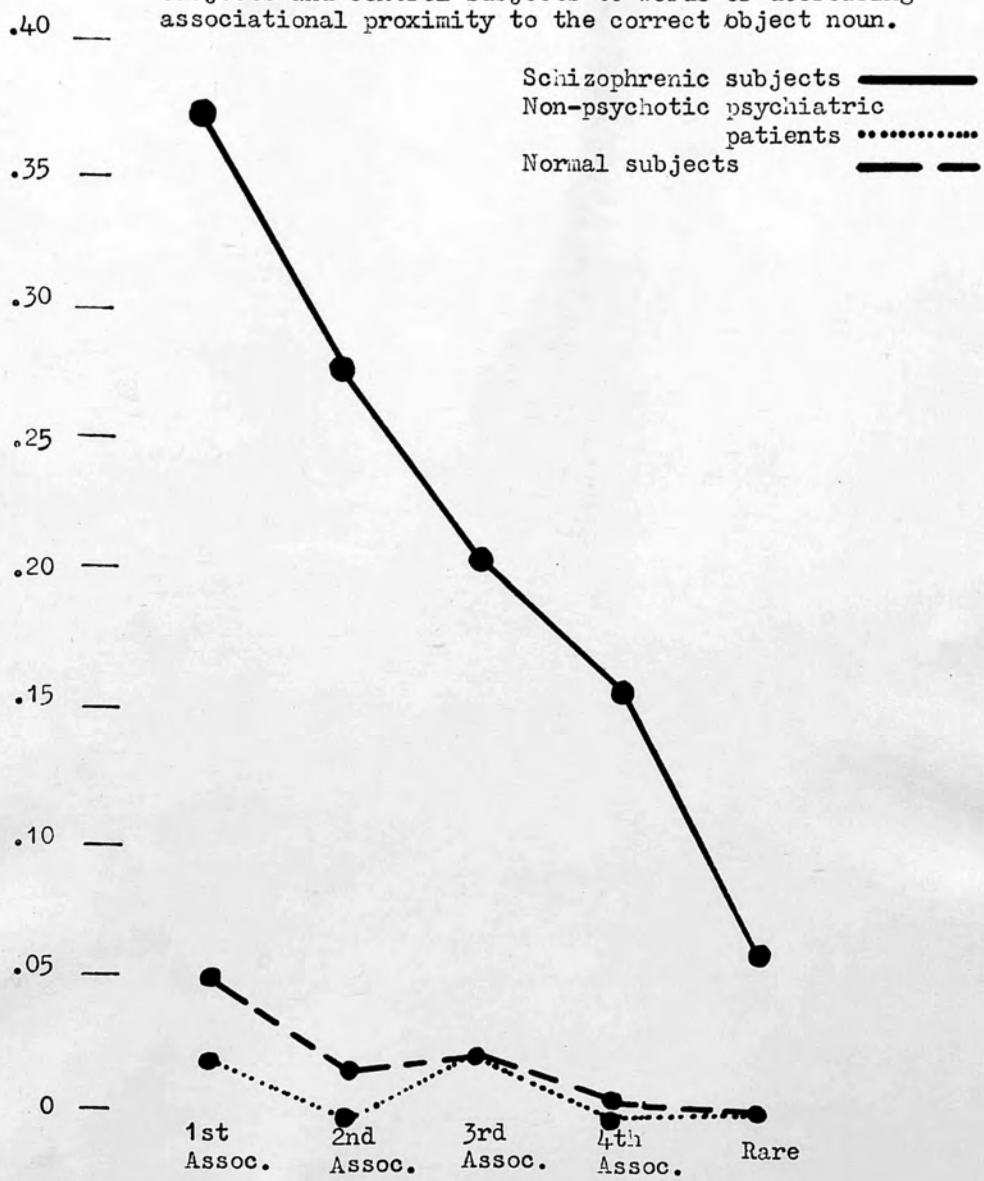
The Friedman 2-way analysis of variance among the 1st, 2nd, 3rd, 4th, and rare associations showed a difference of $p < .001$ for each schizophrenic subgroup except the paranoid subgroup ($p < .02$), and except for the non-thought disordered subgroup which was too small to use in statistical tests (N=3).

The Wilcoxen Test comparing the error scores of the four closely associated words and the four rarely associated words in each group showed a difference at $p < .01$ for each schizophrenic subgroup (except the non-thought disordered) and for the two control groups (see Table 1, Appendix B).

Comparison of Groups

In this experiment normal and non-psychotic patient controls accepted more words than in Experiment 1, but examination showed that some of the associations were also synonyms for the correct object noun. It

Figure 9. Proportions of acceptance errors made by schizophrenic subjects and control subjects to words of decreasing associational proximity to the correct object noun.



was generally these synonyms for the object noun which were accepted by control subjects. If these synonym errors are removed, the proportion of errors made by normal subjects is reduced to zero, and those made by non-psychotic patients is reduced to .0009, but the proportion of errors made by schizophrenic subjects remains high (see Table A, below).

Table A. Proportion of overall errors with and without synonym errors removed.

Schizophrenic subjects	Proportion of errors	Proportion of errors discounting synonym errors
Acute	.1785	.1449
Chronic	.1451	.1275
Thought-disordered	.1781	.1620
Non-thought disordered	.0880	.0700
Paranoid	.0958	.0754
Non-paranoid	.1838	.1691
Control subjects		
Non-psychotic psychiatric patients	.0074	.0009
Normal adults	.0156	0

The error scores for 20 schizophrenic subjects and 20 normal adults were significantly different ($p < .002$) using the Mann Whitney U-Test whether the synonym errors were removed or not. The 20 schizophrenics were also different from the 15 non-psychotic psychiatric patients at $p < .002$ using The Mann Whitney U-Test whether the synonym errors were removed or not.

Using the Wilcoxen Test to compare amount of errors between the schizophrenic subgroups, it was found that acute subjects compared with chronic subjects did not differ, and the comparisons of thought disordered/ non-thought disordered, and paranoid/ non-paranoid could not be made due to the small N in the non-thought disordered and paranoid subgroups.

Multiple and Single Choice Conditions

As in Experiments 1 and 2, there was a significant difference between the errors made under the multiple and single choice conditions for schizophrenic subjects but not for either of the control groups. Each schizophrenic subgroup reached a significant level of difference between the two conditions ($p < .01$) except the non-thought disordered subgroup and the paranoid subgroup, which were too small in numbers (see Table 2, Appendix B).

Associational Proximity under Multiple and Single Choice Conditions

When scores for associational proximity were counted in half the items, only in the multiple choice condition, the close associations still led to significantly more accepting errors than the rare associations for the schizophrenic subjects, but not for the control groups (see Table 3, Appendix B). The differences between close and rare association acceptances by schizophrenics was even greater under the single choice condition (see Table 4, Appendix B).

Experiment 4. The Replacement of Stimulus Alternative Words with Irrelevant Words

Experiments 1 and 2 showed that schizophrenic subjects accepted words irrelevant to the object noun less frequently than phonetically or meaningfully related words. To contrast with Experiment 3, where the alternative words were replaced with associated words, in Experiment 4, the alternative words were replaced by irrelevant words. Hypothetically, the amount of errors made by schizophrenic subjects should decrease.

The null hypotheses for Experiment 4 are:

1. There is no difference in the amount of errors made by normal subjects and by schizophrenic subjects.
2. There is no difference between the amount of errors made under the single choice condition as compared with the multiple choice condition.

Methods

Material

Twelve object nouns were used, and the alternative word choices were chosen at random from the Thorndike and Lorge (1944) word count with the exception that their frequency and syllable length matched with the object noun. Words which were associated to the object noun by any of the 85 normal subjects used in Experiment 3 to gather associations were eliminated. Words which were phonetically similar to the object noun were not used. The words used were as follows.

Object noun	Irrelevant words
AA	
cup	hat bed boy tree church bird key square
fish	weed train car dog chair shoe iron coin
window	circle basket doctor sugar city orange engine famous
finger	table flower circle modern pretty service special double
newspaper	various different beautiful separate several another animal wonderful
Indian	monument direction president industry government tomorrow interest important
1-10	
dice	flute eel duct ape shark chef mauve stripe
jug	badge iris disc bead shore cube grey jazz
hatchet	anthem reindeer corkscrew oval thimble scissors turquoise label
giraffe	shoestring scrapbook tranquil flawless diver tulip lacy fiddler
gondola	feminine tablecloth easychair gorilla colorful cylinder acrobat hemisphere
fingernail	celery abdomen dinosaur furnishing harpsichord triangle flowerpot rectangle

The items were put into random order. The scoring sheet used was the same as the above list, in random order. Pictures of the above object nouns were taken for use from Experiments 1 and 2.

Procedure

The task was administered in the same way as Experiments 1, 2 and 3. Before testing an attempt was made to develop rapport with the subjects by a short conversation. After testing, the clinical assessment for thought disorder was given, as described in Experiment 1.

The task was divided in half, so that 6 items were given under the single choice condition and 6 items under the multiple choice condition. The 6 items in each condition were systematically varied from one subject to another. The instructions were exactly the same as in Experiments 1, 2 and 3. Errors were counted by Method B.

Subjects

Schizophrenic subjects

The experimental subjects were 20 schizophrenic patients from Fulbourn Hospital, drawn from chronic and acute cases by the same criteria as described in Experiment 1. These subjects did not take part in the previous experiments. All the patients were being treated with phenothiazine tranquilizing drugs, and none were being given courses of E.C.T.

The 10 acute schizophrenic subjects were 5 men and 5 women with a mean age of 36.7 years ranging from 18 years to 58 years.

The chronic subjects were 5 men and 5 women with a mean age of 38.2 years ranging from 21 years to 62 years.

These subjects were later divided into groups of thought disordered/ non-thought disordered/ undetermined on the basis of the clinical assessment for thought disorder. They were further subdivided into paranoid/ non-paranoid on the basis of psychiatric diagnosis. The numbers of subjects in each subgroup were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	1	4
Paranoid and Non-thought disordered	1	2
Paranoid and Undetermined	2	0
Non-paranoid and Thought disordered	3	3
Non-paranoid and Non-thought disordered	3	0
Non-paranoid and Undetermined	0	1

Control subjects

The control subjects were 20 normal adults who had never had psychiatric treatment. Fourteen were patients from the orthopaedic wards at Addenbrooke's hospital. Six were university undergraduates. Ten were men and ten were women. Their mean age was 33.5 years, ranging from 19 years to 57 years.

Results

Experimental and Control Groups

There was no significant difference in the amount of errors made by normal and schizophrenic subjects, using the Mann Whitney U-Test.

Multiple and Single Choice Conditions

There was no significant difference between the two conditions for the schizophrenic subjects or for the normal subjects (see Table 5, Appendix B).

Comparison of Experiments 1, 3 and 4

Table B below shows that more errors were made by schizophrenic subjects in Experiment 3, where all eight alternative word choices were associations, than in Experiment 1, where only two alternatives were related by association. So few errors were made by the schizophrenic subjects in Experiment 4, where none of the alternatives were associated to the object noun, that the experimental subjects were almost indistinguishable from the control subjects.

Table B. Proportions of errors made in Experiments 1, 3 and 4.

Schizophrenic subjects	Exp. 1	N	Exp.3*	N	Exp.4	N
Acute	.0723	30	.1449	10	.0047	10
Chronic	.1074	30	.1275	10	.0047	10
Thought disordered	.1134	28	.1620	14	.0067	11
Non-thought disordered	.0675	20	.0700	3	.0031	6
Paranoid	.0664	18	.0754	5	.0037	10
Non-paranoid	.1080	42	.1691	15	.0056	10
Control subjects						
Non-psychotic psychiatric patients	0	10	.0009	15		
Normal adults	.0028	10	0	20	.0005	20

* after discounting synonym errors

Experiment 5. Acceptance of the Names of Parts of Objects as a Category Name

In Experiments 1 and 2, schizophrenic subjects tended to accept words related in meaning to the object noun more often than phonetically similar or irrelevant words. The related words in Experiments 1 and 2 were like associations, and in the replacement task in Experiment 3, it was shown that schizophrenic patients do indeed accept associated words as the names for pictures of objects.

The question of whether acceptance is confined mainly to "associations" (as defined by obtaining words by a free association technique) or whether schizophrenics will accept words in another sort of meaningful relationship is investigated in Experiment 5. In this experiment, the same subjects from experiments 3 and 4 were used for a paper and pencil test designed to reveal whether or not schizophrenic subjects will also accept the names of parts of objects for a category name.

Methods

Material

The following form was duplicated and used as the stimulus material. The correct answers are underlined below, although they were not underlined on the form given to the subjects.

Name: ____

1. Underline the name of each flower:

   rose petal stem daisy plant daffodil leaf bush bed

2. Underline the name of each fruit:

   tree apple pip pear skin vine bowl flesh plum

3. Underline the name of each vehicle:

   wheel car travel train compartment driver bonnet coach

4. Underline the name of each animal:

   nature fox paw dog trunk elephant living thing herd cat

Procedure

The subjects were asked to answer the four questions, and were provided with a pencil for this purpose.

Scoring

As can be seen from the form, there are 22 opportunities to over-include in the four questions by any one subject. There are also 13 opportunities to under-include, or miss out underlining one of the category names. The over - and under-including scores are not meant to be compared with one another.

So few mistakes were made, as can be seen in Table C below, that statistical tests were not attempted.

Subjects

The same 40 schizophrenic subjects from Experiments 3 and 4 took part in this experiment, as did the same 15 non-psychotic psychiatric patients from Experiment 3. Ten of the normal adults from Experiment 3 were also used.

Results

Over - and Under-inclusions

Very few over-inclusions were made by accepting the names of parts of objects as a category name by schizophrenics or by control subjects as can be seen in Table C. The under-inclusions can be regarded informally as simply neglectful omissions.

Table C. Over - and under-inclusions of the names of parts of objects.

	N	No. of over-inclusions	Mean	No. of under-inclusions	Mean
Acute Schizophrenics	20	4	.20	13	.65
Chronic Schizophrenics	20	2	.10	15	.75
Non-psychotic psychiatric patients	15	4	.27	0	0
Normal adults	10	0	0	0	0

Over-inclusions and acceptance of wrong names does not appear to include the names of parts of objects for category names, but does seem to be confined mainly to associations, by schizophrenic patients.

Experiment 6. The Difference between Synonyms, Associated Words and Irrelevant Words

In Experiment 3, where the alternative word choices were controlled associations, it was found that normal subjects made more errors by accepting incorrect words than one might have expected from the pilot experiments. When these errors were examined, it was found that they were almost entirely synonyms for the correct object noun. Schizophrenic subjects also accepted associated synonyms, in addition to words which were associated to the object noun without being synonyms. It was hypothesised that schizophrenic subjects may conceive of synonyms and associations which are not synonyms as more closely related than do normal subjects. In Experiment 5, Osgood's (1957) Semantic Differential was used to discover how different were synonyms, associations and irrelevant words for normal and schizophrenic subjects.

The null hypotheses are:

1. There is no difference between the ratings of synonyms on the Semantic Differential for schizophrenic or for normal subjects.
2. There is no difference between the ratings of associated words on the Semantic Differential for schizophrenic or for normal subjects.
3. There is no difference between the ratings of irrelevant words on the Semantic Differential for schizophrenic or for normal subjects.

Methods

Material

Ten dimensions from Osgood's (1957) Semantic Differential were used in the recommended relationship of five evaluative dimensions, three potency dimensions and two activity dimensions. Forms containing these dimensions with the usual seven spaces between each, were duplicated, and made into 50 booklets containing 17 forms in each booklet. The form appears below.

Active___:___:___:___:___:___:___Passive

Bad___:___:___:___:___:___:___Good

Kind___:___:___:___:___:___:___Cruel

Hard___:___:___:___:___:___:___Soft

Ugly___:___:___:___:___:___:___Beautiful

Feminine___:___:___:___:___:___:___Masculine

Successful___:___:___:___:___:___:___Unsuccessful

Strong___:___:___:___:___:___:___Weak

Wise___:___:___:___:___:___:___Foolish

Slow___:___:___:___:___:___:___Fast

Seventeen words were rated by each subject. There were three key words, two synonyms to each of those, two associated words to each of the key words, and two words irrelevant to all the other words. The words rated were as follows:

Key Words	CUP	HATCHET	NEWSPAPER
Synonyms	MUG	AXE	JOURNAL
	GOBLET	CHOPPER	PERIODICAL
Associations	SAUCER	WOOD	PRINT
	TEA	INDIAN	READ
Irrelevant words	HOSPITAL	GIRAFFE	

One of these words was written on top of the 17 forms in each of the 50 booklets.

Procedure

The experimental subjects were tested individually although some of the control subjects were tested as a group. In both cases, the subject was given a booklet and an example form showing how the Semantic Differential was done. The example was as follows, and was the author's own ratingof the word "dog".

dog

Active	x							Passive
Bad						x		Good
Kind		x						Cruel
Hard					x			Soft
Ugly					x			Beautiful
Feminine						x		Masculine
Successful				x				Unsuccessful
Strong		x						Weak
Wise			x					Foolish
Slow						x		Fast

The instructions were "I want you to rate the word on the top of each page. You can see the example of the way I rated the word 'dog'. I think of the word 'dog' as very active, quite good, quite kind, a little bit soft, a little bit beautiful, quite masculine, neither successful nor unsuccessful, quite strong, a little bit wise and quite fast. As you can see if you think a word is strongly one way or the other, mark it on the furthest line to the left or right. If you think the word is not quite so strong one way or the other there is the next line nearer the middle on each side. And if you think the word is only slightly in one direction or the other, there is the next line further in towards the middle. If you think that the word belongs neither on one side or the other, or if the dimension is inappropriate, you can mark it in the middle line. Do these ratings as quickly as you can without deliberating. The idea of this test is to get your first impression of a word."

The example form was then removed and the subject asked to begin the ratings. Some patients were unable to understand the instructions. If after one repetition they were still not able to grasp the instructions for the Semantic Differential, they were eliminated from the experiment.

Scoring

The scoring was done by counting the number of spaces differing on each dimension between each key word and its two synonyms, two associations and between each key word and the two irrelevant words, for each subject. The number of spaces of differences were then added for the two synonyms, the two associations and the two irrelevant words separately. These scores were added together for the three key words, and each subject then had a total difference score for synonyms, associations and irrelevant words.

Subjects

Experimental Subjects

Twenty-five schizophrenic subjects from the admission wards in Fulbourn Hospital were used as experimental subjects. Their mean age was 36.6 years ranging from 16 years to 65 years. All of these subjects had taken part in one of the previous experiments. They were divided into the same subgroups as in the previous experiments, by the same criteria. The numbers in each subgroup were:

	Acute (N=14)	Chronic (N=11)
Paranoid and Thought disordered	3	2
Paranoid and Non-thought disordered	1	3
Paranoid and Undetermined	0	1
Non-paranoid and Thought disordered	6	5
Non-paranoid and Non-thought disordered	4	0
Non-paranoid and Undetermined	0	0

Control Subjects

The control subjects were 25 normal adults who never had psychiatric treatment. They were 10 occupational therapists, 6 nurses, 3 secretaries and 3 psychologists, all from the staff of Fulbourn Hospital, and 3 orthopaedic patients from Addenbrooke's Hospital.

Results

Table D below shows that schizophrenic and normal subjects rate synonyms, associations, and irrelevant words as significantly different from one another. However, normal subjects show a greater difference between associated words than do schizophrenics (see Figure 10).

Figure 10. Mean differences on Semantic Differential scores between synonyms, associations and irrelevant words made by schizophrenic subjects and normal control subjects.

Schizophrenic subjects ———
Normal subjects – – –

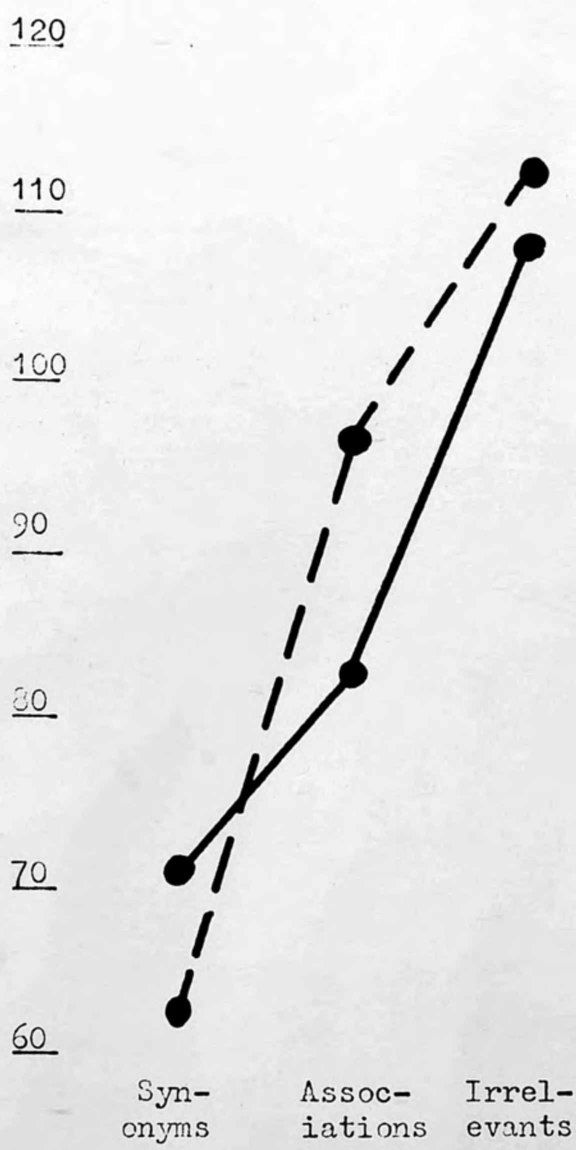


Table D. Mean difference scores* on the Semantic Differential

	N	Synonyms	Associations	Irrelevants	Friedman p-level
Schizophrenic subjects	25	71.04	82.92	108.00	.001
Acute	14	77.57	94.35	111.14	.01
Chronic	11	62.72	68.36	104.00	.01
Thought disordered	16	79.75	86.37	113.81	.05
Non-thought disordered	8	55.50	77.75	98.25	.01
Paranoid	9	71.77	74.66	111.22	.05
Non-paranoid	16	70.62	87.56	106.18	.05
Control Subjects	25	63.48	96.76	112.64	.001

While the 25 schizophrenics and normal controls did not differ significantly from each other in their ratings of synonyms and irrelevant words, they did differ in their ratings of associations ($p = .0574$, Mann Whitney U-Test). As for the subgroups of schizophrenics, the Mann Whitney U-Test showed a significant difference between the acute and chronic subgroups ($p < .05$) in the association scores but there were no significant differences between the other subgroups.

*Standard deviations for 25 schizophrenic subjects were: Synonyms, 108.2; Associations, 101.1; Irrelevants, 106.2. Standard deviations for 25 control subjects were: Synonyms, 110.2; Associations, 104.5; Irrelevants, 99.8.

Discussion

Accepting Associations to Names as Names for Pictured Objects

In Experiments 1 and 2 it was shown that schizophrenic subjects tend to accept words related by meaning to the correct name more than phonetically similar words or irrelevant words. When schizophrenic patients offered their reasons for accepting errors, these reasons appeared to be based on associative connections between the correct name and the wrongly accepted word. Examination of the words accepted by schizophrenic subjects in the pilot experiments showed that many of them were associative in character.

Experiments 3 and 4, which varied the type of alternative words offered, clearly demonstrated that an association factor is employed by schizophrenic patients in their selection of incorrect words to accept as names. Experiment 5 added confirmation to this view, since schizophrenic subjects did not tend to over-include words which were conceived of as the names of parts of objects, as a category name, although Experiment 5 employed a different method and the lack of over-inclusiveness could have been partly due to the simplicity of the task used in Experiment 5.

These results show with greater clarity than the results of the pilot experiments that theories of an all-inclusive attentional defect or an all-inclusive overarousal phenomenon are not adequate. Schizophrenic subjects are able to filter out and reject material which is not associated to the stimuli, and if there is an impairment in the filtering mechanisms of attention, it is only with phenomena associated to the stimuli where the inability to filter becomes important. Similarly, in terms of overarousal, schizophrenic subjects appear overaroused only in the case of associations to the stimuli.

These observations do not imply that theories of attentional defects or of overarousal are wrong, but simply that they cannot be adequately applied to language comprehension defects in schizophrenia. It will be recalled from the description of the experiments done in attentional deficit and in overarousal in the Introduction, that language was generally not the medium used as stimuli. In other areas of schizophrenic behaviour, such as reaction time, evoked EEG responses, skin resistence, recall of lists of digits, psychomotor tasks, etc., theories of arousal and theories of filter defects may be more relevant.

The results in this Section are in agreement with Gathercole's (1965) hypothesis of an "inability to restrain associations". However, the results imply more than a general inability to restrain all associations, since the inability was found to be directly related to associational proximity, as measured on normal subjects.

Some Implications of Associational Proximity

Not only were schizophrenic subjects shown to wrongly accept associations over and above other types of words, but it was also demonstrated in Experiment 3, that the more popular an association (as measured on normal subjects) the more likely it will be accepted as a name by schizophrenic subjects.

This implies that the organization of the associational repertoire is similar for schizophrenics and for normal persons, and that in the case of schizophrenia it is the selective processes from this repertoire, for the purposes of responding, which are impaired.

Some studies reported in the Introduction which employed techniques of free association with schizophrenic subjects, found their associations to be unusual and uncommon in comparison with the associations given by normal subjects, implying a difference in the organization of the schizophrenic associational repertoire (Kent and Rosanoff, 1910; Moran, 1953; Sommer et al, 1960; Sommer et al 1962).

However, three studies support implications that the associative repertoire may not be impaired in schizophrenia. The experiment by Cohen and Camhi (1967) showed that in a word communication task, although schizophrenic speakers were inferior to normal speakers in ability to communicate, schizophrenic listeners were no different from normal listeners in their ability to decode communications. Also, the study by Sommer et al, (1960) demonstrated that although schizophrenic subjects produced significantly more uncommon associations than did normal subjects, they were not different from normals in their ability to judge the commonality levels of their own responses. And Johnson et al (1964), who gave a free association test to schizophrenics and to normal subjects, found that the percentage of popular responses was highly correlated for the two groups, but that schizophrenic subjects produced more uncommon responses in addition to popular responses.

If the view is accepted that the organization of the associational repertoire is similar for schizophrenics and for normal persons, then what is it about the selection processes from this repertoire which is faulty in schizophrenia? Although the organization of the repertoire may remain intact, the boundaries which delineate one word from another in the associational network may be weakened in schizophrenia. And the closer together words are in the network, (i.e. the more closely associated they are), the less they are separated by strong boundaries.

That associational networks exist on a physiological level has been shown by Luria and Vinogradova (1959) as well as by other research workers in the Soviet Union whose papers are unfortunately not translated. Luria and Vinogradova conditioned normal subjects to push a button upon hearing a certain word. The subjects were successful in pushing the button to the correct word only, but a distinct vascular reaction, involving contraction of the blood vessels in the finger, and a dilation of the blood vessels on the surface of the head, was obtained from normal subjects when a word closely associated to the correct word was given.

One might predict on the basis of Experiment 3, that if the Luria and Vinogradova (1959) experiment were repeated on schizophrenic subjects, many schizophrenics would not only show physiological reactions to associated words, but would tend also to exhibit the conditioned response and to press the button upon hearing closely associated words.

If it can be imagined that the encoding of a word involves a special neural connection, and that closely associated words involve similar but not identical neural connections, whereas rarely associated or irrelevant words involve quite different pathways, then one can suppose that the boundaries between close pathways can become confused more easily than the boundaries between distant pathways. This may be the basis of the defect in comprehension by schizophrenics, although no claims can be made along physiological or neurological lines from the purely psychological experiments done in this thesis.

The inability to reject associated material is not confined to schizophrenics but has been shown to exist in normal persons by

Triesman (1965) under conditions of dichotic listening. When different messages are competing for recognition (one message is sent to each ear) a normal subject will often be able to reject highly associated or relevant material appearing in the irrelevant message. For example, when asked to shadow (or repeat back) the message being put into one ear, and to disregard the message to the other ear, normal subjects have difficulty in shadowing if the disregarded message contains the subjects own name, or if it contains something highly associated with the relevant message attended by the subject.

Thus normal subjects under unusual and difficult conditions (such as dichotic listening) may suffer a deficiency somewhat akin to the schizophrenic deficiency in the process of word selection and boundary formation.

The Semantic Differential and its Connection with Impaired Boundaries in Schizophrenia

The technique used in Experiment 6, i.e. the Semantic Differential, involves word boundaries in a certain sense. The rating of a word on the Semantic Differential is determined by its boundaries on dimensional scales. The fact that the schizophrenics rated associated words as closer to the key words (and therefore more similar) than normal subjects, implies a weakening of the boundaries on these dimensions for associated word stimuli. The fact that the ratings of synonyms and irrelevant words were not significantly different for schizophrenics and for normal subjects substantiates the view that it is mainly in the area of associated words where an impairment in boundary strength is revealed. The closeness of associations as rated by the Semantic Differential by schizophrenics may be one of the reasons for the schizophrenic patients' tendency to confuse an object name and its associations with identity.

SECTION 111. THE DIFFERENCE BETWEEN THE MULTIPLE AND THE SINGLE CHOICE CONDITIONS FOR SCHIZOPHRENIC PATIENTS

Experiment 7. The Replacement of the Oral Response with a Non-oral Response

Experiments 1 to 3 (and also Experiments 10 and 11 in Section 1V) showed that there is a significant difference between the amount of errors under the multiple and single choice conditions for schizophrenic subjects. Experiment 7 was designed to reveal whether this was due to the manner of response the subject was required to give. In the single choice condition, the subject was required to give nine oral responses of "yes" or "no". It was thought that since auditory material may be difficult for schizophrenic subjects in comparison with visual material (which was found to be the case in Section 1V, where modality was examined), so many oral responses were responsible for the large proportion of errors under the single choice condition. In this experiment, the nine oral responses required from the subject in the single choice condition were replaced by a pointing response.

The null hypotheses are:

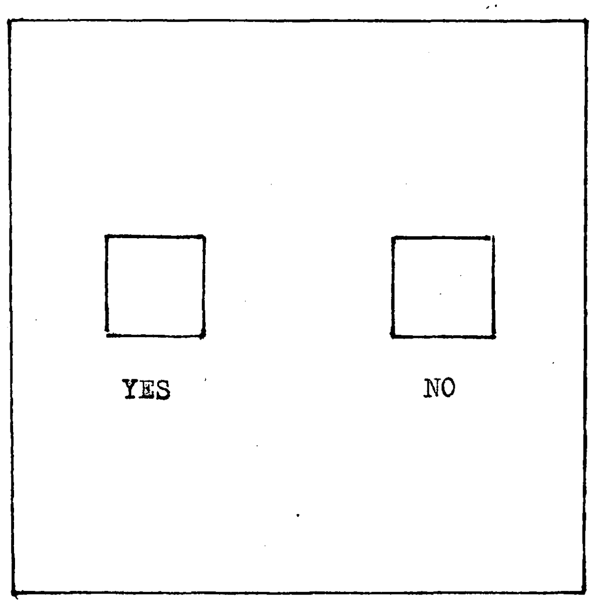
1. There is no difference in the amount of errors between the condition utilizing the pointing response and the condition where an oral response is required.
2. There is no difference between the proportions of errors made by accepting words of different types under these two conditions.

Methods

Material

The 18 items prepared for both Experiments 1 and 2 were used, in random order. The task was divided in half so that 9 items were given in the "saying" condition and 9 items were given in the "pointing" condition. The 9 items in each condition were systematically alternated from one subject to another. The saying condition was the same as the single choice condition in Experiments 1, 2, 3 and 4, i.e. the subject was required to say "yes" or "no" nine times to each alternative stimulus word of each item. In the pointing condition, the subject was required to point to the "yes" or "no" box on a white card nine times.

A 6" x 6" white card was constructed to be used in the pointing condition. On the card were two boxes. Under one box the word "yes" appeared and under the other box, the word "no" was written. Both words were typed in capital letters. A drawing of this response card is shown below.



The same tape recording of the stimulus words from Experiment 1 was joined to the recording of the stimulus words from Experiment 2, and this 18-item tape was used. The same pictures of the object nouns were used.

The random order of presentation of the words in the 18 items was the same as in Experiments 1 and 2. The scoring sheet used consisted of items 1 to 12 from Experiment 1 and items 1 to 6 from Experiment 2 joined together. The items were re-numbered from 1 to 18.

Procedure

The task was administered in the same way as Experiments 1, 2, 3 and 4. Before testing an attempt to develop rapport with the subject was made by a short conversation. After testing, the clinical assessment for thought disorder was given as described previously in Experiment 1.

Under the saying condition, the instructions were the same as in Experiment 1 in the single choice condition. Under the pointing condition, the subjects were given the same instruction with the exception that the word "say" was replaced by the words "point to", so that the instruction was:

"You will hear a list of words on the tape. To each word you will point to the 'yes' or the 'no' box depending on whether the word is the name of the picture or not. For example, if I give you a picture of a dog and the word 'cat' comes up on the tape, you will point to the 'no' box because it is not a picture of a cat. But when you hear the word 'dog' you will point to the 'yes' box, since it is a picture of a dog."

Errors were scored in the same way as in the previous experiments using the word identification task.

Subjects

The subjects were 20 schizophrenic patients from Fulbourn Hospital. They were drawn from chronic and acute cases by the same criteria as described in Experiment 1. None of the 20 subjects had taken part in previous experiments. The subjects were being treated with phenothiazine tranquilizing drugs, but none were being given E.C.T.

The 10 acute patients were equally divided between 5 men and 5 women and had a mean age of 38.8 years with a range between 16 years and 65 years.

The chronic patients were 5 men and 5 women with a mean age of 36.8 years ranging from 16 years to 49 years.

These 20 subjects were later subdivided into groups of thought disordered/ non-thought disordered/ undetermined on the basis of the clinical assessment of thought disorder previously described in Experiment 1. They were also divided into paranoid/ non-paranoid on the basis of psychiatric diagnoses. The numbers of patients falling into each of the subdivisions were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	3	2
Paranoid and Non-thought disordered	0	0
Paranoid and Undetermined	0	1
Non-paranoid and Thought disordered	4	7
Non-paranoid and Non-thought disordered	2	0
Non-paranoid and Undetermined	1	0

Results

Pointing and Saying

The pointing response led to slightly more errors for each schizophrenic subgroup than the saying response, however, there were no significant differences. (see Table 1, Appendix C).

Types of Errors

As in Experiments 1 and 2, schizophrenic subjects made significantly more errors ($p < .05$) by accepting the associationally related words than any other kind of error. This held true under both the pointing and saying conditions (see Table 2, Appendix C).

Experiment 8. Variation on the
Number of Alternatives

Experiments 1 to 4 (and Experiments 10 and 11 in Section 1V) showed that under the single choice condition, schizophrenic subjects made more errors than under the multiple choice condition. Experiment 7 revealed that this did not appear to be due to the form of response the schizophrenic subjects were required to give.

It was thought that this may be related instead to the number, rather than the form of responses required. Under the multiple choice condition the subject was required to respond but once to nine alternative stimulus words, whereas under the single condition the subject was required to respond once to each of the nine alternative stimulus words. It is possible that the number of responses was directly related to the amount of errors, so that there was a continuum from what has been called the multiple choice condition (one response) to what has been called the single choice condition (nine responses). By this reasoning, if five responses were required, the amount of errors produced should lie between the multiple and the single choice conditions.

In Experiment 8 the number of alternatives was systematically varied in the single and in the multiple choice conditions.

The null hypotheses are as follows:

1. There is no difference in the proportion of errors made in the multiple choice condition given two, five or nine alternative stimulus words.
2. There is no difference in the proportion of errors made in the single choice condition given two, five or nine alternative stimulus words.

Methods

Material

The task from Experiment 3 (using the replacement of alternative words with associations controlled for proximity) was used so that under the conditions of reduction of the number of alternatives, the type of word used would always be the same, i.e. an associated word. The 18 items were divided into six parts of three items each. These six parts represented the six conditions of this experiment. The conditions were as follows:

1. Single choice condition, 9 alternatives (the correct word, four close associations and four rare associations, as in Experiment 3).
2. Single choice condition, 5 alternatives (the correct word, two close associations and two rare associations).
3. Single choice condition, 2 alternatives (the correct word, and one associated word, alternating between a close and rare association from one two-alternative item to another).
4. Multiple choice condition, 9 alternatives (same as condition 1 above).
5. Multiple choice condition, 5 alternatives (same as condition 2 above).
6. Multiple choice condition, 2 alternatives (same as condition 3 above).

Procedure

The task was administered in the same way as Experiments 1, 2, 3, 4 and 7, except that fewer alternative words were offered to the subject in conditions 2, 3, 5 and 6 above. The six parts of the task representing the six conditions were systematically varied from one subject to another.

As in the previous experiments an attempt was made to develop rapport with the subject before testing, and the clinical assessment described in Experiment 1 for thought disorder was given after testing.

The instructions were exactly the same as in Experiments 1, 2, 3 and 4. The subject was unaware in advance how many alternative words he would be asked to respond to in each item. The scoring sheet from Experiment 3 was used to tabulate the results.

Scoring

Errors were counted by Method B (i.e. number of item errors). Because the conditions of this experiment varied the number of alternatives, one condition could not be compared with another condition (containing a different number of alternatives per item) unless the scores were converted to proportions, which take this into account. The scores for each subject were therefore converted to proportions. Non-parametric statistical tests using ranking procedures can also be used on proportions to compare the same subjects under different conditions.

Subjects

The subjects were 20 schizophrenic patients from Fulbourn Hospital, drawn from chronic and acute cases by the same criteria described in Experiment 1. These subjects did not take part in previous experiments. They were being treated with phenothyazine drugs without courses of E.C.T.

The ten acute schizophrenic subjects were 5 men and 5 women with a mean age of 28.6 years ranging from 17 years to 61 years.

The ten chronic patients were 5 men and 5 women with a mean age of 36.4 years ranging from 16 years to 61 years.

These subjects were subdivided into groups of thought disordered/ non-thought disordered/ undetermined according to the clinical assessment described in Experiment 1. They were further subdivided into paranoid/ non-paranoid on the basis of clinical diagnoses by the psychiatrist involved. The numbers of subjects falling into each category were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	1	1
Paranoid and Non-thought disordered	0	2
Paranoid and Undetermined	2	0
Non-paranoid and Thought disordered	4	3
Non-paranoid and Non-thought disordered	3	3
Non-paranoid and Undetermined	0	1

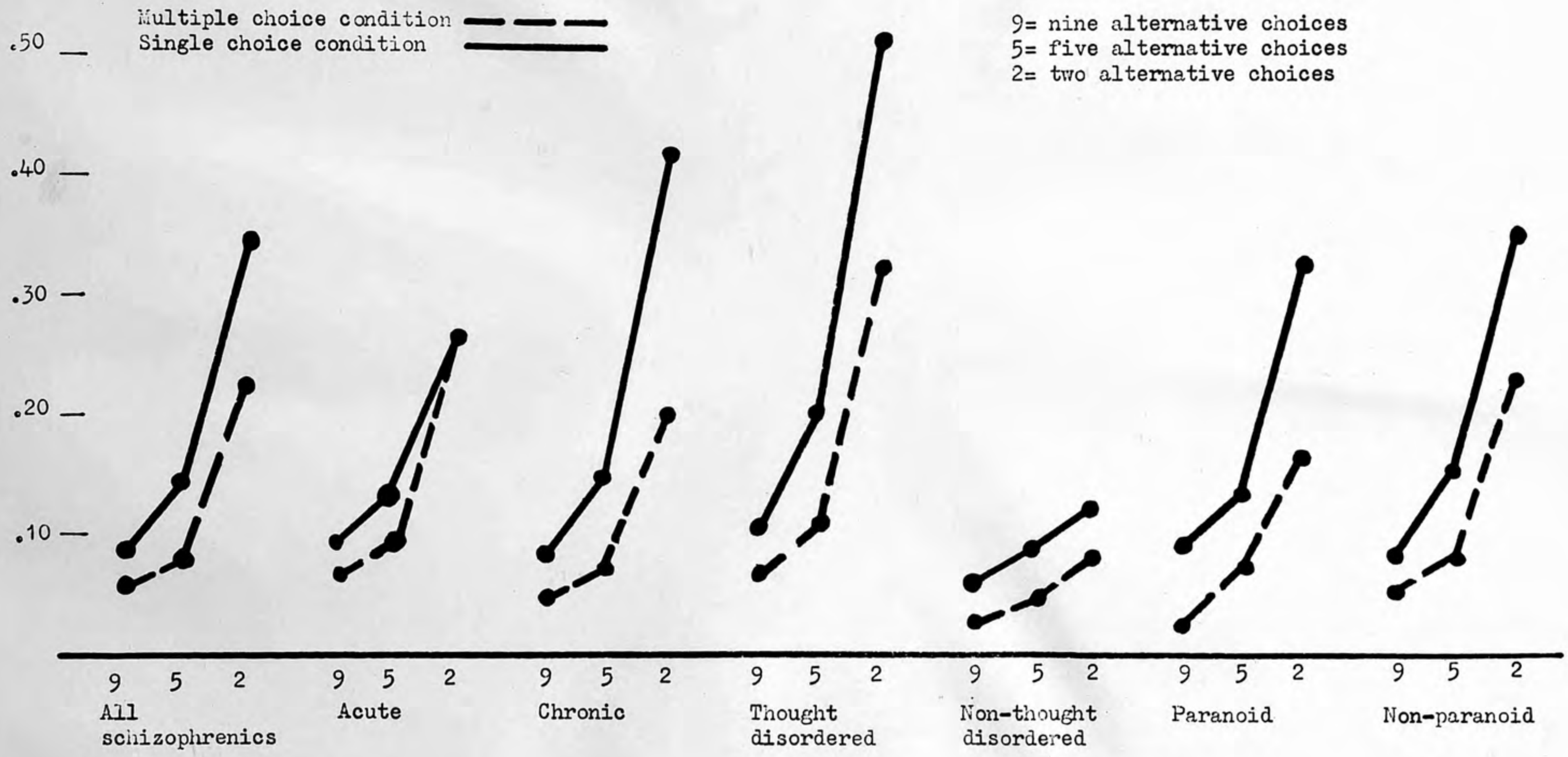
Results

Number of Alternatives in the Single and Multiple Choice Conditions

As in previous experiments using the word identification task, more errors were made under the single choice condition than under the multiple choice condition when each condition was considered separately. However, as the numbers of alternatives increased, the proportion of errors decreased in both the single choice condition ($p < .01$) and the multiple ($p < .01$) condition for all 20 subjects (see Figure 11).

Under the multiple choice condition, all schizophrenic subgroups produced a decrease in the proportion of errors as the number of alternatives increased, but only in the acute and the thought disordered subgroups did this reach significant levels ($p < .02$, acute subjects; $p < .01$ thought disordered subjects; see Table 3, Appendix C).

Figure 11. Proportions of errors made by schizophrenic subjects in the multiple choice and single choice conditions as the number of alternatives decreases.



Under the single choice condition all subgroups showed a decrease in the proportion of errors as the number of alternatives increased. (see Table 4, Appendix C). This reached significant levels with the chronic subgroup ($p < .02$) and the thought disordered subgroup ($p < .01$).

Experiment 9. Aids to Boundary Formation

In Experiment 8 it was shown that the more alternatives given in any one item the lower the proportion of errors made by schizophrenic subjects, under both the single and multiple choice conditions (although more errors were always made under the single condition, when considered as a whole).

It is possible that the extra alternatives act as increased cues for the subjects to sample, to compare, to judge and finally, to consider a word more precisely in relation to other words in the memory store. Such additional cues may help the schizophrenic in his difficulty in rejecting the associations which impinge when such cues are not present.

The nature of the multiple choice condition, it will be remembered, also appears to serve a similar purpose - of giving the schizophrenic more uninterrupted alternatives to consider, than under the single choice condition where the subject must consider and respond to each word separately.

In Experiment 9 an attempt was made to insert extra cues which might help the schizophrenic even further to accept only the correct word under the single choice condition. The associated replacement task devised for Experiment 3 was used under four conditions:

1. The single choice condition, as previously administered.
2. A condition where the subject was required to read a list of irrelevant words before each item, and then proceed to be tested under the single choice condition.

3. A condition where the subject was required to read the eight words associated with the correct object noun, and then proceed to be tested under the single choice condition.

4. A condition where the subject was asked to read and define the meanings of each of the eight words associated with the correct object noun, and then proceed to be tested under the single choice condition.

The null hypotheses for this experiment are:

1. There is no difference in amount of errors made in conditions (1), (2), (3), and (4).
2. There is no difference in the amount of errors made to alternative words of differing associational proximity under conditions (1), (2), (3) and (4).

Methods

Material

Sixteen items from the associated replacement task used in Experiment 3 were divided into four groups of four items to correspond with the four conditions. The four groups of items were systematically varied among the conditions from one subject to another.

In condition (1) no new materials were required.

For condition (2) different sets of 8 irrelevant words were typed on 16 white 5" x 8" cards for presentation to the subject to read before testing on each item. These words were chosen at random from the Thorndike and Lorge (1944) word count with the exception that they had not been associations to the object noun used by any of the normal subjects used in Experiment 3 for collection of associations.

For condition (3) the 8 alternative words in each of the 16 items were typed on 16 white 5" x 8" cards for presentation to the subject to read before testing on each item.

No other materials were needed for condition (4). The cards from condition (3) were used. Instead of simply reading the list however, under this condition the subjects were asked to define and discuss each word.

Procedure

Before testing an attempt to develop rapport with the subject was made by means of a conversation. Then, the instructions for the single choice condition were given (the same instructions as in Experiment 1).

If condition (1) was to be given first, the subject proceeded as under the single choice condition of previous experiments.

When conditions (2) or (3) were to be given, the subject was told before each of the items "Would you please read this list of words before we proceed", and then the items of condition (2) or (3) were given under the single choice condition.

When condition (4) was to be given, the subject was told before each item: "We will read and discuss the meanings of each of the words on this list. Please read the first word and tell me what it means". If the subject defined the word adequately, he was told "good" or "that's right". If the subject did not define it very well, or did not know the word, he was given a definition and asked "Does that seem a good definition?". The subject was encouraged to discuss any of the words more fully if he wished. Approximately 5 to 10 minutes were spent under condition (4) in defining and discussing the definitions of each of the 8 associated words before testing each item, in the single choice condition.

After testing, the clinical assessment for thought disorder was given as described in Experiment 1.

Scoring

As in previous experiments, scoring method B was used to count the errors to investigate the null hypothesis regarding the difference among the conditions, and Method A was used to investigate the null hypotheses regarding associational proximity.

In Experiment 3 it was shown that the normal subjects often accepted associated words which are also synonyms. As the same associated alternative word choices were used in this experiment, any acceptances of synonyms for the correct object noun were not counted as errors.

Subjects

The subjects were 20 schizophrenic patients from Fulbourn Hospital, chosen by the same criteria as in Experiment 1, and these subjects did not take part in previous experiments.

The 10 acute subjects were 3 men and 7 women with a mean age of 26.4 years, ranging from 19 years to 56 years.

The 10 chronic subjects were 5 men and 5 women, with a mean age of 46.7 years ranging from 34 years to 55 years.

These subjects were subdivided in the same way as in previous experiments. The number of subjects falling into each category were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	0	1
Paranoid and Non-thought disordered	3	1
Paranoid and Undetermined	0	0
Non-paranoid and Thought disordered	6	4
Non-paranoid and Non-thought disordered	1	2
Non-paranoid and Undetermined	0	2

Results

The Four Conditions

A much higher proportion of errors was made in condition (1) than in the other conditions, as is shown in Figure 12. The proportion of errors in condition (1) was similar to the proportion of errors made in Experiment 3 under the single choice condition (see Table 2, Appendix B), as one would expect since condition (1) was the same as the single choice condition of Experiment 3.

The Friedman 2-way analysis of variance yields significant levels of difference for the four conditions for all schizophrenics ($p < .001$) and for each of the subgroups (acutes, $p < .02$; chronics, $p < .01$; thought disordered, $p < .02$; non-thought disordered, $p < .05$; paranoid, $p < .01$; non-paranoid, $p < .01$); see Table 5, Appendix C).

A comparison of the difference in errors between condition (1), which led to the most errors for each subgroup, and the next most difficult condition for each subgroup was made (see Table 5A, Appendix C). For all the subjects taken together, condition (1) was significantly different from condition (2) at $p < .01$ using the Wilcoxen Test. However, condition (2) was not significantly different from condition (3), and condition (3)

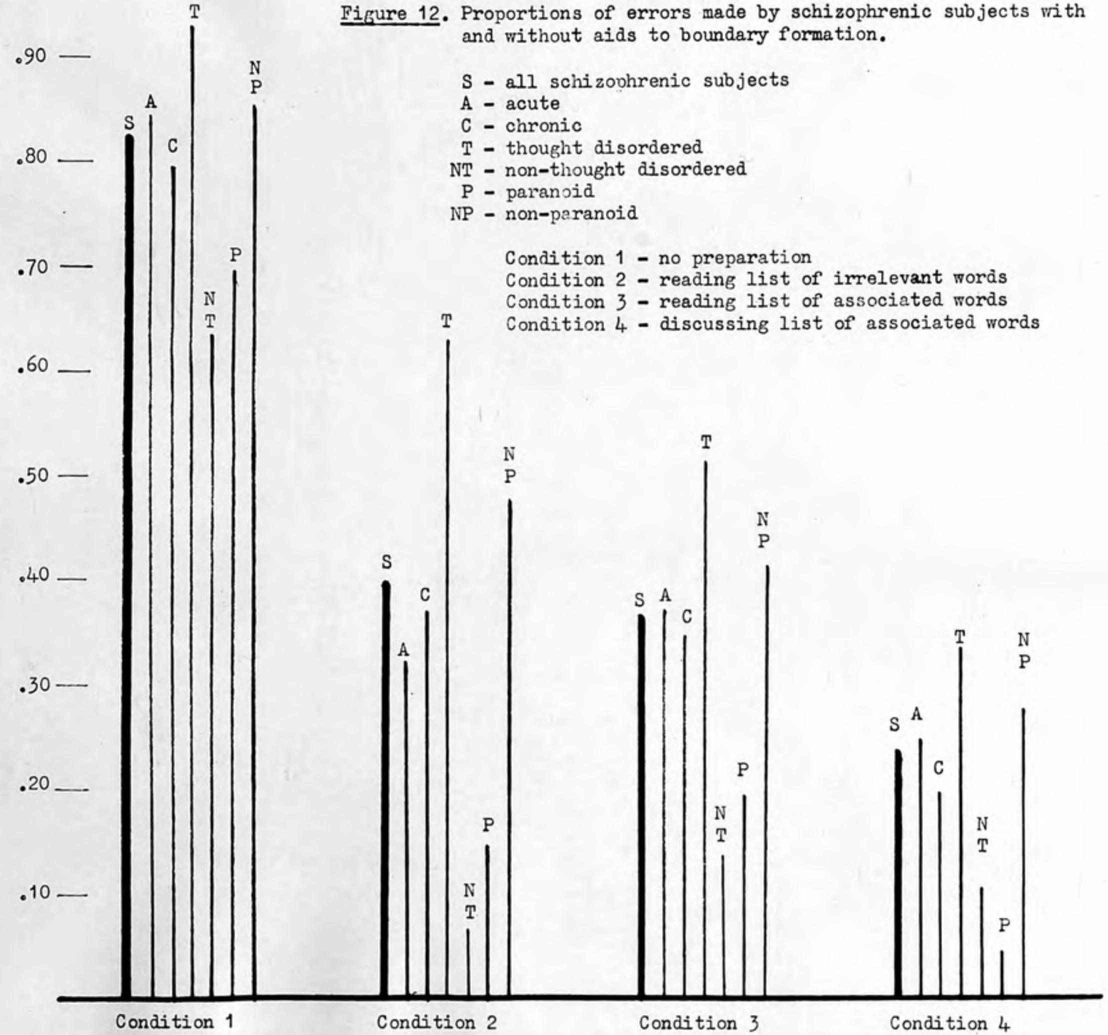


Figure 12. Proportions of errors made by schizophrenic subjects with and without aids to boundary formation.

S - all schizophrenic subjects
A - acute
C - chronic
T - thought disordered
NT - non-thought disordered
P - paranoid
NP - non-paranoid

Condition 1 - no preparation
Condition 2 - reading list of irrelevant words
Condition 3 - reading list of associated words
Condition 4 - discussing list of associated words

was not significantly different from condition (4), although condition (2) was significantly different from condition (4) at $p < .05$.

Associational Proximity under the Four Conditions

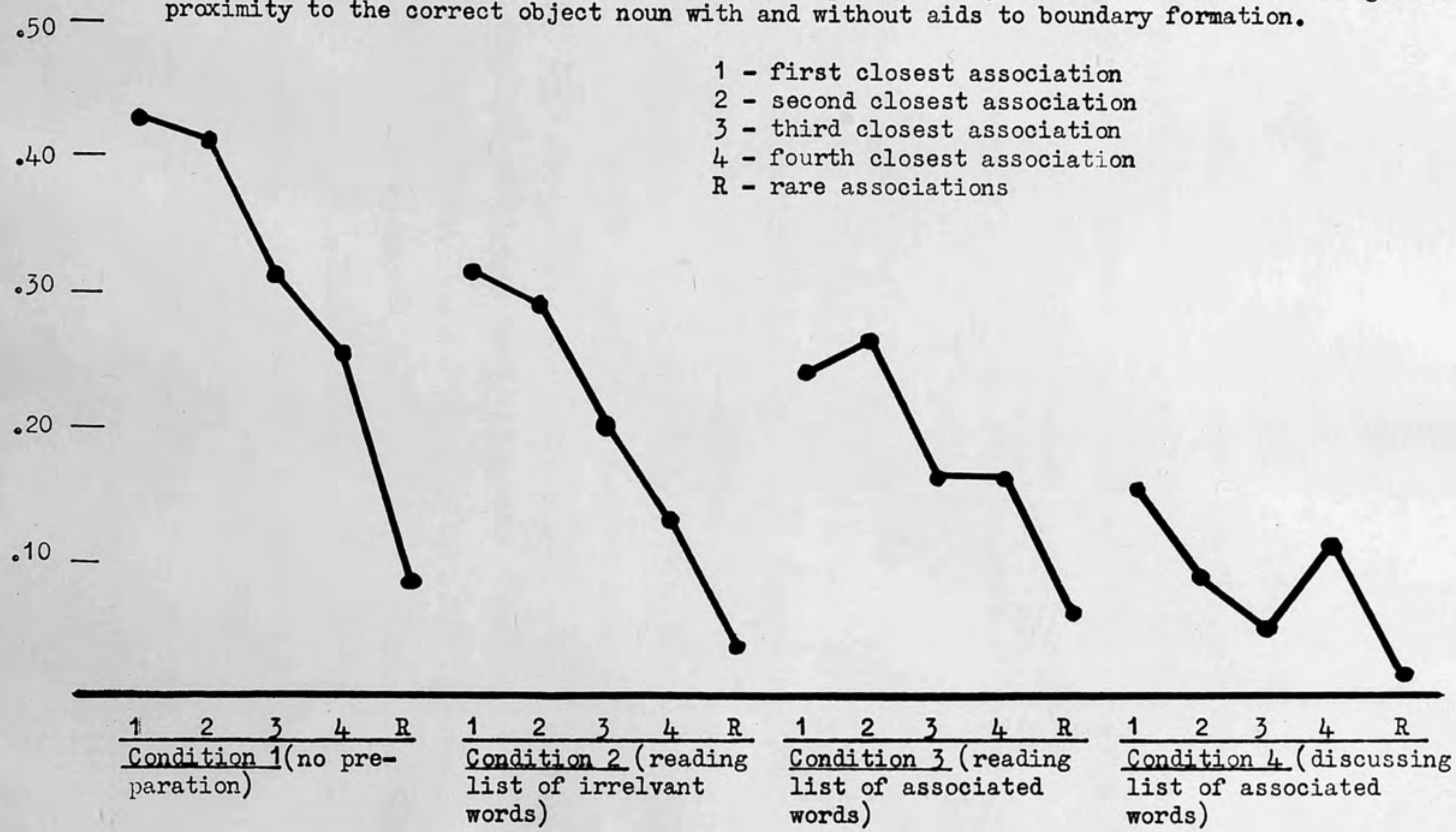
As one would expect, there was a close relationship between the strength of an association and the proportion of errors in condition (1) (see Figure 13), which is comparable with the proportions of errors made in Experiment 3, by schizophrenic subjects (see Figure 9).

Although there were less errors made under condition (2), a similar relationship between associational proximity and the proportion of errors made exists. In conditions (3) and (4), the relationship is not so clear. The Friedman 2-way analysis of variance showed a significant difference among the amount of errors made in each associational category in condition (1) ($p < .001$), condition (2) ($p < .05$) and condition (3) ($p < .01$) but not in condition (4).

However, there was a significant difference in amount of errors between the four close associations and the four rare associations under each condition at $p < .01$ using the Wilcoxen Test.

Significant differences were found between the close and the rare associations for each subgroup (except the non-thought disordered, and the paranoid subgroups, which were very small in numbers) under conditions (1), (2), and (3), but under condition (4) this difference was found only for acute, thought-disordered and non-paranoid subjects (see Table 6, Appendix C).

Figure 13. Proportions of acceptance errors made by schizophrenic subjects to words of decreasing associational proximity to the correct object noun with and without aids to boundary formation.



Discussion

Additional Stimuli

This Section has shown that the more information connected with processing material a schizophrenic subject is given, the easier it will be for him to reject incorrect names for pictures of objects. The more alternative words he is given, and the more aids to boundary formation he is given, the greater the proportion of incorrect words he will be able to reject.

In an indirect way, this result fails to lend support to the attentional deficit theory described in the Introduction. One would hypothesize, on the basis of the distractibility experiments (which demonstrated attentional defects in the ability to filter out "extraneous" or "distracting" additional stimuli by schizophrenic patients) that the more stimuli given, the more distractible the situation would become for schizophrenics, and the worse a schizophrenic would do. Although the additional stimuli (i.e. more alternative words in Experiment 8 and interspersed lists of words in Experiment 9) were not designed to distract the subject, one might have conjectured that they would act as distractors and decrease performance level in schizophrenic subjects as a logical outcome of the theory of faulty filter mechanisms and attentional defects.

Additional stimuli in Experiments 8 and 9 had just the opposite effect on schizophrenic subjects than one would expect from a theory of attentional impairment. However, it must be remembered that the experiments supporting this theory were not directly concerned with language. Additional stimuli in other spheres of behaviour may act as distracting agents for schizophrenics

The Difference between the Multiple and Single Choice Conditions

In Experiments 1 and 2, more errors were made under the single choice condition than under the multiple choice condition by schizophrenic subjects, but not by children, dysphasics, non-psychotic psychiatric patients, or normal adults. This difference between the conditions held true for schizophrenic subjects in all experiments involving word identification. Examination of these two conditions revealed that under the multiple choice condition, more clues concerning the boundaries of a word are given. The subject has more opportunity to compare one alternative with another under the multiple choice condition. Under the single choice condition, there is some opportunity to compare one alternative with another as they come up in the list of stimuli, but this opportunity is interrupted after each alternative word is presented, so that a response can be made.

The hypothesis on which Experiment 8 was based, i.e. that if the number of responses is reduced, particularly in the single choice condition where more are required, that the amount of errors would decrease, was not confirmed. In fact, just the opposite was found, so that the more alternative words offered, the better was schizophrenic performance under both of the stimulus conditions.

This result implies that the quantity of stimulus clues which help schizophrenics to form appropriate word boundaries is extremely important. The number of responses required is less important, although, since the single choice condition produced more errors than the multiple choice condition no matter how many responses were required, the number of responses may have some importance in boundary formation.

This result, as well as the lack of difference between the pointing and saying conditions in Experiment 7, supports the general hypothesis assumed in the approach used in this thesis, that the stimulus is more important than the response, and that it is more useful to look into the receptive side of language to investigate the language impairment in schizophrenia than to examine the expressive variables. In Experiment 7, the response was changed from an oral response to pointing to a written response. Although the difference between oral stimuli and written stimuli has been shown to be an important variable for schizophrenic comprehension (see Section 1V), this change in the modality of the response made little difference in performance by schizophrenic subjects.

It was a surprise to the author to find that reading a list of irrelevant words before an item (in Experiment 9, condition (2) improved performance. This seems to indicate that any words, even those not connected with the aroused associative repertoire, help to form the boundaries influencing the decision process for the stimulus word choices. It might be conceivable that just the presence of a list of separate words may evoke a "set" toward more acute discrimination of words by schizophrenics, whose boundaries separating closely associated words are normally "un-set" or "loose". If the list contains the content of the loosely aroused associations, this aids the schizophrenic in his rejection mechanism a little bit more. And when the list is defined and discussed, the schizophrenic is further aided in his ability to reject.

The presence of these lists interposed between items in Experiment 9 may serve the schizophrenic to set up the kind of delineations and differences on dimensions with regard to individual words which normal people carry with them, and which may become partially lost in schizophrenia.

The lists interposed between the items in Experiment 9 may be related to the longer inter-trial intervals shown to improve schizophrenic performance in reaction time by Zahn _et al_ (1961). Zahn found that schizophrenic subjects have long reaction times as compared with normal subjects when preparatory intervals are long and inter-trial intervals are short. But when preparatory intervals are short and inter-trial intervals are long, normal and schizophrenic subjects are identical. The lists interposed between items in Experiment 9 may have served the purpose of lengthening the interval between items, and thus facilitating schizophrenic performance.

The conditions where aids to boundary formation were employed in Experiment 9 made the stimulus presentation under the single choice condition more like the multiple choice condition by the presence of more uninterupted words which the schizophrenic was able to employ for strengthening his weakened boundaries between words, and which helped him to differentiate between closely associated words more like normal subjects can do without aids.

SECTION 1V. THE VISUAL MODALITY

Experiment 10. The Word Identification Task in Written Form

In 1954 Teichner told of the widespread finding of faster reaction times to auditory than to visual stimuli for normal subjects. Many workers have found this to be reversed in schizophrenia. Venables and O'Conner (1959) and later, Sutton et al (1961) repeated reaction time studies with schizophrenic subjects. They found that some paranoid schizophrenics behaved similarly to normal subjects, but all non-paranoid schizophrenics and withdrawn paranoid patients showed slower reactions to auditory than to visual stimuli. Spain (1966) showed better eyelid conditioning to a visual conditioned stimulus than to an auditory conditioned stimulus in schizophrenics and the reverse in normal subjects. Sutton and Zubin (1965) found that with schizophrenic subjects reactions to sound stimuli are impaired if the previous trial was a light, whereas reactions to visual stimuli however preceded, do not yield differences between schizophrenic and normal subjects. Venables (1966) found thresholds of paired clicks higher for schizophrenic subjects than for normal subjects, and that for the most deteriorated schizophrenics two click thresholds were higher than two flash thresholds. Venables concluded that schizophrenic pathology appears to involve a relative deficiency in performance involving the auditory modality.

Some workers however have discovered a visual impairment in schizophrenia. Begelman (1966) found that schizophrenic subjects scored better on an auditory task requiring the availability of a generic category name for objects than on a similar visual task. Weckowitz (1960) found a visual deficit in schizophrenics as compared with patient controls in identifying drawings of common objects when overlapping lines were superimposed. McGhie et al (1965a) found that schizophrenic performance was worse than that of normal persons on visual tasks involving immediate recall. Stilson and Kopell (1964) found visual distractions to hinder the performance of schizophrenic subjects in a visual detection test, where it did not affect normal subjects.

The task in Experiment 10 is the same task as in Experiment 1 with the exception that the stimulus words are presented in written form.

The null hypotheses are:

1. There is no difference in the amount of errors between the single and multiple choice conditions.
2. There is no difference between the amount of errors made in items with long or short object nouns.
3. There is no difference between the amount of errors made in items with rare or frequent object nouns.
4. There is no difference between the amount of naming errors for normal patients and for schizophrenic patients.
5. There is no difference in the amount of overall errors between normal and schizophrenic subjects.
6. There is no difference between the amount of errors made on one type of word or another.
7. There is no difference between the proportions of errors made in Experiments 1 and 10.

Methods

Material

A task was prepared using the same 12 object nouns and the same 12 pictures of these nouns as in Experiment 1. The same 8 alternative words were attached to each of the object nouns to form the alternatives as in Experiment 1. The same random orders as in Experiment 1 were also used, and the same scoring sheet was used.

The tape recording of the words used in Experiment 1 was not employed, however. In place of the recording, the words were typed on cards for visual presentation to the subject. Two sets of cards were typed; one set for the presentation of the single choice condition, and one set for the multiple choice condition. The set used in the multiple choice condition was typed on 6" x 6" white cards. Each item, comprising nine alternative words was typed in a column on a separate card. The column appeared in the same random order as the presentation of the alternative words in Experiment 1. The typewriter used was one in which lower case letters are $\frac{1}{4}$" high. All the words were typed in lower case.

The set of cards used in the single choice condition was typed in exactly the same way, except each word was cut out, for presentation one at a time. The nine words for each item were put into separate envelopes.

Procedure

The written form of the word identification task was administered as the aural task in Experiment 1 with one exception. Instead of the tape recorded words, the typed cards were presented to the subject.

Under the multiple choice condition the subjects were given the following instruction concurrent with the presentation of the first picture and the first multiple choice card: "Here are a list of words.

Please read them and point to the name of this picture, or what this is a picture of."

Under the single choice condition the subjects were given this instruction concurrent with the presentation of the first picture: "I will show you some words on little cards one by one. To each card please say 'yes' or 'no' as to whether it is the name of the picture or not. If the word you see is the name of the picture or what the picture is called, say 'yes'; if it is not the name of the picture, say 'no'."

As in Experiment 1, the task was divided in half for the two conditions, and the halves were varied from one subject to another. Errors were counted by the same method as described in Experiment 1. After testing, schizophrenic subjects were asked to explain the meaning of the same four proverbs and the same open-ended question as in Experiment 1, in order to elicit the presence or absence of thought disorder as clinically demonstrated. After these questions each subject was asked to name all the pictures one at a time as in Experiment 1.

Scoring

The scoring was based on the number of errors made as described in Experiment 1. The two Methods, A and B, were similarly employed. Method B was used to compute all the results except those concerning types of errors, where it was necessary to use Method A.

Subjects

Schizophrenic Patients

Schizophrenic patients were chosen as subjects on the same basis as described in Experiment 1. None were the same subjects used in previous experiments.

There were 10 chronic schizophrenics, 5 men and 5 women, whose mean age was 35.5 years ranging from 16 years to 50 years.

The 10 acute schizophrenic patients were 5 men and 5 women, with a mean age of 33.5 years, and an age range of 16 years to 48 years.

The schizophrenic subjects were subdivided into groups of thought disordered/ non-thought disordered/ undetermined on the basis of the clinical assessment described. They were also divided into paranoid/ non-paranoid on the basis of psychiatric diagnosis. The numbers of schizophrenic subjects falling into each category were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	1	0
Paranoid and Non-thought disordered	1	0
Paranoid and Undetermined	0	0
Non-paranoid and Thought disordered	4	8
Non-paranoid and Non-thought disordered	4	0
Non-paranoid and Undetermined	0	2

Control Subjects

The control subjects were 10 convalescing patients from the orthopaedic wards of Addenbrooke's Hospital, Cambridge. None of these patients had ever had any in-patient or out-patient psychiatric treatment.

They were 5 men and 5 women with a mean age of 27.0 years, ranging from 16 years to 46 years. No control subjects had taken part in previous experiments.

Results

Multiple and Single Choice Conditions

Significantly more errors were made in the single choice condition than in the multiple choice condition for schizophrenic subjects ($p < .05$) but not for normal subjects.

Among the schizophrenic subgroups, only the thought disordered subgroup reached a significant level of difference, however, on both the Wilcoxen Test ($p < .05$) and the Sign Test ($p = .032$). The acute and non-paranoid subgroups reached significant levels of difference between the conditions only by the Wilcoxen Test at $p < .05$ (see Table 1, Appendix D). Less errors were made under both conditions in this experiment than in Experiment 1 (see Figure 14).

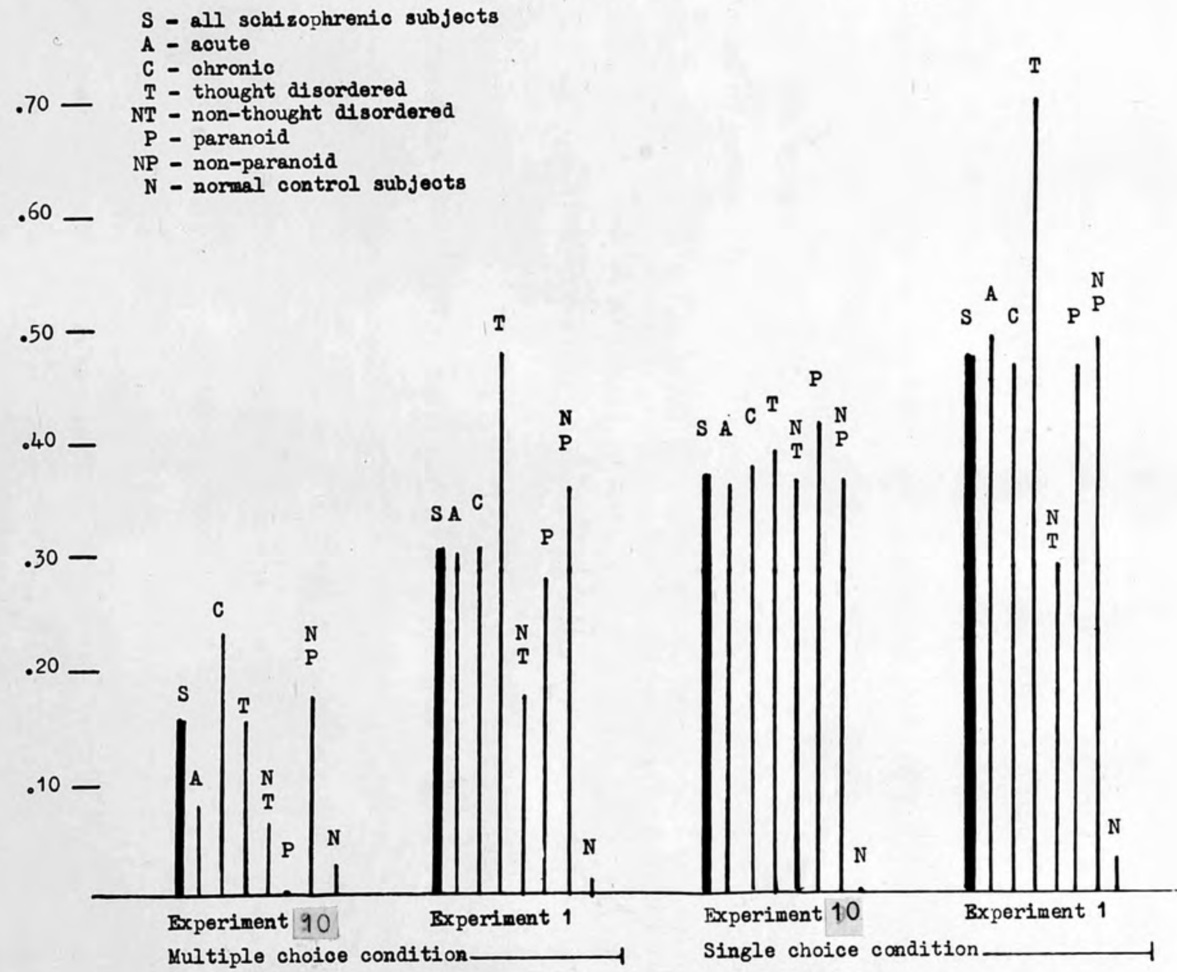
Word Length

Whereas in Experiment 1 the chronic and non-paranoid subgroups of schizophrenic subjects found three-syllable object nouns significantly more difficult to respond to than one-syllable object nouns, in this experiment, the chronic patients do not show a significant difference. However, the acute, thought disordered and non-paranoid subgroups show a significant difference at $p < .05$, $p < .05$ and $p < .01$, respectively (see Table 2, Appendix D).

Word Frequency

As in Experiment 1, schizophrenic subjects did not show a difference between the amount of errors made to rare or frequent object nouns (see Table 3, Appendix D).

Figure 14. Proportions of errors made by schizophrenic subjects and normal control subjects in the single choice and multiple choice condition in Experiments 1 and 10



Naming

Very slightly more naming errors were made in Experiment 1 by schizophrenic subjects than in Experiment 10. The schizophrenic subgroups remained in the same relation to one another as in Experiment 1 with respect to number of naming errors; thought disordered subjects made more than non-thought disordered, and non-paranoid subjects more than paranoid subjects (see Table 4, Appendix D).

There was no significant difference between the incidence of naming errors by schizophrenic subjects and by normal patients. Nor were there any significant differences in the amount of naming errors between any of the schizophrenic subgroups.

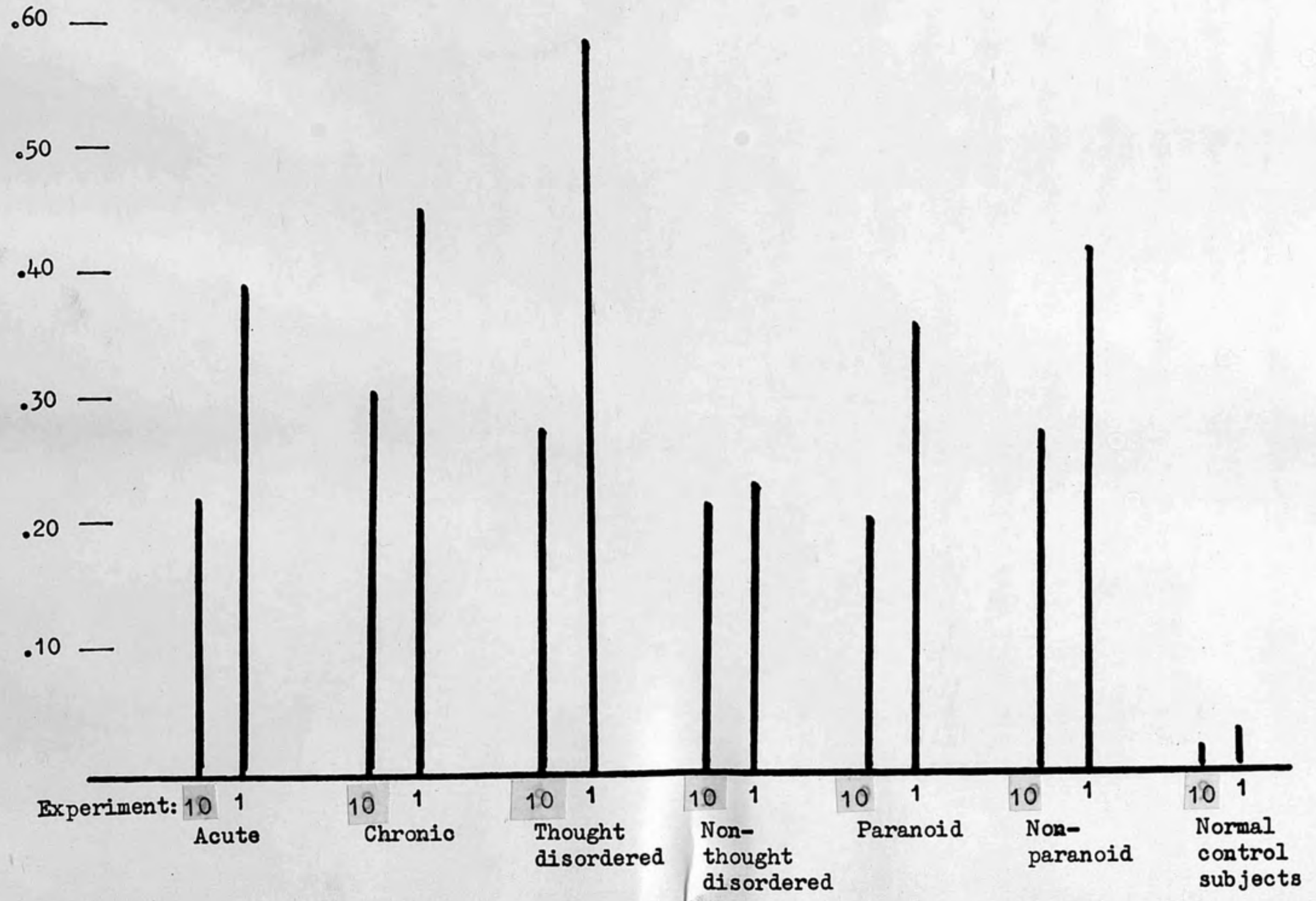
Elaboration of names similar to the elaboration given by the schizophrenics in Experiment 1 was given by schizophrenic subjects. No elaboration was given by the orthopaedic patients.

Comparison of Groups on Overall Errors

The schizophrenic subjects in Experiment 10 made clearly fewer errors than their equivalents in Experiment 1 (see Figure 15). As in Experiment 1, the chronic subjects made more overall errors than the acute subjects, the thought disordered subjects made more errors than the non-thought disordered subjects, and the non-paranoid subjects made more errors than the paranoid subjects. None of the differences in overall errors between schizophrenic subgroups reached significant levels in this experiment.

Schizophrenic subjects and normal subjects differed at $p < .002$ using the Mann Whitney U-Test on overall errors (see Table 5, Appendix D).

Figure 15. Proportions of overall errors made by schizophrenic subjects and normal control subjects in Experiments 1 and 10.

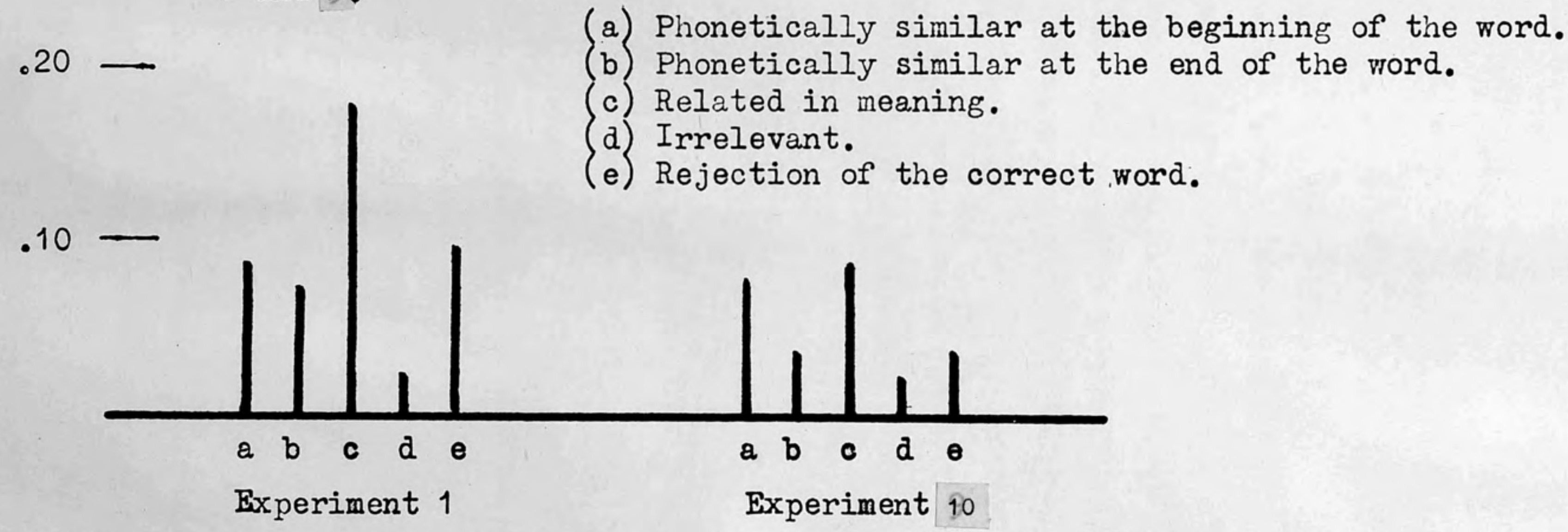


Types of Error

There are not as many clear cut differences among the types of errors made as there were in Experiment 1 (see Figure 16) where schizophrenic subjects made more errors on words related in meaning to the stimulus word than any other kind.

Although the Friedman 2-way analysis of variance shows a significant overall difference ($p < .05$) between the types of errors for all schizophrenics, the number of related-type errors was not significantly larger than the next highest type for schizophrenics as a group, or for the subgroups, using the Wilcoxen Test (see Table 6 and Table 6A, Appendix D).

<u>Figure 16</u>. Proportions of types of errors made by schizophrenic subjects in Experiments 1 and 10.



Experiment 11. The Word Identification Task in Written Form with the Picture Stimuli Replaced by a Sentence Context

Some research workers have found schizophrenia to involve perceptual distortion when viewing pictures (Bemporad, 1967; Weckowicz, 1960). Bemporad asked schizophrenic subjects to respond to what they saw on the Pseudo-Isometric Plates, which are composed of colored dots in the form of a number against a background of dots of contrasting colors. Schizophrenic subjects responded to the dots, for the most part, while a patient control group responded to the form the dots took, i.e. the numbers. That schizophrenic patients had difficulty identifying drawings of common objects when overlapping lines were superimposed, was shown by Weckowicz. A control group of subjects had no difficulty identifying these drawings.

Although the picture stimuli used in previous experiments in this thesis were not as complicated as the picture stimuli used by Bemporad (1967) and Weckowicz (1960), elaboration was given to these picture stimuli by schizophrenic subjects in Experiments 1, 2 and 10, when they were asked to name the pictures. The type of elaboration was described and discussed in Experiment 1. It did not generally involve incorrect naming, by schizophrenic patients, but took the form of additions to the correct name, such as adding fragments or associational material to the name.

Elaboration was not exhibited by other members of the linguistic community used as subjects in Experiment 1, or by control subjects in Experiment 10. Thus, it appears that the picture stimuli are perceived differently by schizophrenic patients, than by other persons. The pictures may have a detrimental effect on schizophrenic task performance, particularly if the pictures arouse words associated with the name of the picture, as may be the case when elaboration is taken into consideration.

In Experiment 11, the picture stimuli are replaced by simple sentences where the key word, or correct object noun, is deleted. In all other respects, the stimuli and conditions are the same as in Experiment 10.

The null hypotheses for Experiment 11 are:

1. There is no difference between the amount of errors made under the single and multiple choice conditions.
2. There is no difference between the amount of errors made to items with long or short object nouns.
3. There is no difference between the amount of errors made to items with rare or frequent object nouns.
4. There is no difference between the experimental group and the control group on amount of naming errors.
5. There is no difference between schizophrenic subjects and the control subjects in amount of overall errors.
6. There is no difference in the amount of errors of each type.

Methods

Material

Ten simple sentences were constructed for each of the 12 object nouns used in Experiment 1. That is, there were 10 sentences including the word "window", 10 sentences including the word "dice", etc. Altogether there were 120 sentences. The correct word (i.e. the object noun) was deleted from all of them, and the sentences were typed in random order with the exception that none of the 10 sentences carrying the same deleted word were placed next to one another. These typed forms were duplicated, and given to 20 normal subjects, from hospital staff. The instructions given these subjects were to guess and to write in the deleted words.

The Sentence Task

One sentence per object noun was extracted from the completed forms by the 20 normal subjects, to serve on the sentence task. That one sentence was chosen only if 19 out of 20 of the normal subjects had written the correct word in the blank space. This was done to make the sentence contexts as similar to the pictures used in previous experiments as possible. The pictures had one unequivocal name for normal persons. The deleted words in these sentences were also unequivocal, since normal subjects could guess them without additional cues.

The 12 sentences which made up the task were as follows:

1. He looked out of the _____ and saw the sun.
2. The gambler wants to win when he throws his _____.
3. In Venice one would travel on a canal in a _____.
4. She held out her _____ and he put on the ring.
5. Every morning he read a daily _____.
6. The children threw buns to the _____ in the zoo.
7. She put pink polish on one _____ to try out the color.
8. The woodsman chops his way through the forest with a _____.
9. The red Indian raised his bow and shot an _____.
10. The carpenter hammered a _____ into the wood.
11. She drank her tea from a _____.
12. When the snow was heavy he put on his _____.

Two sets of the above sentences were typed on 3" x 5" white cards. One set was used for the multiple choice condition, and the nine alternative words, which were the same as in Experiments 1 and 10, were typed below the sentence in the same random order used in Experiments 1 and 10.

Under the single choice condition, the subject was presented with a 3" x 5" white card with only the sentence typed on it, and then given the alternative words one at a time from smaller cards. The subjects had to say "yes" or "no" as to whether each alternative word fit into the space in the sentence.

Procedure

The task was administered in the same way as in Experiment 10. Testing was done individually in a private room. Each subject was given six items under the multiple choice conditions and six items under the single choice condition; the items for each condition being alternated from one subject to another.

The instructions for the multiple choice condition were: "Here is a sentence with a word missing, and underneath it are some words. Please read the words and point to the word or words which fit in the sentence."

The instructions for the single choice condition were: "Here is a sentence with a word missing. I will show you some words one at a time, and you will say "yes" or "no" as to whether it is the word which fits in the sentence or not."

The same proverbs and open-ended question were asked as in previous experiments to elicit the presence or absence of thought disorder. Then the subject was asked to "name". No pictures were presented for naming, as in Experiments 1 and 10; instead the bare sentences were presented and the subject was asked to guess the missing word.

Scoring of errors and statistics were carried out as described in

Experiment 1.

Subjects

Schizophrenic Patients

The experimental subjects were 20 schizophrenic patients from Fulbourn Hospital, chosen on the same basis as described in Experiment 1, although none of the subjects were the same persons as those used in previous Experiments.

The 10 acute schizophrenic patients were 5 men and 5 women with a mean age of 35.2 years ranging from 17 years to 56 years.

The 10 chronic schizophrenic patients were 5 men and 5 women with a mean age of 39.1 years ranging from 20 years to 59 years.

The schizophrenic subjects were divided into subgroups. The numbers of patients who fell into each subgroup were:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	1	1
Paranoid and Non-thought disordered	0	1
Paranoid and Undetermined	0	0
Non-paranoid and Thought disordered	4	3
Non-paranoid and Non-thought disordered	4	3
Non-paranoid and Undetermined	1	2

Control Subjects

Ten convalescing orthopaedic patients who were not used as subjects in previous experiments, and who had not had any psychiatric treatment, were used as control subjects. Their mean age was 26.5 years ranging from 16 years to 46 years. They were 5 men and 5 women.

Results

The Multiple and Single Choice Conditions

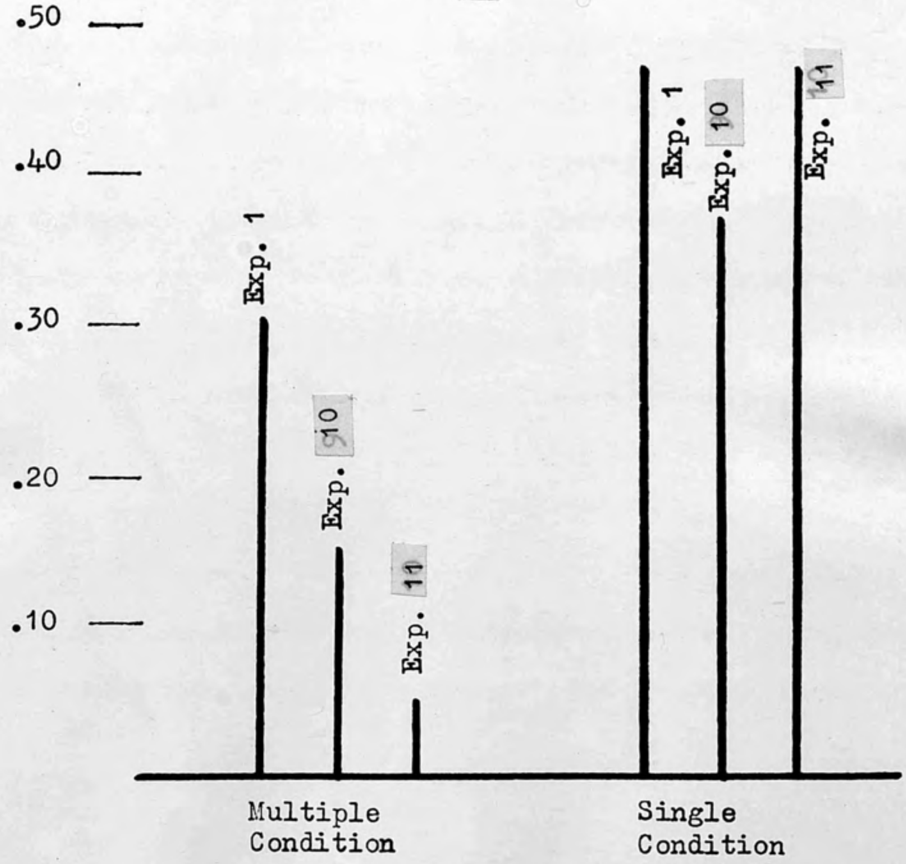
The difference between the amount of errors under the single and multiple choice conditions was large in this experiment, and reached significant levels of difference for schizophrenic subjects as a whole ($p < .01$), as well as when they were divided into subgroups (acute subjects, $p < .01$; chronic subjects, $p < .02$; thought disordered subjects, $p < .02$; non-thought disordered subjects, $p < .05$; non-paranoid subjects, $p < .01$) excepting the paranoid subgroup who were too small in numbers to use tests of statistical differences. Control subjects made no errors in this experiment (see Table 7, Appendix D).

The amount of errors made by schizophrenic subjects in this experiment under the multiple choice condition was less than the amount of errors made under the multiple choice condition in Experiment 10, and much less than the amount of errors made under the multiple choice condition in Experiment 1. The amount of errors made under the single choice condition remains high in this experiment (see Figure 17).

Length of the Object Noun

No differences were found in amount of errors made in items with long or short object nouns (see Table 8, Appendix D). In Experiments 1 and 10, some differences in word length had been found.

Figure 17. Proportions of errors made by schizophrenic subjects in the multiple choice and single choice conditions in Experiments 1, 10 and 11.



Frequency of the Object Noun

Similarly to Experiments 1 and 10, no differences were found in amount of errors made in items with rare or frequent object nouns (see Table 9, Appendix D).

Naming

Although the naming task was quite different from the naming task in Experiments 1 and 10* the amount of naming errors made by schizophrenic subjects was very close to Experiment 10, and slightly less than in Experiment 1. Unlike Experiments 1 and 10, acute schizophrenic subjects made more naming errors than chronic subjects. The other two subgroups produced naming errors in the same relation as in Experiments 1 and 10 (see Table 10, Appendix D).

There was no significant difference between the amount of naming errors made by schizophrenic subjects and by control patients. Nor were there any significant differences between the schizophrenic subgroups.

Comparison of Groups

The schizophrenic subjects in this experiment made much fewer overall errors than those in Experiment 1, but a similar amount to those

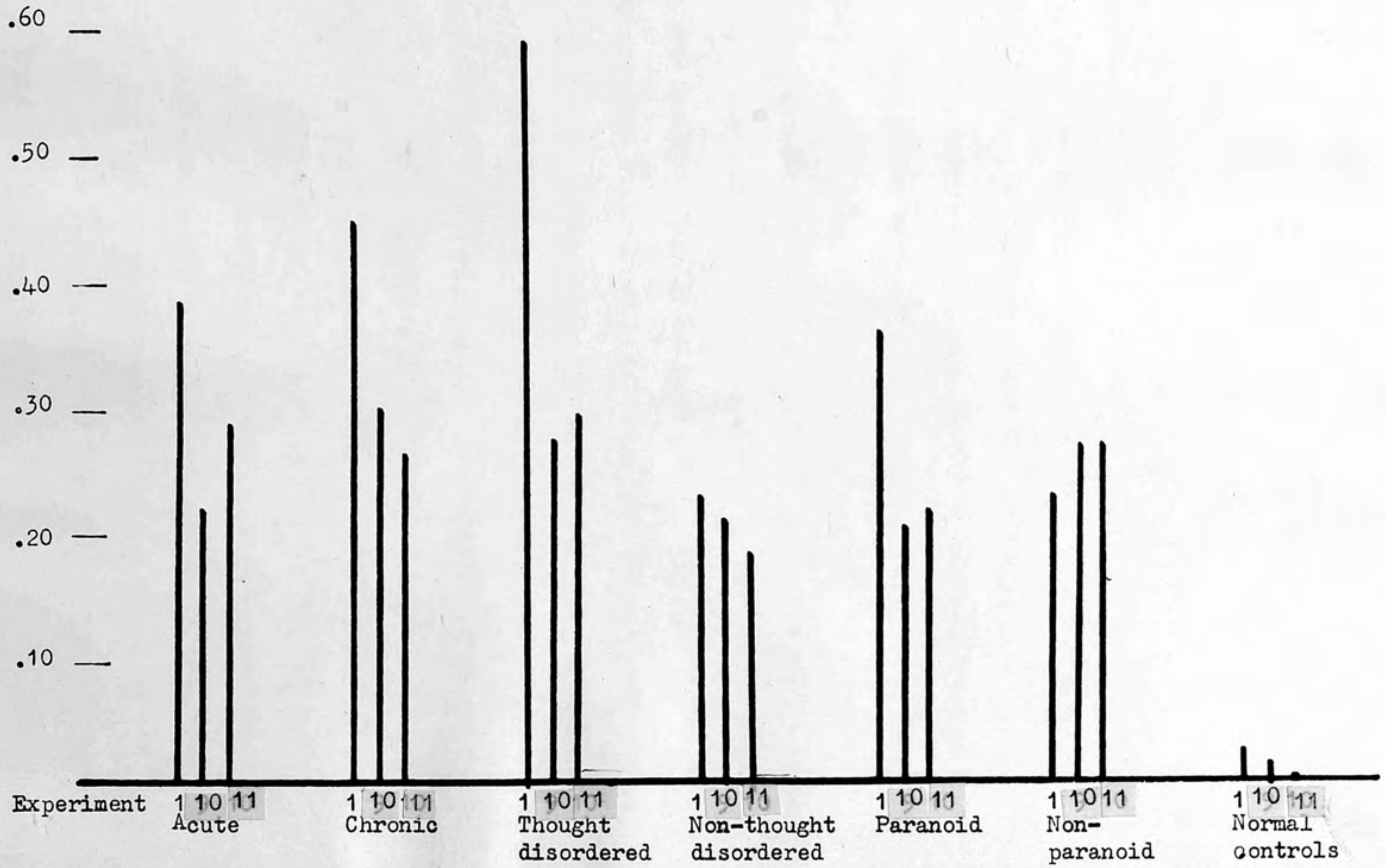
*Here, the subjects were asked to guess the deleted word, without being offered any choices, in place of the naming task using the pictures in previous experiments. Actually, the naming task required of the subjects in Experiment 11 was virtually the same as the task given to the normal subjects in order to collect the sentences, as described in the Methods.

in Experiment 10 (see Figure 18). None of the schizophrenic subgroups in this experiment showed significant differences in amount of overall errors. Schizophrenic patients and control subjects differed at $p < .002$ using the Mann Whitney U-Test on overall amount of errors made (see Table 11, Appendix D).

Types of Errors

Although schizophrenic subjects made more errors by accepting words related in meaning to the object noun than any other type of error, the Friedman two-way analysis of variance among the different types of errors did not reach significant levels (see Table 12, Appendix D).

Figure 18. Proportions of overall errors made by schizophrenic subjects and normal control subjects in Experiments 1, 10 and 11.



Experiment 12. Fast and Slow Presentation of the Word Identification Task in Written Form

Experiments 1, 10 and 11 showed that when word stimuli were presented visually, fewer errors were made by schizophrenic subjects than when the stimuli were presented orally. This modality difference occurred mainly under the multiple choice condition.

The written stimuli in Experiments 10 and 11 however, were seen by the subjects for a longer amount of time than the oral stimuli were heard by the subjects in Experiment 1. In fact, the time of presentation of the written word stimuli in Experiments 10 and 11 was not controlled, so that the subject could view the stimulus words for as long as he required.

It was hypothesized that if the time allowed to see a stimulus word was approximately the same as the time to hear a stimulus word, the amount of errors would then be approximately equal. This hypothesis bears similarity to Yates' (1966) more general hypothesis, mentioned in the Introduction, that a primary deficit in schizophrenia may be an abnormally slow rate of information processing.

In Experiment 12, written word stimuli were presented in two conditions. In one condition, the "slow" condition, the time for viewing the stimulus words was unlimited, as in Experiments 10 and 11. In the "fast" condition, the viewing time was limited to one second per stimulus word. The rate of one second per word was approximately equal to the amount of time it took to say a word on the tape recordings prepared for use in Experiments 1 and 2.

The null hypotheses for Experiment 12 are:

1. There is no difference between the amount of errors made under the fast presentation condition and under the slow presentation condition.
2. There is no difference between the fast and slow presentation conditions in the amount of errors made of different types.

Methods

Material

The 18 items prepared for Experiments 1 and 2 were used in the same random order. The scoring sheet was the same as the scoring sheet from Experiments 1 and 2 combined.

The same 12 6" x 6" white cards from Experiment 10 (multiple choice condition) were used in addition to 6" x 6" white cards made up in the same way for the 6 items from Experiment 2. The same pictures were used for the 18 object nouns as in Experiments 1 and 2. A stop-watch was employed to control the stimulus presentation time in the fast condition.

Procedure

The task was administered in the same way as Experiment 10, under the multiple choice condition. This experiment was carried out only under the multiple choice condition because the presentation of the stimulus words under the single choice condition could not be controlled for time. The reason for this was that it was not possible to get schizophrenic subjects to respond with "yes" or "no" quickly enough for continuous one second presentations in the single choice form.

Another reason for employing the multiple choice condition was that it was the amount of errors in the multiple choice condition which decreased so dramatically from oral presentation in Experiment 1 to written presentation in Experiments 10 and 11. The single choice condition was less affected by the change in modality of stimulus presentation.

Before testing, an attempt to develop rapport with the subject was made by a short conversation. After testing, the clinical assessment for thought disorder was given as described in Experiment 1.

The task was divided in half so that 9 items were presented in the slow condition and 9 items in the fast condition. The 9 items in each condition were systematically alternated from one subject to another.

The slow presentation condition was the same as Experiment 10 in the multiple choice condition, and the same instructions were used. For the fast presentation, the subject was warned that the stimulus card would be shown for a limited amount of time. Otherwise the instructions were the same as for the slow presentation. A stop-watch was used to expose the stimulus card for only 9 seconds.

Errors were scored in the same way as the previous experiments.

Subjects

The subjects were 20 schizophrenic patients from Fulbourn Hospital. They were drawn from chronic and acute cases by the same criteria described in Experiment 1, but none of the patients had taken part in previous experiments.

The 10 acute schizophrenic subjects were 5 men and 5 women with a mean age of 36.8 years ranging from 16 years to 63 years.

The 10 chronic schizophrenic subjects were 5 men and 5 women with a mean age of 41.0 years ranging from 28 years to 57 years.

These subjects were subdivided into groups of thought disordered/ non-thought disordered/ undetermined, on the basis of the clinical assessment for thought disorder, and into groups of paranoid/ non-paranoid on the basis of psychiatric diagnosis. The numbers of subjects in each subgroup were:

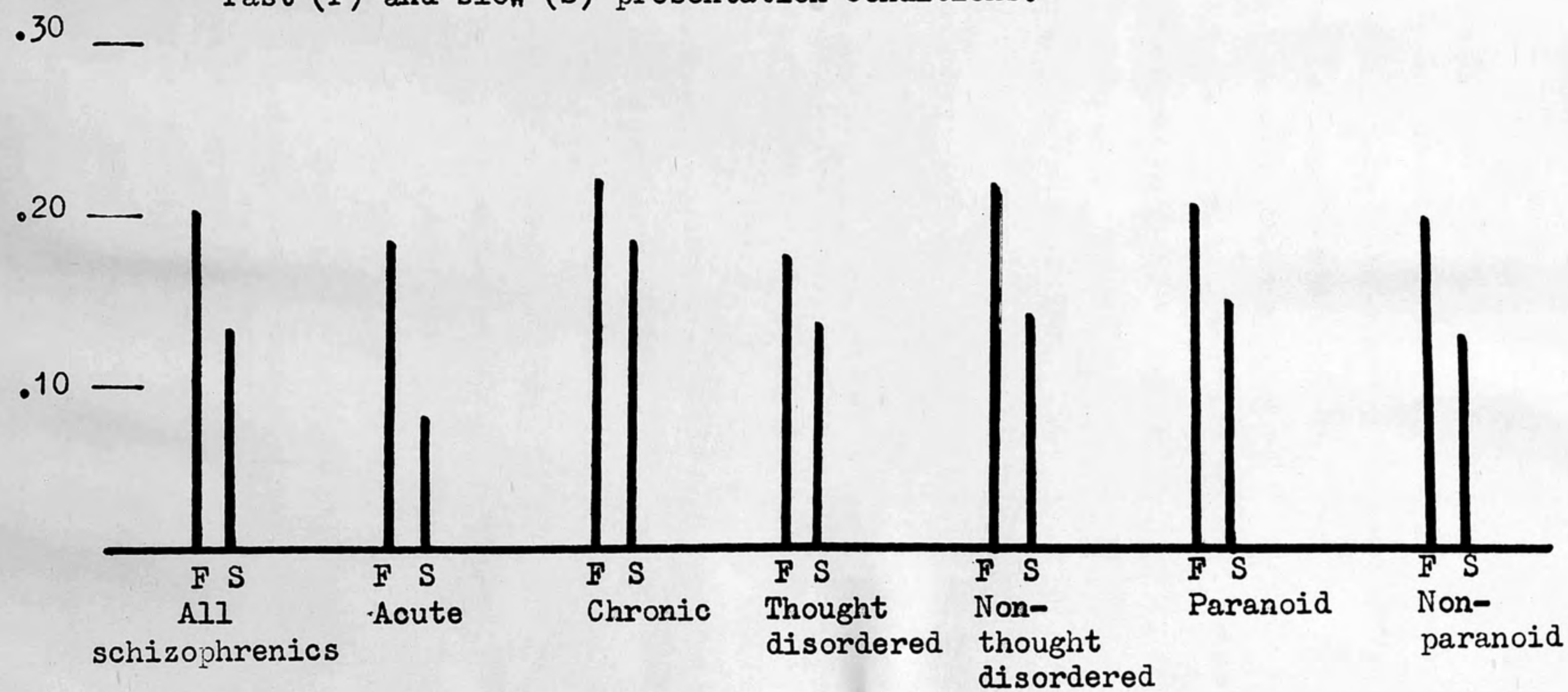
	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	2	3
Paranoid and Non-thought disordered	1	2
Paranoid and Undetermined	0	0
Non-paranoid and Thought disordered	4	4
Non-paranoid and Non-thought disordered	2	1
Non-paranoid and Undetermined	1	0

Results

Fast and Slow Presentation of the Stimulus Words

Under the fast condition, all schizophrenic subjects made significantly more errors than under the slow condition ($p < .01$). The individual subgroups each made more errors under the fast condition, but this only reached a significant level of difference for the acute subgroup ($p < .01$) (see Figure 19, and Table 13, Appendix D).

Figure 19. Proportions of errors made by schizophrenic subjects in the fast (F) and slow (S) presentation conditions.



Types of Errors in the Fast and Slow Presentation Conditions

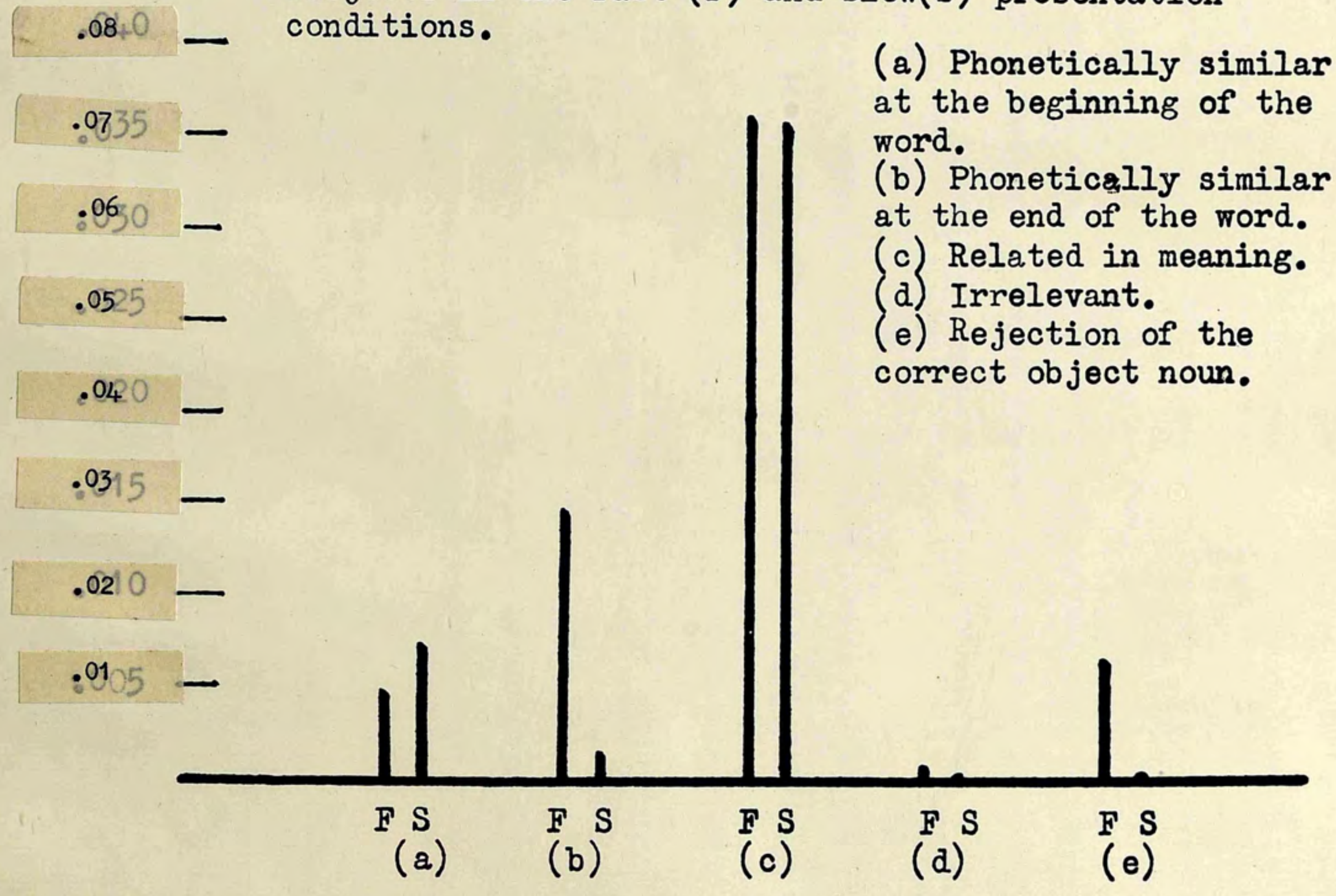
In the fast presentation condition, schizophrenic subjects as a group reached a significant level of difference ($p < .01$) using the Friedman 2-way analysis of variance, between the amount of errors made among the five different possible types of errors (see Figure 20). Of the subgroups, only the acute subjects reached a significant level of difference ($p < .05$) on the Friedman 2-way analysis of variance among the types of errors in the fast condition (see Table 14, Appendix D).

Type (c) error was the most common type of error made by the subjects (see Figure 20). When type (c) error was compared with the next most common type of error made under the fast condition, i.e. type (b) error, schizophrenic subjects taken as a group reached a significant level of difference ($p < .05$) on the Wilcoxen Test. The only subgroup to achieve significance in this comparison was the acute group ($p < .02$) (see Table 14A, Appendix D).

In the slow presentation condition, schizophrenic subjects as a whole, as well as each of the subgroups, reached significant levels of difference using the Friedman 2-way analysis of variance to compare the amount of errors made of each type (all subjects, $p < .001$; acute subjects, $p < .05$; chronic subjects, $p < .02$; thought disordered subjects, $p < .001$; non-thought disordered subjects, $p < .001$; paranoid subjects, $p < .01$; non-paranoid subjects, $p < .01$; see Table 15, Appendix D).

When type (c) error was compared with the next most common type of error under the slow condition, type (a) error, schizophrenic subjects as a group reached a significant level of difference ($p < .01$) on the Wilcoxen Test as did the acute subjects ($p < .02$); the chronic subjects ($p < .02$), the thought disordered subjects ($p < .02$), the non-thought disordered subjects ($p < .05$), the paranoid subjects ($p < .05$) and the non-paranoid subjects ($p < .01$), (see Table 15A, Appendix D).

Figure 20. Proportions of types of errors made by schizophrenic subjects in the fast (F) and slow(S) presentation conditions.



Experiment 13. The Number of Associations to Written or to Spoken Words.

From previous experiments it was shown that more errors were made by schizophrenic patients when identifying words presented orally than when identifying words presented in written form. Since schizophrenic errors are mainly of accepting words of the associationally related type (as was shown in Section 11), it was hypothesized that more associations may come to mind in free association to an oral word stimulus than to a written word stimulus, in schizophrenia.

Experiment 13 involves a free association test under conditions of oral stimulus presentation and written stimulus presentation, with schizophrenic and normal subjects.

The null hypotheses are:

1. There is no difference in the number of associations given to a word presented orally or a word presented in written form.
2. There is no difference between schizophrenic and normal subjects in number of associations given to written or orally presented words.

Methods

Material

A tape recorder was used to record the associations given by subjects to 18 stimulus words. The stimulus words were the 18 object nouns which were originally prepared for Experiments 1 and 2.

When the stimulus words were presented orally, they were spoken clearly by the experimenter. For the written presentation, each word was typed separately on a 3" x 5" white card.

Procedure

Each subject was asked to free associate to a stimulus word for 30 seconds. At the end of 30 seconds, the subject was told, "Stop".

The stimulus words were divided in half so that 9 stimulus words were presented orally, and 9 were presented in written form. These two conditions were varied systematically from subject to subject.

In the oral condition the instructions were, "I will say a word, and I want you to tell me all the words that come to mind after I say the word. Keep associating until I say stop".

In the written condition the instructions were, "I will show you a word on a slip of paper, and I want you to tell me all the words that come to mind after I show you the word. Keep associating until I say stop."

The subjects' responses were recorded on tape, and the numbers of words each subject gave to each stimulus word in the 30-second interval were counted afterwards.

Subjects

Schizophrenic Patients

The schizophrenic subjects were 10 chronic patients and 10 acute patients selected by the same criteria as described in Experiment 1.

The acute patients had a mean age of 30.0 years, ranging from 19 years to 56 years; they were 5 men and 5 women.

The chronic patients were 5 men and 5 women with a mean age of 46.9 years, ranging from 32 years to 61 years.

These subjects all took part in previous experiments, and they fell into the following subgroups:

	Acute (N=10)	Chronic (N=10)
Paranoid and Thought disordered	1	2
Paranoid and Non-thought disordered	0	0
Paranoid and Undetermined	1	2
Non-paranoid and Thought disordered	2	1
Non-paranoid and Non-thought disordered	5	3
Non-paranoid and Undetermined	1	2

Normal Subjects

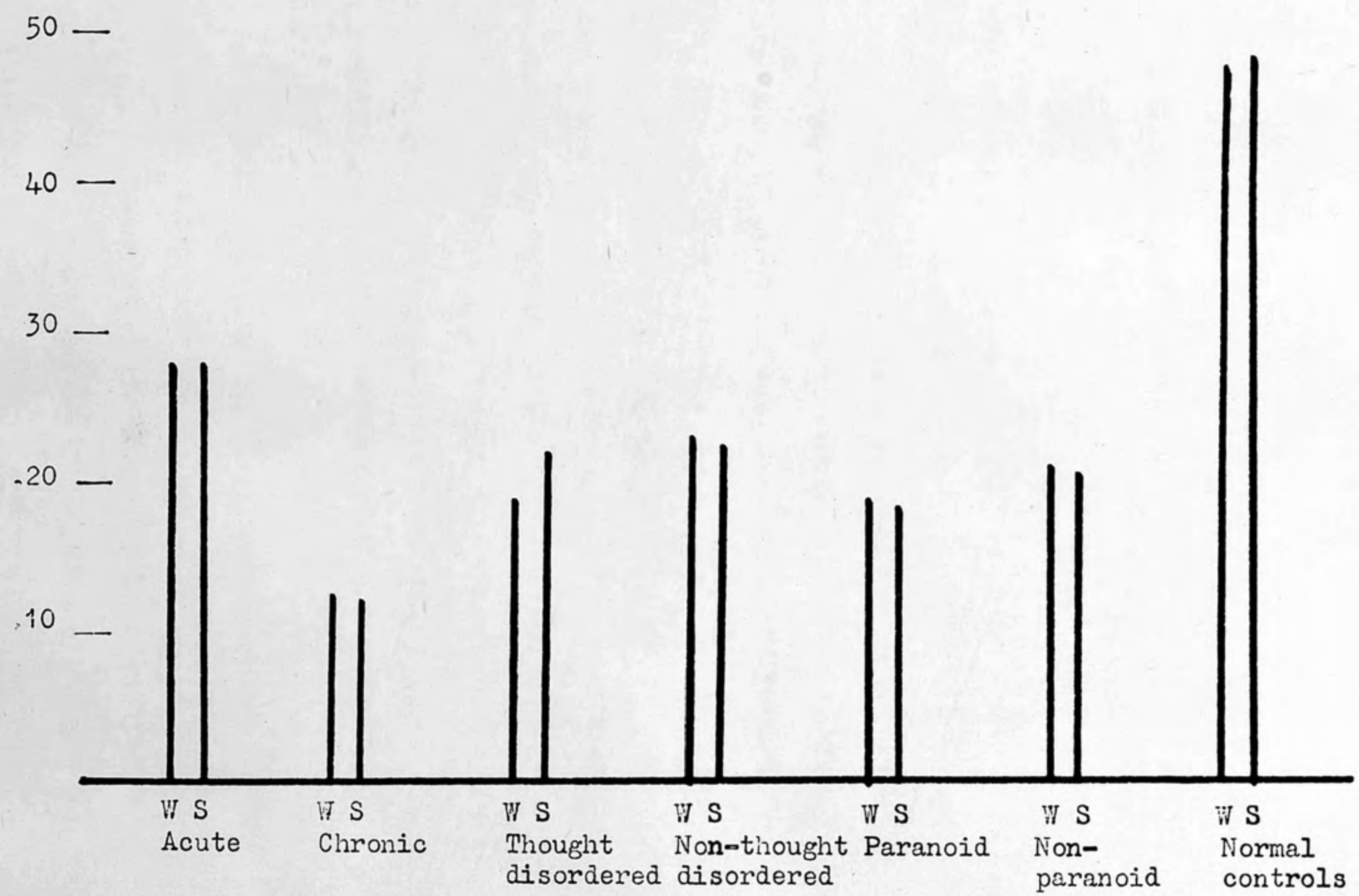
The normal subjects were 4 men and 6 women members of hospital staff. Their mean age was 27.5 years, ranging from 21 years to 46 years.

Results

There was no difference in the number of associations to words presented orally or to words presented in written form for schizophrenic or normal subjects. (see Figure 21, and Table 16, Appendix D).

There was a large variation in the number of associations produced by different schizophrenic subgroups and by normal subjects. Normal subjects were able to produce more associations than any schizophrenic subgroup under both written and oral presentations. Acute subjects produced more associations than any other subgroup, and chronic patients produced the least number of associations, under both conditions.

__Figure 21__. Mean number of associations given to a written (W) or to a spoken (S) stimulus word by schizophrenic subjects and by normal control subjects.



Discussion

The Visual Modality versus the Auditory Modality in Word Recognition by Schizophrenic Patients

In the Introduction, where experiments supporting the theory of overarousal were described, investigators found a modality difference opposite from normal behaviour in reaction time and in recognition threshold for non-paranoid schizophrenic subjects. Teichner (1954) described experiments with normal subjects showing faster reaction times to auditory than to visual stimuli.

Sutton *et al* (1961), Venables (1968) and Venables and O'Conner (1959) demonstrated that the opposite is the case in reaction times for non-paranoid schizophrenic subjects. Spain (1966) showed better eyelid conditioning to a visual conditioned stimulus than to an auditory conditioned stimulus in non-paranoid and withdrawn paranoid schizophrenic patients and the opposite for intact paranoids and normal subjects.

However, investigators examining the theory of attentional deficit revealed contradictory results regarding modality. McGhie *et al* (1965a) and Lawson *et al* (1967) demonstrated significantly worse performance by schizophrenic patients (hebephrenics in particular) in the visual modality using tasks which involve short term memory (presentation of digits of letters orally or visually to the subject who was required to report the series).

Lawson _et al_ (1967) attempted to explain these contradictory results by hypothesizing a defect in the mechanism which converts visual data into auditory form for memory storage, in schizophrenia. There is some evidence that this conversion takes place for normal subjects in experiments by Averbach and Coriell (1961), Conrad (1964) and Sperling (1960). Thus, experiments using schizophrenic subjects and requiring only detection or immediate processing of stimuli, such as reaction time experiments, reveal a defect in the auditory modality, while those involving memory (and the necessary conversion of visual data into auditory form) show a deficiency in the visual modality. The implication is that any stimuli trying to enter the auditory system, whether from outside stimulation not requiring memory, or from visual data being converted into the auditory system, will be impaired.

Experiments 1, 10 and 11 which did not involve memory, demonstrated that the modality of the stimulus material affects performance by schizophrenic patients, and that schizophrenics accept less incorrect words for the names of objects when the modality of presentation is in written form. In over-all amount of errors, the oral presentation (in Experiment 1) led to 40.8% errors by schizophrenic subjects, while the visual presentation of the same task (in Experiments 10 and 11) produced 26.7% error responses. The difference in amount of errors made between the two forms of stimulus presentations is significant at $p < .02$ using the Mann Whitney U-Test.

These results support the investigators who hypothesize that the visual modality is easier than the auditory modality for schizophrenic patients.

Paranoid and Non-paranoid Subjects

The investigators mentioned above found that most paranoid schizophrenics perform like normal subjects in reaction time (i.e. reaction time to an auditory stimulus faster than to a visual stimulus) and in tasks involving short term memory (i.e. no difference in tasks using different modality for paranoid schizophrenics and normal controls).

In Experiments 10 and 11 the number of paranoid schizophrenic subjects was very small (N=2 and N=3, respectively). Although these paranoid schizophrenic subjects produced a lower mean error than non-paranoid schizophrenics, the mean was not near the level given by normal subjects. The mean number of errors for paranoid schizophrenics was: 2.5 (Experiment 10) and 2.7 (Experiment 11); for non-paranoid schizophrenics, 3.2 (Experiment 10) and 3.3 (Experiment 11), and for normal control subjects, 0.2 (Experiment 10) and 0.0 (Experiment 11). In Experiment 12, no normal control subjects were used, however, paranoid schizophrenic subjects (N=8) were no different from non-paranoid schizophrenics in Experiment 12. The mean number of errors for paranoid schizophrenics was 1.9 (fast condition) and 1.4 (slow condition) and for non-paranoid schizophrenics, 1.8 (fast condition) and 1.2 (slow condition).

No consistent differences between paranoid and non-paranoid subgroups or similarities between paranoid schizophrenic subjects and normal subjects were found in the previous experiments in this thesis, involving auditory presentation of stimulus materials.

The great differences between paranoid and non-paranoid schizophrenics found by other research workers, and not substantiated in this series of experiments may be due either to a difference in psychiatric diagnoses at Fulbourn Hospital as compared with other hospitals, or to the fact that these differences may exist when measuring variables other than language comprehension. In most factors investigated in this study, paranoid and non-paranoid schizophrenic subjects were not generally different in the quality of errors made, although they were slightly different in the quantity of errors made. In most of the experiments, paranoid schizophrenic subjects made less errors than non-paranoid schizophrenics but this difference did not reach significant levels.

The studies reported which showed a strong difference between paranoid and non-paranoid schizophrenics, generally made up their two groups on the basis of psychiatric diagnoses, as was done in this thesis. Some research workers, however, have requested medical and nursing staff to rate patients on a factor of delusional intensity (Venables 1968) and have relegated those subjects with a strong delusional intensity score to the paranoid group.

In Fulbourn Hospital, there appears to be some variation among the consultant psychiatrists regarding the diagnosis of paranoid schizophrenia. Some psychiatrists tend to diagnose paranoid schizophrenia only when the delusional system appears to be the main focus of the illness, and other schizophrenic symptoms are minimal; other psychiatrists tend to diagnose paranoid schizophrenia whenever a delusional system occurs in a schizophrenic patient.

The Effect of Modality on the Multiple Choice Condition

An important finding of the experiments in this Section, was that the written modality affected the multiple choice condition by decreasing the amount of errors made by schizophrenic patients, but did not affect the single choice condition. In Experiment 10, where the stimulus words were presented in written form but the pictures were maintained, the proportion of errors made in the multiple choice condition was approximately half that made in Experiment 1, and in Experiment 11 where there were written stimulus words but sentence contexts were used instead of pictures, the proportion of errors under the multiple choice condition was reduced to approximately 1/6 of the proportion of errors under the multiple choice condition in Experiment 1 (see Figure 17).

One reason that the proportion of errors under the single choice condition did not change very much from one modality to another, where the proportion of errors under the multiple choice condition did, might be that the single choice condition remained virtually the same in the auditory and written modalities. Whether the word was presented by tape or by typewriter, the subject had one word to consider in each case. However, there was an important and unavoidable change in the multiple choice condition between the auditory and written tasks. In the auditory experiment, the subject had to listen to the list of multiple choice words one after the other whereas in the written experiments, the subject could see them all at once before him. Having all the alternative words to see at the same time most probably added structure and strength to the schizophrenic patients' ability to make comparisons between the words, to see the differences more clearly, and to form the appropriate boundaries, delineating one word from another.

Furthermore, in Experiment 11 where the sentence context was used instead of the picture, the blank space in the sentence indicated more dramatically to the subject that the choice of only one word from the group of words was to be made, whereas in Experiment 10 as in Experiment 1 where pictures were used, more than one word often seemed appropriate to the subject.

This might explain the approximately similar amount of errors under the single choice condition in the three experiments, and the great reduction under the multiple choice condition from the auditory to the written form of the task, and from the written task with pictures, to the sentence replacement task.

Another explanation could be based on the finding in Section 111, that the presence of additional words in the stimulus presentation, whether in the form of a greater number of alternative words (as in Experiment 8) or in the form of lists of words preceding each item (as in Experiment 9), help schizophrenic patients to avoid making errors.

In Experiment 10, additional word stimuli were not present under the single choice condition, but were present under the multiple choice condition, where the alternative words were shown to the subject in written form on a card all at once.

In Experiment 11, additional word stimuli were present under both the multiple and the single choice conditions, in the sentences which replaced the pictures. By this reasoning, one might assume the amount of errors under both the single and the multiple choice conditions should have been reduced in Experiment 11. However, in Experiment 11, errors were decreased only under the multiple choice condition. Possibly, the presence of the words in the sentence context, plus the alternative word choices typed below the sentence, as under the multiple choice condition, produced the "additional stimuli" effect, and thus reduced the errors under the multiple choice condition.

The Effect of Speed

One factor which influences the amount of errors made by schizophrenic subjects is the speed of presentation of written stimuli. In Experiment 12, where the speed of presentation of written word stimuli was controlled, and the experiment was conducted under the multiple condition, more acceptance errors were made by schizophrenics when the stimuli were presented at a faster rate.

This supports Yates (1966) hypothesis, mentioned in the Introduction, that schizophrenic patients are deficient in processing information at a normal rate of speed.

The effect of speed on performance is examined in more detail in the auditory modality in Section V.

Numbers of Free Associations Produced

In 1964, Horowitz and Newman found with normal subjects that if asked to speak on a given topic, subjects produced more material, more associations, and more ideas than when they were asked to write on a given topic. In Experiment 13, in an attempt to find a difference between the number of associations to a written or to a spoken word, no difference was found. One of the reasons was that the subjects sometimes read the written stimulus word out loud, even though they were asked not to (this was the case for normal subjects even more than for schizophrenics). This action virtually converts the written word into a spoken one. In cases where the subjects did not have this inclination, there was no way of telling whether or not they had "voiced" the word internally to themselves. Perhaps a difference would have been found had there been some mechanism for making the presentation of a written word truly visual.

However, there were considerable differences in the number of associations produced by normal subjects and by the schizophrenic subgroups in Experiment 13. The most associations were produced by normal subjects. Acute schizophrenic subjects produced more than any other schizophrenic subgroup, and chronic subjects produced the least number of associations. This agrees with the finding by Judson and Katahn (1964) who asked schizophrenic subjects to write down as many names of animals they could think of, and then as many names of persons they could think of. In both cases, the reactive schizophrenics produced more numbers of names than the process schizophrenics, and since the distinction between process and reactive schizophrenia was measured by length of stay in hospital, these groups were roughly equivalent to the acute and chronic groups in Experiment 13.

SECTION V. THE PRESENTATION SPEED OF VERBAL STIMULI

Experiment 14. The Speed of Stimuli in the Giving of Commands

This Section is devoted to the investigation of schizophrenic language comprehension employing a more realistic task than in previous experiments. The task devised for the experiment reported below involves the manipulation of real objects (rather than pictures of objects) as a response to commands consisting of entire sentences given orally.

Speed

Experiment 12, in Section 1V, indicated that the speed of the presentation of stimuli may be an important factor in the comprehension of words by schizophrenic subjects. Other workers mentioned in the Introduction have also found a relationship between the speed with which incoming stimuli are dealt with and performance in schizophrenia (Salzinger, et al, 1966; Williams, 1966; Yates, 1966; Zahn et al, 1961). In normal subjects, speech pauses were found to be an important factor in spontaneous speech (Goldman-Eisler, 1958a, 1958b; Henderson et al 1965; Levin and Silverman, 1965; Levin et al 1967; Siegman and Pope, 1965) and it has been suggested that speech pauses have an effect on the listener's interpretation of speech (Williams, 1965).

In the experiment to be reported below, the speed of the given commands was controlled in two ways. One was by increasing and decreasing the speed of the words uttered in each command by mechanical means. The second way was by editing a tape recording of the commands in such a way as to eliminate the speech pauses. It was hypothesized that these two ways of controlling the speed of incoming auditory stimuli may lead to a difference in performance by schizophrenic patients.

Length

The length of the object noun had a significant effect on some schizophrenic subgroups in Experiments 1 and 10, so that 3-syllable words led to more errors made by schizophrenic patients than one-syllable words. This length effect may or may not hold true for the length of commands. The length of the commands in this experiment is strictly controlled.

Lawson _et al_ (1964) and McGhie and Chapman (1961) reported that schizophrenic patients' difficulty in assimilating speech is due to an overloading of short term memory with irrelevant stimuli which are not screened out, leading to an inability to organise incoming verbal data in an economical way.

The control over the length of the commands in the experiment below involved the stringing together of an increasing number of stimuli, and short term memory was thus involved. The nature of the task was such that irrelevant stimuli in the form of objects on a tray not involved in the given command, were always present. The extent to which schizophrenic patients as compared with non-psychotic psychiatric patients were unable to screen out irrelevant stimuli was also investigated in the experiment reported below.

The null hypotheses for Experiment 14 are:

1. There is no difference in the amount of errors or repeats made in the four conditions varying speed.
2. There is no difference in the amount of errors made to long or to short commands.
3. There is no difference in the amount of errors or repeats made to commands employing frequent words, or to commands employing rare words.
4. There is no difference in the amount of errors or repeats between the experimental and control groups.
5. There is no difference in the amount of errors or repeats between the thought disordered and non-thought disordered schizophrenic patients, or between the chronic and acute schizophrenic patients.

Methods

Material

A task consisting of 12 commands was constructed. The key words in each command were adjectives and nouns. The verbs, articles and conjunctions were nearly the same in every command, and thus considered to be held constant.

In 6 of the commands, all the adjectives and nouns were taken from the AA words in the Thorndike and Lorge (1944) word count (these were the "frequent" commands). In the other 6 commands, the nouns used had frequencies from 1-10, and the adjectives had frequencies from 1-49 (these were the "rare" commands).

Each of the groups of 6 frequent and 6 rare commands were made up of commands of varying lengths so that one command in each group had one noun, one command had one adjective and one noun, one command had two nouns, one had two adjectives and two nouns, one had three nouns, and one had three adjectives and three nouns. The commands used are shown below.

Frequent commands

a) (1 noun). Point to the dog.

b) (1 adjective, 1 noun). Point to the big shoe.

c) (2 nouns). Point to the chair and bed.

d) (2 adjectives, 2 nouns). Put the two cats next to the small cup.

e) (3 nouns). Put the chair, the iron and the bed together.

f) (3 adjectives, 3 nouns). Put the green car, the two cats and the big shoe together.

Rare commands

g) (1 noun). Point to the anteater.

h) (1 noun, 1 adjective). Point to the pink thimble.

i) (2 nouns). Put the cooker next to the motorcycle.

j) (2 nouns, 2 adjectives). Point to the purple shoestring and the white thimble.

k) (3 nouns). Put the toilet, bathtub and wardrobe together.

l) (3 nouns, 3 adjectives). Put the yellow shoestring, the large scissors and the blue thimble together.

These commands were put into random order, and duplicated copies were made to serve for recording the responses. The random order of presentation was: b, h, a, i, c, f, k, j, g, e, l, d.

Objects in miniature, some of which came from a child's doll house, were collected for the response, which involved manipulation by the subjects.

The objects were chosen so that for each command every adjective and every noun had to be comprehended for correct performance by the subjects, i.e., given the command, "Point to the big shoe", a big shoe and a small shoe were present among the objects.

The following objects were presented to the subjects on a board in a scattered pattern:

1 big shoe	1 motorcycle	1 bathtub
1 small shoe	1 chair	1 wardrobe
1 pink thimble	1 bed	1 purple shoestring
1 white thimble	1 man	1 yellow shoestring
1 blue thimble	3 cats	1 anteater
1 dog	1 large scissors	1 small cup
1 iron	1 small scissors	1 large cup
1 cooker	1 toilet	

The commands were read into a tape in a standard English female voice. The tape was put through a Mark 11 Information Rate Changer by courtesy of the Gotham Audio Development Corporation, New York City, U.S.A. This is a device which can speed up or slow down a tape recording without distorting the pitch. Two new tapes were made from the machine: one which speeded each command by 35% and one which slowed each command by 35%.

A copy of the tape at normal speed was made, and this tape was edited by courtesy of the BBC Editing Department. By putting the tape very slowly through the head of a recorder containing built-in splicing equipment, the editor was able to remove the natural pauses in each command. Since the original recording was made at 15" per second the editor was able to be very accurate in removing the areas of tape without sound, and not disturbing the areas containing sounds. The original and the edited tape were played through an oscilloscope, and one could see that in the edited tape, the areas of zero frequency had been virtually eliminated.

Procedure

The board with miniature objects was placed in front of the seated subject, and the subject was told:

"Here are some toys. I will play a tape recording on which there are instructions telling you what to do with the toys. For example, you might hear the tape say, 'point to the man' and then you would point to the man". (The experimenter points to the man, by way of demonstration). "Now I will give you an example instruction and you do it. Put the man next to the chair". (The subject does this). "Now I will put on the tape, and you will follow the instructions."

Under the three conditions where the speed was distorted, the experimenter added: "The speed of the speech on the tape has been changed so that it is faster (slower) than usual."

Generally there was enough time left on the tape recording between commands for the subject to complete his manipulation of the objects. For the slower patients, the recorder was turned off between commands.

Two factors were recorded by the experimenter: 1) whether the command was carried out correctly or not, and 2) the number of times subjects repeated key words out loud as they conducted their search for the response.

Scoring

Errors were counted by whether or not each command was satisfactorily carried out. A maximum number of 12 errors could be committed by each subject.

The number of times a subject repeated the key words was also counted. One repeat (R) was tallied for a command if the subject said a noun, or an adjective and noun combination out loud. For example, if the subject said in response to the command: Point to the big shoe, "big shoe" or just "shoe", this was counted as one (R). If the subject, in response to: Put the cooker next to the motorcycle said: "cooker", this is counted as one R, but if he said: "cooker, motorcycle" or "cooker and motorcycle", etc., this is counted as 2 (R)s. Repeats were also added in the same manner if the subject kept repeating the same key word(s) in the same command.

Statistics

It is interesting to see the amount of errors compared with the amount of repeats in some of the data. Although there is a maximum number of errors possible, there is no maximum to the number of repeats a subject could make. Therefore, the amount of repeats could not be converted into proportions for graphic presentation in the form previously employed to report results in preceding experiments. Means are employed in some of the following figures for this reason. Numbers of errors, means, standard deviations and proportions are given in Appendix E for errors. Numbers, means and standard deviations are given in Appendix E for repeats.

All probability tests are non-parametric, and the differences reported are two tailed, as in all the preceding experiments.

Subjects

Experimental Subjects

Eighty schizophrenic patients were divided into four groups of 20 subjects to correspond with the four speed conditions. These patients had all been subjects in previous experiments and their status as to chronicity and thought disorder had already been determined. Paranoid and non-paranoid groups were not formed. Each group contained the following subjects:

Group i (ordinary speed):

- 10 acute schizophrenic patients (5 men and 5 women, mean age, 33.7 years, ranging from 16 years to 57 years); 5 were thought disordered, 4 were non-thought disordered, 1 was undetermined.
- 10 chronic schizophrenic patients (5 men and 5 women, mean age, 36.3 years, ranging from 19 years to 59 years); 4 were thought disordered, 4 were non-thought disordered, 2 were undetermined.

Group ii (slow speed):

- 10 acute schizophrenic patients (5 men and 5 women, mean age, 35.1 years, ranging from 17 years to 55 years); 5 were thought disordered, 4 were non-thought disordered, 1 was undetermined.
- 10 chronic schizophrenic patients (5 men and 5 women, mean age, 36.9 years, ranging from 21 years to 60 years); 5 were thought disordered, 3 were non-thought disordered, 2 were undetermined.

Group iii (fast speed):

- 10 acute schizophrenic patients (5 men and 5 women, mean age, 34.5 years, ranging from 16 years to 50 years); 2 were thought disordered, 4 were non-thought disordered, 4 were undetermined.

Group iii (fast speed) continued:

- 10 chronic schizophrenic patients (5 men and 5 women) mean age, 38.4 years, ranging from 21 years to 60 years); 3 were thought disordered, 2 were non-thought disordered, 5 were undetermined.

Group iv (edited speed):

- 10 acute schizophrenic patients (5 men and 5 women, mean age, 37.2 years, ranging from 17 years to 59 years); 7 were thought disordered, 2 were non-thought disordered, 1 was undetermined.
- 10 chronic schizophrenic patients (5 men and 5 women, mean age, 35.9 years, ranging from 16 years to 55 years); 6 were thought disordered, 3 were non-thought disordered, 1 was undetermined.

Control Subjects

The control subjects were 40 non-psychotic psychiatric patients, some of whom were used in previous experiments. They were 20 men and 20 women, with a mean age of 35.1 years, and an age range of 20 years to 48 years.

They were randomly assigned to one of the four groups, except an equal number of men and women were in each group.

Their diagnoses were: reactive depression (10 subjects), inadequate personality (10 subjects), phobic state (2 subjects), obsessional (4 subjects), identity crisis (2 subjects), personality disorder (8 subjects), and anxiety neurosis (4 subjects).

Results and Discussion

The Effect of Speed on Errors

In Figure 22 the mean number of errors for schizophrenic and non-psychotic control patients shows that the fast condition was the most difficult for schizophrenic patients, but the edited condition was the most difficult for the patient control group.

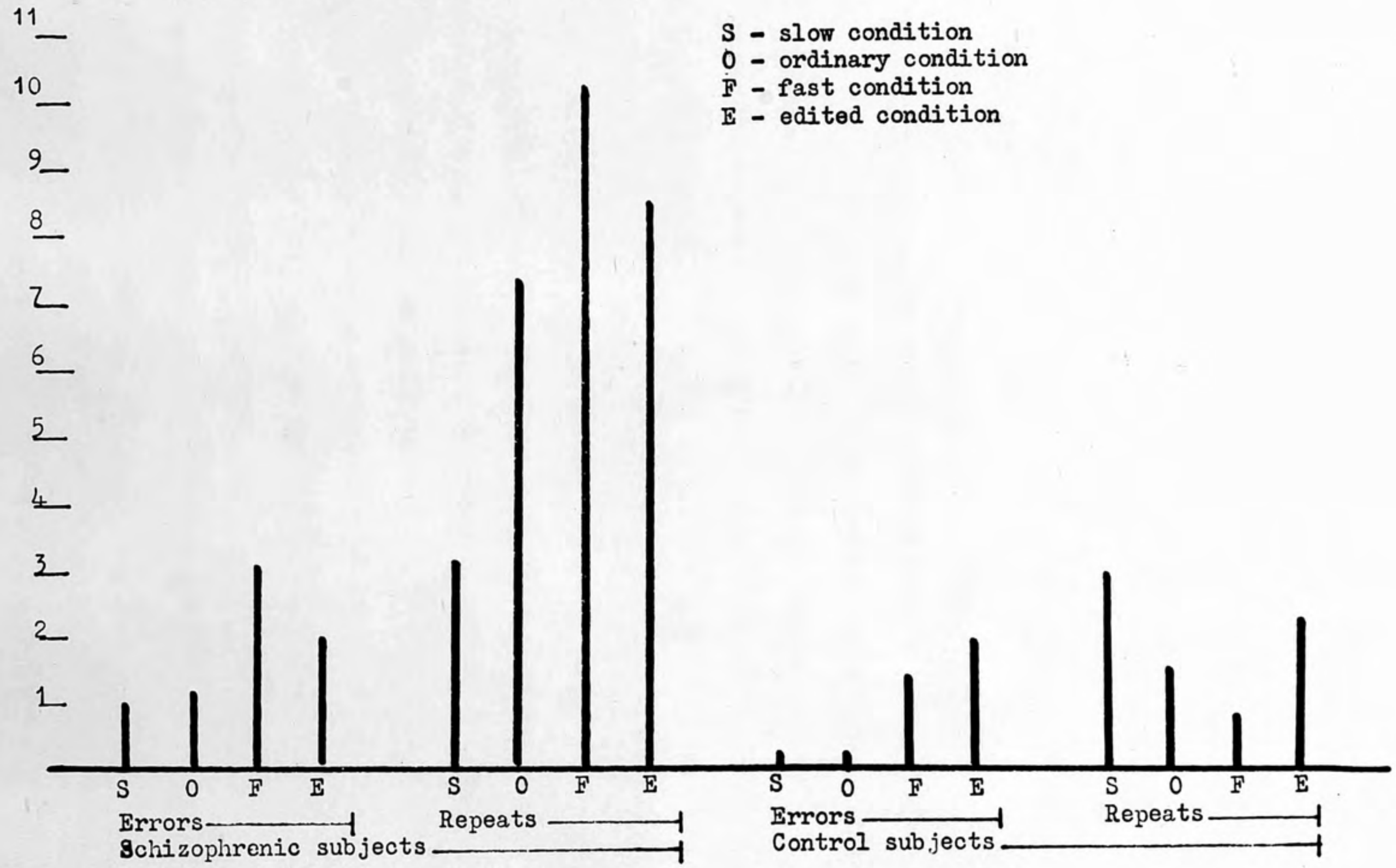
For schizophrenic patients, the slow and ordinary conditions were not significantly different, but the ordinary and fast conditions were significantly different using the Mann Whitney U-Test at $p < .02$. The fast and edited conditions were not significantly different, but neither were the ordinary and edited conditions for schizophrenic subjects.

In the control group, the slow and ordinary conditions were not different, but the ordinary and fast conditions were significantly different at $p < .05$, and the fast and edited conditions were different at $p < .05$ using The Mann Whitney U-Test. (see Table 1 and 1A, Appendix E).

It has been hypothesized by Suci (1967) that pauses are the delineations of natural units in spoken language, and by Williams (1965) that pauses serve a function for the listener. Williams suggests that the listener is able to utilize pause time to organise incoming verbal stimuli in a meaningful way.

We can assume that in most circumstances schizophrenic patients generally make more errors than non-psychotic control patients. This has been the case in the previous experiments, and research workers utilizing these diagnostic groups have generally found that schizophrenic patients make more errors on all sorts of tasks. The edited condition was the only condition where control subjects made as many errors as schizophrenics. This can be interpreted to mean that in fact, the edited condition was more difficult for the control subjects than for schizophrenics.

Figure 22. Mean number of errors and of repeats made by schizophrenic subjects and patient control subjects in four speed conditions.



If the nature of the edited tape is kept in mind, i.e. that the micro-pauses within and between words which are normally not audible to an untrained ear, but visible on the graphic representation of speech passages on the oscilloscope were removed, then an interpretation of this result could be that schizophrenic subjects make less use of these pauses in their processing of incoming speech passages. Control subjects find themselves with a greater comprehension loss as the result of the removal of the micro-pauses.

A further interpretation can be made based on Williams (1965) suggestion that micro-pauses are utilized by the listener. The time taken up by these pauses may be the period normally used for the formation and organisation of the boundaries distinguishing separate bits of information. Two papers by Goldman-Eisler (1958a, 1958b) demonstrate that longer pauses occur before words of high information value (or low transition probability) and shorter pauses before words of low information value (or high transition probability) in spontaneous speech with normal speakers. It seems as if a speaker is unconsciously "announcing" to the listener something about the nature of the word(s) he is about to utter by varying pause length, and this possibility adds support to the idea that pauses are functional for the listener.

It may be that schizophrenic patients make less use of the pauses during their processing of incoming speech material, or perhaps their mechanism for utilizing pauses is impaired, so that they may tend to resort to alternative and possibly less efficient mechanisms for information processing.

Conceivably, the pauses which exist in speech at an ordinary or even a slowed up rate are still not long enough periods of time for the schizophrenic to utilize for efficient boundary formation.

Also, the placement of pauses by normal speakers may be wrong for the schizophrenic patient. If a time element is involved, one might presume on the basis of the results of Experiment 3, that schizophrenic listeners may need greater pause intervals to decode material which is closely related by association, than to decode bits of information which are not closely related. If this is the case, and the findings of Goldman-Eisler (1958a and 1958b) are taken into account, then normal speakers pause more between material which is low in transitional probability (and therefore less related associationally). The schizophrenic, however, may require pauses to occur between speech material which is high in transitional probability, and thus more closely related, to aid his special difficulty in boundary formation between more closely associated material. This requirement by schizophrenics can lead them to put less value on natural pauses (by normal speakers) than the control group.

The Effect of Speed on Amount of Repeating

The mean number of repeats and errors go hand in hand for schizophrenic subjects, so that the more errors there were, the more repeats had been made, as can be seen in Figure 22. The opposite was true for control subjects in the slow, ordinary and fast conditions. The more errors controls made, the less they repeated, except in the edited condition (see Table 2, Appendix E).

If the function of repeating can be thought of as an aid in the search for the correct response, as a kind of rehearsal mechanism, this result could be interpreted in the following way. Control subjects were able to make use of repeats to process the incoming stimuli, so that the more they repeated, the less errors they made. Thus, in the slow and ordinary conditions, where control subjects repeated the most, they made the least errors, but in the fast and edited conditions, where they failed to repeat sufficiently for the difficulty of the material, they made more errors.

Schizophrenic subjects, on the other hand, in attempting to process the material and make the correct response, repeated increasingly as the stimuli increased in difficulty. Whether or not repeating was useful in reducing errors for schizophrenic subjects cannot be determined. However, since the amount of repeats and the amount of errors follow one another so closely in the schizophrenic group, it is likely that the function of repeating was at least an effort to reduce errors.

Another interpretation of the function of repeating can be made. Schizophrenic subjects may have used the opportunity permitted them to repeat, in order to delay the response. It was shown in the slow, ordinary and fast conditions that the faster the stimuli were presented, the more repeating was done by schizophrenic subjects, whereas the opposite was the case for the non-psychotic psychiatric control group.

The control group, in an effort to fall in with the tempo of the experiment by matching their rate of responding in relation to the rate of stimulus presentation, repeated items less, thereby using less time to produce the response, as the speed of the stimuli increased, and repeated more as the speed of the stimuli decreased.

The schizophrenic subjects, finding it too difficult to fall in with the tempo of the experiment, consequently made attempts to delay making a response by repeating the stimuli more and more as the rate of stimulus presentation increased.

If the processing of material takes an abnormally long time with schizophrenic patients as Yates (1966) has suggested, an attempt to gain more time on the part of schizophrenic subjects by the mechanism of repeating is understandable.

The Effect of Speed on the Schizophrenic Subgroups

The fast condition was the most difficult for all schizophrenic subgroups (see Figure 23). Significantly more errors were made in the fast condition than in the slow or ordinary conditions for each schizophrenic subgroup using the Mann Whitney U-Test. Significantly more errors were made in the fast condition than in the edited condition for the chronic and thought disordered subgroups (see Table 1A, Appendix E).

Repeats in the Subgroups

For chronic and acute subjects, the most repeats were made in the most difficult condition, i.e. the fast condition. When these subjects were subdivided into thought disordered and non-thought disordered groups however, this did not hold true (see Figure 23 and Table 2, Appendix E). For the non-thought disordered schizophrenic subjects, more repeats were made in the edited condition, although this was not the most difficult condition for this group. In the thought disordered subgroup, more repeats were made in the ordinary and edited conditions than the fast condition, although the fast condition proved the most difficult for this group as well.

However, no schizophrenic subgroup resembled the pattern of repeats made by the non-psychotic patient control group.

Frequent and Rare Commands

There were no significant differences between errors made to the frequent or rare commands under any of the four conditions for schizophrenic subjects or for control subjects (see Figure 24, and Tables 3 and 4, Appendix E).

Figure 23. Mean number of errors and of repeats made by schizophrenic subjects in four speed conditions.

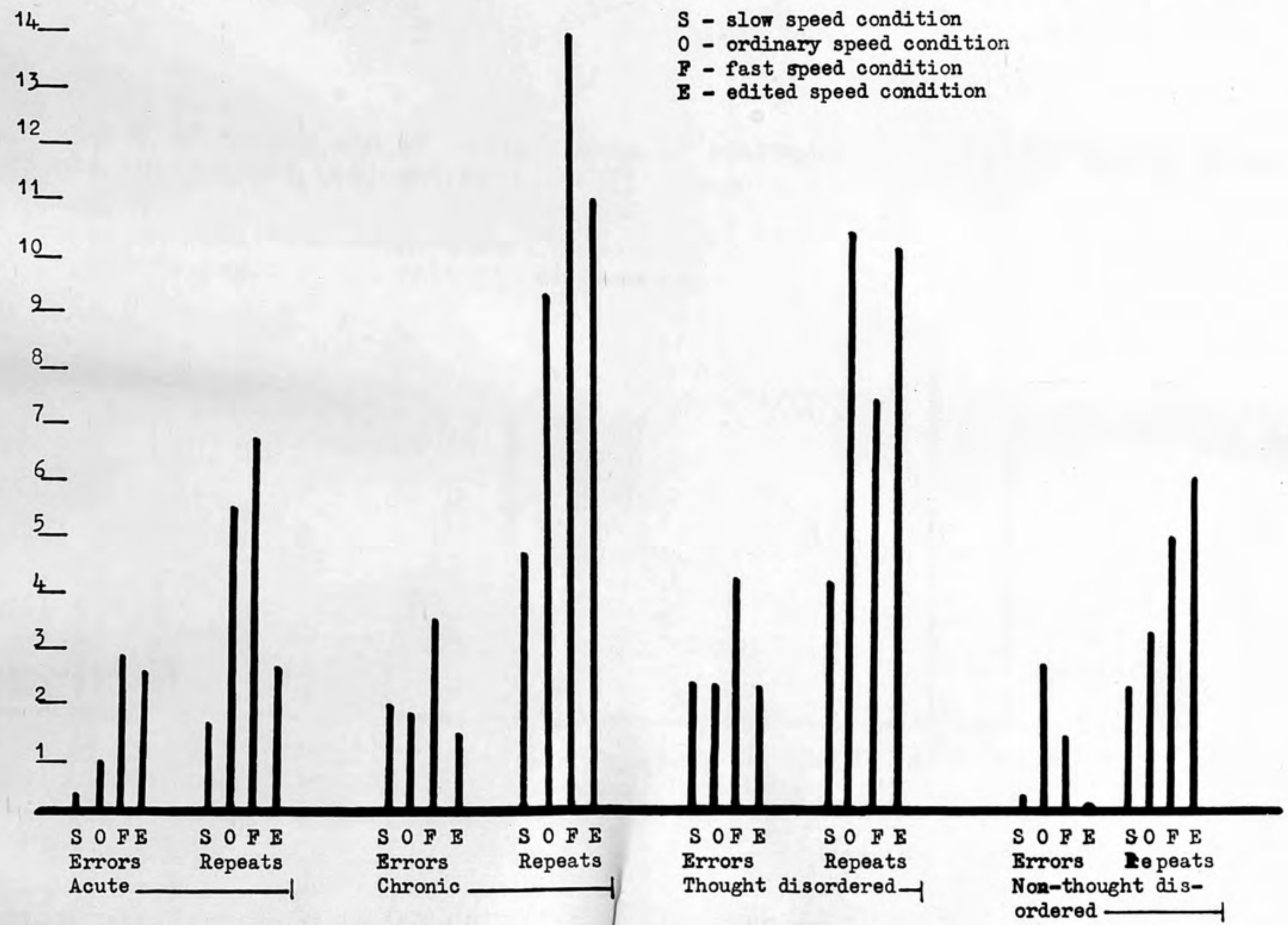
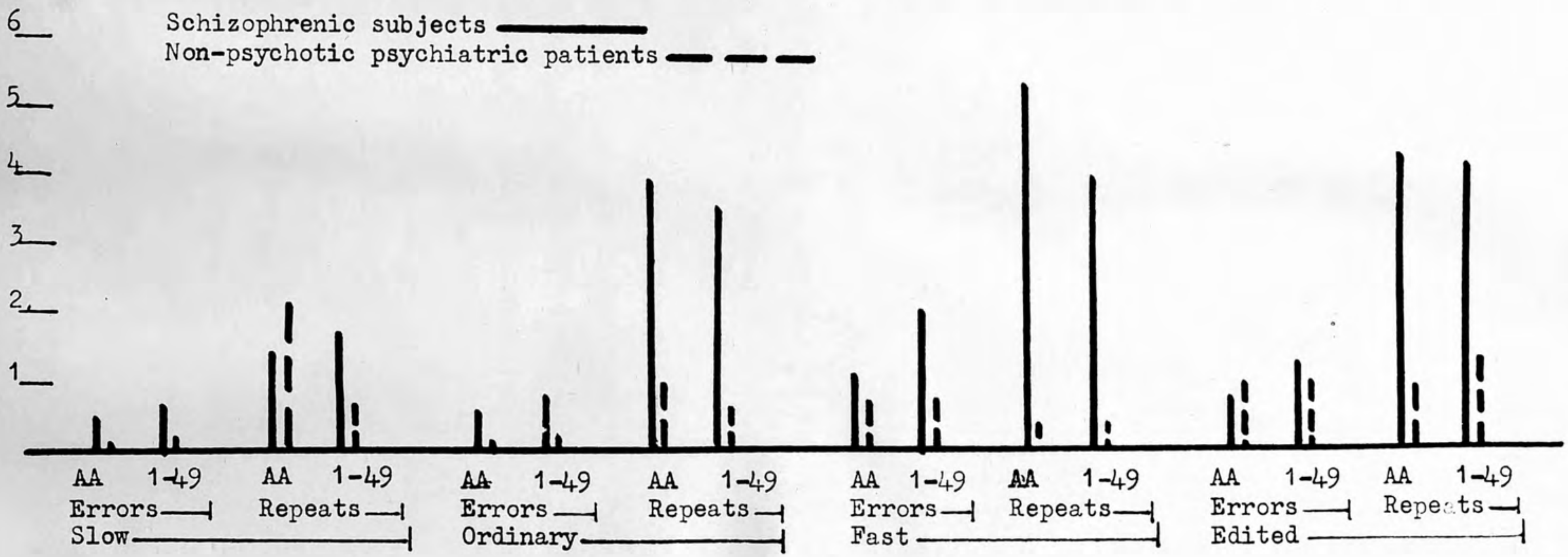


Figure 24. Mean number of errors and of repeats made by schizophrenic subjects and by patient control subjects to frequent (AA) and rare (1-49) commands.



The Effect of Length of Command on Errors

In the slow, ordinary and fast conditions there appears to be a general trend for more errors to be made to longer commands than to shorter commands for schizophrenic subjects and for non-psychotic control subjects. In the edited condition, the longer commands were more difficult for the control group, but the schizophrenic group made more errors in the middle length commands than on the long or short commands (see Figure 25).

It appears from Figure 25, that the addition of adjectives to nouns sometimes had no increased error effect or else tended to decrease the amount of errors, particularly in the slow condition for schizophrenic patients and for control patients, and in the ordinary condition for schizophrenic patients.

Figure 26 shows the same data as Figure 25, but dividing the noun commands from the adjective plus noun commands. It seems that adding nouns does lead to more errors by schizophrenic subjects under the slow and ordinary conditions.

Tests of significant differences could not easily be done on this data because of the very small scores in each length condition (see Table 4, Appendix E). These results do not disagree with Yates' (1966) hypothesis that increasing quantity of information is a factor leading to breakdown in performance by schizophrenics, although these data are not a clear cut confirmation of that data, since increasing quantity did not lead to increased errors in every condition, and since non-psychotic control subjects also made more errors to the long commands, although to a lesser degree than the schizophrenic subjects.

Since subjects were required to respond after hearing commands of varied lengths, this task has been one involving short-term memory. Although Lawson *et al* (1967) put forth the proposition that schizophrenics

Figure 25. Proportions of errors made by schizophrenic subjects and by patient control subjects to commands of different lengths in four speed conditions.

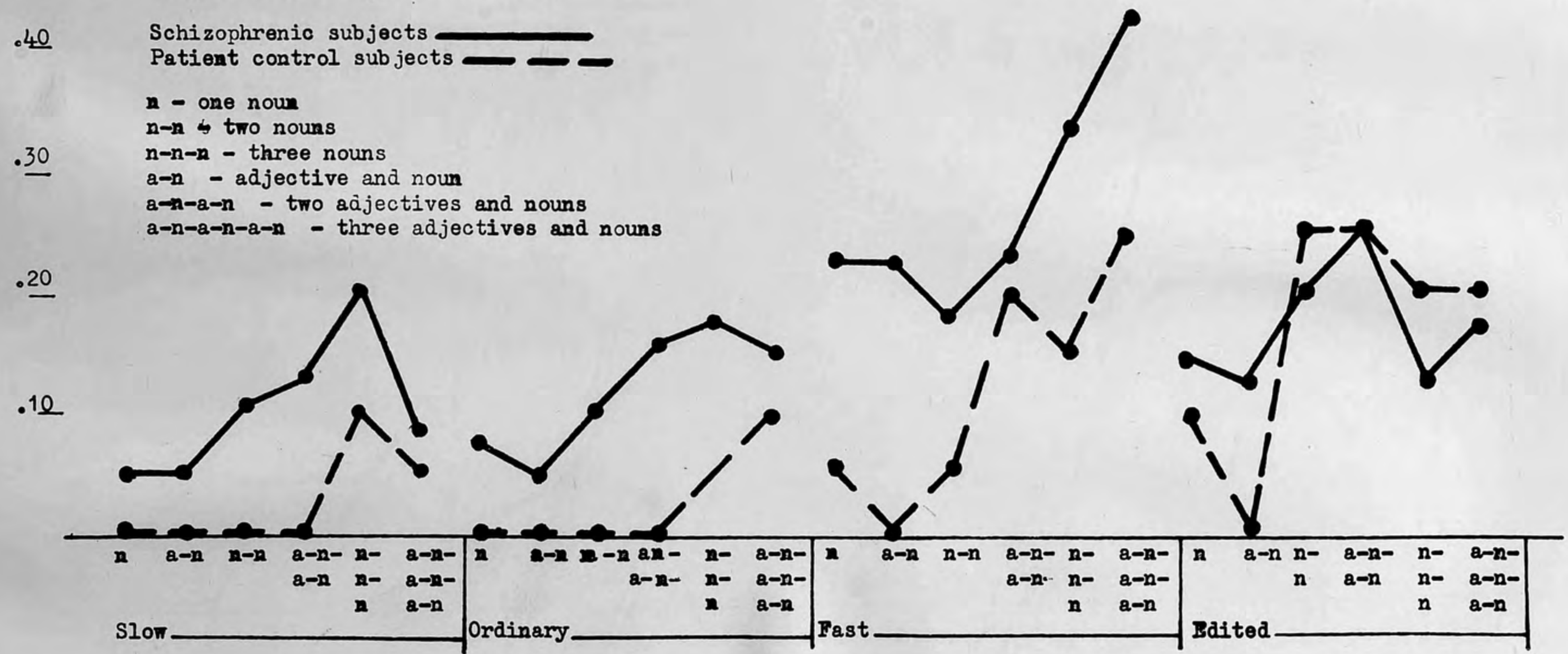
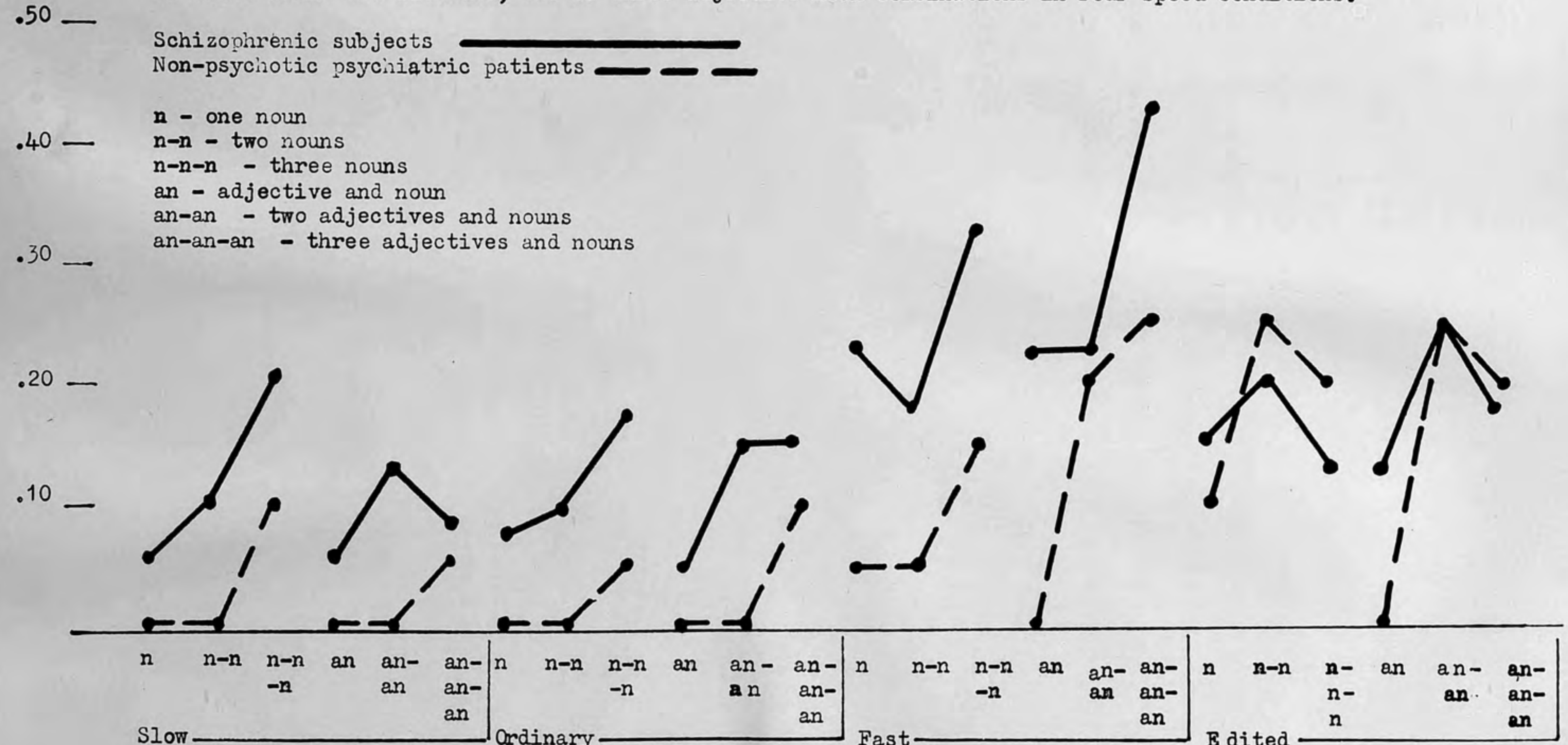


Figure 26. Proportions of errors made by schizophrenic subjects and by patient control subjects to commands with one, two or three nouns and with one, two or three adjective noun combinations in four speed conditions.



fare far worse than non-organic control groups on tasks involving memory than on tasks involving only detection, the difference in errors on this kind of task between the schizophrenics and the non-psychotic control subjects was not so gross as it was in, for example, Experiment 3. Of course, Lawson et al may not have had in mind the kind of situation where the schizophrenic subject was given the opportunity of rehearsal, in the form of repeats. If the much larger number of repeats made by the schizophrenic group as compared with the control group is taken into account, perhaps the difference between the groups can seem greater.

Final Discussion

The Existing Theories Explaining Disorders in Schizophrenia

The theory of word boundaries was developed in order to explain some of the results from this study, which cannot be adequately explained by existing theories.

The most popular theory attempting to explain schizophrenic symptomatology is that put forward by Chapman and McGhie (1963, Lawson *et al* (1967), McGhie and Chapman (1961) and McGhie *et al* (1965a, 1965b) which proposes an inability by hebephrenic schizophrenic patients to direct their attention focally as required in normal concentration due to a disturbance in the filter mechanisms which automatically filter out irrelevant stimuli in normal subjects.

The rejection of this theory as an adequate explanation is based on some results found in this study. First, the finding in the pilot experiments (Experiments 1 and 2) that schizophrenic subjects, unlike other control groups, accept one type of word more than other types; they accept words related in meaning to the correct name more than phonetically related words or irrelevant words. Secondly, the further development of this finding, showing schizophrenic overacceptances to be directly related to associational proximity (in Experiment 3) and showing that schizophrenic subjects do not overaccept in the cases where all the alternatives are irrelevant (in Experiment 4). These results do not support a theory of defective filtering mechanisms in so far as such a theory proposes an overall distractibility phenomena. It seems clear that if the filter mechanisms are disordered, the disorder is present only when the competing stimuli are associated to the relevant stimuli, and that degree of association is involved in determining the degree of filter mechanism disorder.

Another objection to this theory is the finding that when schizophrenic subjects are given additional stimuli, as in Experiment 8 where the number of alternatives was varied and in Experiment 9 where additional lists of words were interspersed between items, their ability to reject incorrect words is facilitated. According to a theory of defective filter mechanisms based on experiments demonstrating distractibility, additional stimuli should lead to more chance for distraction, and thus performance by schizophrenic subjects should be worse with additional stimuli. This was not the case; additional stimuli improved performance.

Another popular theory attempting to account for non-paranoid schizophrenic behaviour is that put forward by Venables (1968) proposing neurological and physiological overarousal to stimuli. The same objections to the theory of attentional impairment can be made to the overarousal theory. The supposition that some alternative words are more "overaroused" than other words, does not support the theory of a general overarousal. If overarousal plays a part in the comprehension of words by schizophrenic patients, then it is not an all-encompassing phenomena, as suggested by the research workers proposing overarousal theory, but one which exists only when material associated with the relevant stimuli is competing for recognition. Also, additional stimuli should serve as additional sources of overarousal for non-paranoid schizophrenics, and the experiments which involved additional stimuli should have resulted in more acceptances of wrong words by non-paranoid schizophrenic subjects. Instead, additional stimuli aided the rejection of wrong words, for all subgroups of schizophrenic subjects, which does not support the theory of overarousal.

The research workers who reported the experiments which support theories of attentional deficit or of overarousal found that it was almost entirely hebephrenic or non-paranoid schizophrenics who suffered from attentional defects or overarousal. In the experiments reported in this thesis, the difference between the performance of paranoid and non-paranoid schizophrenic subjects was minimal. In general, the non-paranoid schizophrenics made more overacceptance errors than the paranoid subjects, but this difference was small, and the proportion of errors made by paranoid schizophrenics was not comparable with those made by normal subjects, as was found by research workers in the fields of attentional defects and overarousal.

This difference in findings in the behaviour of the paranoid and non-paranoid subgroups of schizophrenia suggests that the variables measured in the series of experiments in this thesis may be quite different from the variables measured by research workers in distractibility and in overarousal. In fact, the investigators into overarousal measured physiological phenomena such as skin resistance, evoked EEG responses, heart rate and reaction times to tones or to light stimuli. The investigators into attentional defects used recall of lists of digits or letters to determine distractibility. The stimuli and requirements for response from the subjects in the experiments examined in this thesis are quite different from the techniques employed by other investigators. Consequently, different variables are being measured. It seems likely that although defective attention and/or overarousal may be adequate theories in explaining some data, they are not adequate in explaining the results of this investigation into factors influencing language comprehension in schizophrenia.

In 1966 Yates proposed a theory to explain defective schizophrenic behaviour, which was that the primary deficit may be that schizophrenics process material at an abnormally slow rate. This theory was proposed as an alternative theory, to account for existing experimental data, and no experiments known to the author have been published to test this theory directly.

The results of Experiments 12 and 14 show that the speed of delivery of stimuli does affect schizophrenic performance. Fast delivery resulted in more overacceptance errors by schizophrenic subjects in Experiment 12, and in more errors in Experiment 14. In Experiment 14, however, non-psychotic patient controls were also affected by speed, and produced more errors when the speed was increased.

The results of the measurement of repeating in Experiment 14 however may be interpreted to support Yates' hypothesis. Schizophrenics may have utilized the opportunity permitted them to repeat, in order to delay the response. It was shown in Experiment 14 (in the slow, ordinary and fast presentation conditions) that the faster the stimuli were presented, the more repeating was done by schizophrenic subjects, whereas the opposite was the case for the non-psychotic psychiatric control group. It is possible that the control group, in an effort to fall in with the tempo of the experiment by matching their rate of responding in relation to the rate of stimulus presentation, repeated less (thereby using less time to produce the response) as the speed of the stimuli increased, and repeated more as the speed of the stimuli decreased. The schizophrenic subjects on the other hand, finding it impossible to fall in with the tempo of the experiment, consequently made every attempt to delay making a response, by repeating the taped stimuli more and more as the rate of stimulus presentations was increased. If the processing of material takes an abnormally long time with schizophrenic subjects as Yates suggests, making use of available mechanisms (such as repeating) to give the schizophrenic more time to process the stimuli is understandable.

The results concerning additional stimuli can either support or refute the theory of abnormally slow processing in schizophrenia, depending on interpretation. On the one hand, additional stimuli means more processing should take place, in which case one would expect reduced performance on tasks with additional stimuli given to schizophrenics, if the stimuli are processed with abnormal slowness. On the other hand, the procedure of adding stimuli, whether in the form of more alternative words (as in Experiment 8) or of installing lists of words between the items (as in Experiment 9), added time between responses. Thus, although additional stimuli were presented, there was more time in which to process the stimuli.

The theory of abnormally slow stimulus processing cannot, however, account for the results pertaining to overacceptance of mainly associated words by schizophrenic patients, for the same reason the other theories discussed above cannot account for this. The proposal of a slow rate of processing as a primary deficit implies that this slow rate accounts for the errors made by schizophrenic subjects as they are not able to process material in time for a correct response. If this is so, then irrelevant words should have been badly processed just as associated words, and overacceptance errors should have been randomly distributed for schizophrenic subjects.

In the field of language comprehension, it may be best to consider the theory of an abnormally slow processing rate not as a theory, but rather as one factor influencing language comprehension by schizophrenic patients. Schizophrenic subjects appear to need more time for processing verbal material than control subjects, but this time factor may depend on other factors, one of which being the associational proximity of the material to be processed.

In 1965, Gathercole proposed an explanation for the high scores for non-retarded schizophrenic patients on tests of overinclusion. The proposal was that these tests are really measuring the ability to restrain responses, rather than an overinclusive factor. His view was that high scores on these tests are given by subjects who continue to respond (i.e. continue to talk on the proverbs test, and continue to sort the objects on the object classification test and on the object sorting test) and that this continuation to respond is due to overly fluent associations.

The results in this thesis support Gathercole's explanation. Schizophrenic subjects were characterised by errors of overacceptance, rather than errors of rejection of the correct word shown by other control groups from the linguistic community in Experiment 1. Schizophrenic patients continued to exhibit overacceptance in all the other experiments involving word recognition, except Experiment 4, where the alternative words were irrelevant to the correct word.

Gathercole's term for describing schizophrenic behaviour on tests of overinclusion i.e. "fluency of association" was not used by him in the strictest sense. Gathercole actually meant a lack of inhibition in responding, rather than anything concerning actual "associations" as the term has been used in this thesis. Nevertheless, Gathercole's intuitive use of the word "association" could be applied descriptively to the behaviour shown by schizophrenic patients in the experiments reported in this thesis, who certainly exhibited a fluency of association by wrongly accepting mainly associations (as collected from normal subjects) to the correct object noun.

Two other theories explaining schizophrenic abnormalities were described in the Introduction; the theory of serial invalidation proposed by Bannister and Fransella (1965), and the theory of faulty logical thinking proposed by Arieti (1966) and by Von Domarus (1944).

The theory of serial invalidation is a developmental theory, and little can be said about its usefulness in the light of the experiments conducted in this thesis. However, the "weakened conceptual structure" ascribed to thought-disordered schizophrenics on the Repertory Grid (Bannister, 1960) is in accordance with the weak boundaries or weak distinctions between associated words proposed to exist for schizophrenics in this thesis.

The theory of faulty logical thinking in schizophrenia was described by both adherents of the theory in terms of syllogistic reasoning. Two studies (Gottesman and Chapman, 1960; and Williams, 1964) which tested the theory by means of paper and pencil tests of syllogistic reasoning failed to confirm the theory, and thus this theory has not been very popular. Nevertheless, Arieti's (1966) observation that schizophrenics make use of isolated segments and parts in judging the whole of a concept, was exhibited only by the schizophrenic subjects and not by other representatives of the linguistic community in Experiment 1 when they elaborated in naming pictures. Elaboration was also given in naming by schizophrenic subjects in Experiments 2 and 10. However, elaboration of names was not only fragmentary in character, but often included what seemed to be associative phenomena, and this led to the interpretation that the basis of elaboration of names was the expression of the comprehensive disorder involving associations, as exhibited by schizophrenic subjects in Experiment 3.

The Theory of Word Boundaries

The word boundary theory, proposed earlier in this thesis, fits the results found in the series of experiments conducted here better than previous theories. This theory is not meant as an overall explanation of schizophrenic behaviour outside language, and no attempt to explain the performance by schizophrenics in studies measuring phenomena other than language variables is made.

The word boundary theory is based on the assumption that something separates the meaning of one word from another word, and that thing has been called a boundary. The existence of boundaries serve discrimination between one word and another and give words their individual identity.

Psychologically, the boundaries may be made up of series of dimensions relevant to distinguishing two words. For example, given the words "hatchet" and "axe" to match with a picture, neither word can be rejected if the object pictured gives no indication of size, since size is the only relevant dimension by which the meanings of the two words can be separated. An axe is actually a larger variety of hatchet. When no indication of the size of the pictured object is given, these two words can be regarded as synonyms, or identical as far as distinguishing dimensions are concerned, and a meaningful boundary cannot be drawn between them. In fact, "axe" was one of the "synonyms" often accepted by normal subjects as well as schizophrenic subjects in Experiment 3 as the name of a picture which was meant to elicit "hatchet" as the correct response. Since the picture was deficient in representing the relative size of the object, the inability to form a boundary between the two words is understandable and normal behaviour.

However, the inability to form a boundary between the words "hatchet" and "wood" and the resulting acceptance of the two words as the name of the picture, is not easily understandable, and is abnormal, schizophrenic behaviour.

Perhaps it can be more understandable if the "word store" or "vocabulary" can be imagined as organized in the form of associational networks. If a word store exists, there is some evidence that it is organised in this manner. Evidence of this organisation comes from studies of free association and from conditioning experiments. When a normal person is asked to say the words immediately coming to mind given the stimulus word "cat" the person will not list types of cats (if this were so, it would lend evidence that the word store is built up by an organisation of classes of objects) nor will he generally list words which rhyme with cat (if this was so it would lend evidence that the word store is built up by assonance or phonetic similarity). Instead, a normal person will express what has been called "associations" to the word cat. These associations, although they are individual and vary from person to person, are similar enough among normal persons for investigators to be able to list "common" and "uncommon" associations. A normal person's associations are generally meaningfully understandable to a second normal person. Associations are also fairly consistent in normal persons from one testing session to another.

Evidence from conditioning experiments has been demonstrated by Luria and Vinogradova (1959) who showed distinct vascular reactions to words associated to the conditioned stimulus word in normal persons.

Let us assume, then, that the word store is organised on the basis of associations, and that associated words have proximity, i.e. they are some measurable distance apart from one another in the word store. If this much can be assumed, then some hypotheses can be made about the process of selection from the word store.

One might expect that when a person is required to select a word from the store, neighbouring words, or close associations, are also aroused (the conditioning experiments by Luria and Vinogradova, (1959) support this hypothesis). The aroused neighbouring associations must then be rejected on some basis before the appropriate word can be selected. The basis on which aroused associations are rejected must be something which distinguishes words from one another, and which has been termed boundaries.

Evidence from the results of the experiments in this thesis suggests that it is the formation of boundaries in the selection process where schizophrenic patients have difficulty. This difficulty however is not an "extraordinary process", i.e. it is not something mysteriously interjected into the thought processes of schizophrenics akin to disease phenomena. It is more like a deficiency which can be manipulated and under the right circumstances can be avoided or overcome.

An implication from the result in Experiment 3 that there is a direct relationship between associational proximity (as measured on normal subjects) and the likelihood of wrong acceptance by schizophrenics, is that the organisation of the word store in schizophrenic subjects is similar in associational networks to that of normal persons. Three other studies (Cohen and Camhi, 1967; Johnson et al 1964; and Sommer et al 1960) support this implication. Cohen and Camhi found that schizophrenic listeners were no different from normal listeners in a word communication task, although schizophrenic speakers were inferior to normals. Johnson et al found that the percentage of popular responses for schizophrenics in free association was highly correlated with the percentage of popular responses offered by normal subjects, even though schizophrenics produced more uncommon associations in addition to common associations. Sommer et al found that schizophrenics were adequate judges of the commonality of their own responses in free association.

If the association repertoire in the word store in schizophrenic subjects and normal subjects is similar, then the word selection process is most probably where the difficulty in communication in schizophrenia is based.

The process of word selection involves the formation of boundaries and the rejection of the surrounding associations, and this process takes time. Some results from the experiments described in this thesis imply that the process takes more time for schizophrenic subjects than for control subjects. In Experiment 12 it was shown that when written word alternatives were presented in a controlled time interval of one second per word, more errors were made by schizophrenics than when the subjects had as much time as they wanted (within reasonable limits) to view the stimuli. The results of Experiment 14, which controlled the speed of oral command stimuli also showed that time was an important factor for schizophrenics; fast stimuli resulting in more errors than slowly presented stimuli. Furthermore, schizophrenic subjects in Experiment 14 appeared to be attempting to slow up the evokation of a response by repeating the stimuli in increasing amounts as the speed of delivery of the stimuli increased. If the process of word selection takes more time for schizophrenic patients than for control patients, as is implied by these results, then schizophrenic patients are probably having more difficulty in making their selections than control subjects.

The experiments into schizophrenic language described in the first part of the Introduction can be explained on the basis of the theory of word boundaries.

When the process of selection from the word store is defective due to the inability to form boundaries between associated words, one would expect the language of schizophrenic patients to be unusual or bizarre as has been observed. It is likely that schizophrenic patients have a continuous barrage of unbounded associative material from the word store impinging on their attempts at speech production.

Investigators who have done research into the aberrant nature of schizophrenic speech have come up with four main findings: (1) schizophrenic speech is less communicable than normal speech; (2) schizophrenic subjects do not make use of contextual cues as efficiently as normal subjects; (3) more unusual associations are produced by schizophrenics than by normal subjects in free association; (4) weaker meanings of words are less available as responses by schizophrenics than by normal subjects.

All of these findings can be due to the difficulty in the process of word selection and boundary formation and maintenance. The language stimuli used in the experiments which led to the above findings aroused associations from the word store, and these associations remained unbounded due to the schizophrenic disability in this sphere, and due to the lack of factors which help the schizophrenic to form word boundaries.

Practical Conclusions

The major aim of this series of experiments was to discover the factors which help and which impede communication with and by schizophrenic patients. Some practical results have been found, which can be applied by clinicians or persons who find it necessary to communicate with schizophrenic patients, or to design tests to assess their behaviour. These can also be regarded as a list of the factors impeding or helping the formation of word boundaries with schizophrenic patients, as well as a list of indications and contra-indications for language communication with schizophrenic patients.

1. Communication will be more successful if stimuli are offered under multiple choice conditions, and less successful under single choice or open-ended conditions.

2. A large number of alternative choices will lead to better communication than a small number of alternative choices.

3. Rarely associated stimulus material will be better understood than closely associated stimulus material.

4. Communication will be more successful when aids to boundary formation are present, in the form of lists or discussion, and less successful without such aids.

5. Written stimuli will be better understood than spoken stimuli.

6. Communication using a slow stimulus presentation will be more successful than communication using a fast stimulus presentation.

7. The opportunity to rehearse or repeat stimuli will aid communication whereas a lack of such opportunity will impede communication.

APPENDIX A

Experiment 1.

Part i. Photographs of the stimulus pictures.

Table 1. Errors made under the multiple (M) and single (S) choice conditions.

Table 2. Errors made to items with object nouns of one, two or three syllables.

Table 3. Errors made to items with frequent (AA) or rare (1-10) object nouns.

Table 4. Errors made to items where the object noun is a composite word, and to items where the object noun is a component of a composite word.

Table 5. Overall errors for each group.

Table 5A. Statistical comparison of groups on overall errors made.

Table 6. Incorrect names given in the naming task.

Table 7. Types of errorsmade.

Table 7A. Statistical comparison of the highest error score of each type with the second highest error score, and the second highest error score with the third highest error score, using the Wilcoxen Test (W) and the Sign Test (S).

Experiment 2.

Part ii. Photographs of the stimulus pictures.

Table 8. Errors made under the multiple (M) and single (S) choice conditions.

Table 8A. Proportions of errors in Experiments 1 and 2 under the multiple and single choice conditions.

Table 9. Errors made to items with object nouns of one, two or three syllables.

Table 10. Errors made to items with frequent (AA) or rare (1-10) object nouns.

Table 11. Incorrect names given in the naming task.

Table 12. Types of errors made.

Table 12A. Statistical comparison of the highest error score of each type with the second highest error score, and the second highest error score with the third highest error score, using the Wilcoxen Test (W) and the Sign Test (S).

APPENDIX A
Experiment 1
Table 1

Appendix A
Experiment 1

Table 1. Errors made under the multiple (M) and single (S) choice conditions.

	N	No. of Errors		Mean No. of Errors		Standard Deviations		Proportions of Errors		P-level* of difference between M & S
		M	S	M	S	M	S	M	S	
Schizophrenic Ss.										
Acute	30	54	88	1.80	2.93	1.55	2.15	.3000	.4889	.01 W; .094 S.
Chronic	30	65	87	2.17	2.90	1.79	2.17	.3622	.4833	.02 W; .006 S.
Thought disordered	28	81	118	2.89	4.22	2.99	3.87	.4821	.7023	.01 W; .002 S.
Non-thought disordered	20	21	35	1.05	1.75	1.01	1.61	.1750	.2916	N S.W; N S. S.
Paranoid	18	28	50	1.56	2.72	1.38	2.31	.2825	.4629	.05 W; .011 S.
Non-paranoid	42	91	125	2.17	2.98	1.70	2.07	.3613	.4960	.0094 W-Test for large groups
Control Ss										
Normal adults	10	1	2	.10	.20	.40	.40	.0167	.0333	N S.W; N S. S.
5-year old children	10	21	21	2.10	2.10	1.22	1.13	.3500	.3500	N S.W; N S. S.
Dysphasics	10	34	36	3.40	3.60	1.56	1.80	.5667	.6000	N S.W; N S. S.
Demented patients	10	36	54	3.60	5.40	1.35	.66	.6000	.9000	.01 W; .040 S.
Non-psychotic psychiatric patients	10	0	0	0	0	0	0	0	0	

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

APPENDIX A
Experiment 1
Table 2

Appendix A
Experiment 1.

Table 2. Errors made to items with object nouns of one, two or three syllables.

	N	No. of Errors 1-syl.	2-syl.	3-syl.	Mean No. of errors 1-syl.	2-syl.	3-syl.	Standard Deviations 1-syl.	2-syl.	3-syl.	Proportions of Errors 1-syl.	2-syl.	3-syl.	P-level * between 1 & 3 syllable words			
Schizophrenic Ss																	
Acute	30	40	53	49	1.33	1.77	1.63	1.35	.60	1.20	.3333	.4416	.4083	NS	W;	NS	S
Chronic	30	40	52	60	1.33	1.73	2.00	1.30	1.38	1.43	.3333	.4333	.5000	.01	W;	.021	S
Thought disordered	28	57	70	72	2.04	2.50	2.57	.62	.48	.58	.5089	.6250	.6428	NS	W;	NS	S
Non-thought disordered	20	13	22	21	.65	1.10	1.05	.81	.62	.53	.1625	.2750	.2625	NS	W;	NS	S
Paranoid	18	22	29	27	1.22	1.61	1.50	1.43	.81	1.11	.3055	.4027	.3750	NS	W;	NS	S
Non-paranoid	42	58	76	82	1.38	1.81	1.95	1.22	1.31	1.28	.3452	.4523	.4880	.01	W;	.007	S
Control Ss																	
Normal adults	10	0	0	3	0	0	.30	0	0	.45	0	0	.0750	NS	W;	NS	S
5-year-old children	10	7	17	18	.70	1.70	1.80	1.00	.78	.87	.1750	.4250	.4500	.01	W;	.004	S
Dysphasics	10	24	19	27	2.40	1.90	2.70	1.20	1.30	1.00	.6000	.4750	.6750	NS	W;	NS	S
Demented patients	10	28	27	35	2.80	2.70	3.50	.74	1.00	.50	.7000	.6750	.8750	NS	W;	.062	S
Non-psychotic psychiatric patients	0	0	0	0	0	0	0	0	0	0	0	0	0				

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

Appendix A
Experiment 1

Table 3. Errors made to items with frequent (AA) or rare (1-10) object nouns

	N	No. of Errors AA	No. of Errors 1-10	Mean No. of errors AA	Mean No. of errors 1-10	Standard Deviations AA	Standard Deviations 1-10	Proportions of Errors AA	Proportions of Errors 1-10	P-level * of difference between AA & 1-10 words W	S
Schizophrenic Ss											
Acute	30	50	42	1.67	1.40	1.21	1.14	.4166	.3500	NS W;	NS S
Chronic	30	50	49	1.67	1.63	1.33	1.41	.4166	.4083	NS W;	NS S
Thought disordered	28	66	67	2.36	2.39	1.41	1.06	.5892	.5982	NS W;	NS S
Non-thought disordered	20	20	15	1.00	.75	.83	.78	.2500	.1875	NS W;	NS S
Paranoid	18	29	23	1.61	1.28	1.02	1.16	.4027	.3190	NS W;	NS S
Non-paranoid	42	71	68	1.69	1.62	1.36	1.31	.4226	.4047	NS W;	NS S
Control Ss											
Normal adults	10	2	1	.20	.10	.40	.30	.0500	.0250	NS W;	NS S
5-year-old children	10	11	23	1.10	2.30	.94	1.10	.2750	.5750	.05 W;	.040 S
Dysphasics	10	23	24	2.30	2.40	1.10	1.01	.5750	.6000	NS W;	NS S
Demented patients	10	32	29	3.20	2.90	.40	.83	.8000	.7250	NS W;	NS S
Non-psychotic psychiatric patients	0	0	0	0	0	0	0	0	0	-	-

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

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Experiment 1

Table 4

Appendix A
Experiment 1

Table 4. Errors made to items where the object noun is a composite word, and to items where the object noun is a component of a composite word.

	N	Finger		Nail		Fingernail	
		No. Errors	Proportion	No. errors	Proportion	No. Errors	Proportion
Schizophrenic Ss							
Acute	30	15	.5000	15	.5000	17	.5667
Chronic	30	6	.2000	5	.1667	21	.7000
Thought disordered	28	12	.4286	12	.4286	17	.6071
Non-thought disordered	20	4	.2000	6	.3000	15	.7500
Paranoid	18	4	.2222	4	.2222	13	.7222
Non-paranoid	42	17	.4048	16	.3809	25	.6000
Control Ss							
Normal adults	10	0	0	0	0	0	0
5-year-old children	10	0	0	1	.1000	7	.7000
Dysphasics	10	1	.1000	4	.4000	5	.5000
Demented patients	10	8	.8000	9	.9000	8	.8000
Non-psychotic psychiatric patients	10	0	0	0	0	0	0

Appendix A
Experiment 1

Table 5. Overall errors for each group

	N	No. of Errors	Mean No. of errors	Standard Deviations	Proportions of Errors
Schizophrenic Ss					
Acute	30	142	4.73	2.98	.3944
Chronic	30	152	5.07	3.17	.4500
Thought disordered	28	199	7.11	3.98	.5922
Non-thought disordered	20	56	2.80	1.98	.2333
Paranoid	18	78	4.33	3.16	.3611
Non-paranoid	42	216	5.14	3.15	.4285
Control Ss					
Normal adults	10	3	.30	.45	.0250
5-year-old children	10	42	4.20	2.35	.3500
Dysphasics	10	70	7.00	3.09	.5833
Demented patients	10	90	9.00	1.34	.7500
Non-psychotic psychiatric patients	10	0	0	0	0

Table 5A. Statistical comparison of groups on overall errors made

Comparison of Groups	P-level using the Mann Whitney U-Test (two-tailed)
Acute schizophrenics and normal adults	.0021
Acute schizophrenics and 5-year-old children	NS
Acute schizophrenics and dysphasics	NS
Acute schizophrenics and demented patients	.0023
Acute schizophrenics and non-psychotic psychiatric patients	.0020
Chronic schizophrenics and normal adults	.0020
Chronic schizophrenics and 5-year-old children	NS
Chronic schizophrenics and dysphasics	NS
Chronic schizophrenics and demented patients	.0202
Chronic schizophrenics and non-psychotic psychiatric patients	.0020
Acute and chronic schizophrenics	NS
Thought disordered and non-thought disordered schizophrenics	.0262
Paranoid and non-paranoid schizophrenics	NS

Appendix A
Experiment 1

Table 6. Incorrect names given in the naming task.

	N	No. incorrect names	Mean No. Incorrect Names	Standard Deviations	Proportions of incorrect names
Schizophrenic Ss					
Acute	30	12	.40	.63	.0333
Chronic	30	29	.97	1.52	.0822
Thought disordered	28	31	1.11	1.59	.0922
Non-thought disordered	20	6	.30	.21	.0250
Paranoid	18	11	.61	1.73	.0510
Non-paranoid	42	30	.71	.90	.0595
Control Ss					
Normal adults	10	0	0	0	
5-year-old children	10	41	4.10	2.63	.3444
Dysphasics	10	66	6.60	3.75	.5500
Demented patients	10	75	7.50	2.20	.6250
Non-psychotic psychiatric patients	10	0	0	0	0

APPENDIX A

Experiment 1

Table 7

Appendix A
Experiment 1

Table 7. Types* of errors made

	N	No. of Errors (a)	(b)	(c)	(d)	(e)	Mean No. of Errors (a)	(b)	(c)	(d)	(e)	Standard Deviations (a)	(b)	(c)	(d)	(e)	Proportions of Errors (a)	(b)	(c)	(d)	(e)	Friedman P-level
Schizophrenic Ss																						
Acute	30	60	45	112	5	25	2.00	1.50	3.73	.17	.83	1.54	1.01	2.06	.48	.66	.0833	.0625	.1556	.0069	.0694	.001
Chronic	30	71	66	163	32	16	2.37	2.20	5.43	1.07	.53	1.44	1.57	2.68	1.40	.67	.0986	.0917	.2264	.0444	.0444	.001
Thought disordered	28	70	60	164	29	20	2.50	2.14	5.86	1.04	.71	1.52	1.22	2.88	1.0	.64	.1017	.0893	.2440	.0432	.0595	.001
Non-thought disordered	20	33	27	71	4	11	1.65	1.35	3.55	.20	.55	.92	1.00	1.99	.48	.59	.0688	.0563	.1479	.0083	.0458	.001
Paranoid	18	39	30	45	3	12	2.17	1.67	2.50	.17	.67	1.10	1.01	1.87	.48	.64	.1174	.0903	.1353	.0090	.0555	NS ($p < .1$)
Non-paranoid	42	92	81	230	34	53	2.19	1.93	5.48	.81	1.26	1.47	.99	2.70	.66	1.10	.0912	.0803	.2202	.0337	.0525	.001
Control Ss																						
Normal adults	10	0	0	2	0	1	0	0	.20	0	.10	0	0	.40	0	.30	0	0	.0095	0	.0020	NS
5-year-old children	10	4	11	7	4	27	.40	1.10	.70	.40	2.70	.66	2.38	.64	.66	1.38	.0167	.0458	.0291	.0167	.2250	.001
Dysphasics	10	17	16	25	13	53	1.70	1.60	2.50	1.30	5.30	1.95	1.90	2.06	2.68	3.03	.0708	.0667	.1042	.0542	.4417	.001
Demented patients	10	18	33	65	31	36	1.80	3.30	6.50	3.10	3.60	1.28	1.84	2.88	2.38	2.05	.0750	.1375	.2708	.1291	.3000	.001
Non-psychotic psychiatric patients	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

* (a) - phonetically similar at the beginning of the word
(b) - phonetically similar at the end of the word
(c) - related in meaning
(d) - irrelevant
(e) - rejection of the correct word

Appendix A
Experiment 1

Table 7A. Statistical comparison of the highest error score of each type* with the second highest error score, and the second highest error score with the third highest error score, using the Wilcoxen Test (W) and the Sign Test (S)

Comparison of Types of Errors	P-levels (two-tailed) (c) and (a)	(a) and (b)	(e) and (b)	(e) and (c)	(b)and(c)
Schizophrenic Ss					
Acute	.01 W .002 S	NS W NS S			
Chronic	.01 W .002 S	NS W NS S			
Thought disordered	.01 W .002 S	NS W NS S			
Non-thought disordered	.05 W .042 S	NS W NS S			
Paranoid	NS W NS S	NS W NS S			
Non-Paranoid	.01 W .002 S	NS W			
Control Ss					
Normal adults				NS W NS S	
5-year-old children			.01 W .002 S		NS W NS S
Dysphasics	NS W NS S			.01 W .002 S	
Demented patients				NS W NS S	.01 W .002 S
Non-psychotic psychiatric patients					

* Types: (a) - phonetically similar at the beginning of the word
(b) - phonetically similar at the end of the word
(c) - related in meaning
(d) - irrelevant
(e) - rejection of the correct word

Appendix A
Experiment 2

Table 8. Errors made under the multiple (M) and single (S) choice conditions

	N	No. of Errors M	No. of Errors S	Mean No. of Errors M	Mean No. of Errors S	Standard Deviations M	Standard Deviations S	Proportion of Errors M	Proportion of Errors S	P-level* between M & S	
Schizophrenic Ss											
Acute	20	6	27	.30	1.35	.54	1.17	.1000	.4500	.01 W;	.006 S
Chronic	20	15	28	.75	1.40	.64	1.30	.2500	.4666	.02 W;	.012 S
Thought disordered	17	16	38	.94	2.23	.80	1.04	.3137	.7450	.01 W;	.004 S
Non-thought disordered	13	1	6	.08	.46	.26	.46	.0256	.1537	NS W;	NS S
Paranoid	13	7	18	.53	1.38	.64	1.25	.1794	.4615	.02 W;	.008 S
Non-paranoid	27	14	37	.51	1.70	.73	1.44	.1728	.4569	.01 W;	.004 S

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

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Experiment 2

Table 8A: Proportions of errors in Experiments 1 and 2 under the multiple and single choice conditions

	Multiple condition		Single Condition	
	Exp. 2	Exp. 1	Exp. 2	Exp. 1
Schizophrenic Ss				
Acute	.1000	.3000	.4500	.4889
Chronic	.2500	.3622	.4666	.4722
Thought disordered	.3137	.4821	.7450	.7023
Non-thought disordered	.0256	.1750	.1537	.2916
Paranoid	.1794	.2825	.4615	.4629
Non-paranoid	.1728	.3613	.4569	.4960

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Experiment 2
Table 9

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Experiment 2

Table 9. Errors made to items with object nouns of one, two or three syllables

	N	Number of Errors			Mean No. of Errors			Standard Deviations			Proportions of Errors			P-level between 1 & 3 syllable words
		1-syl.	2-syl.	3-syl.	1-syl.	2-syl.	3-syl.	1-syl.	2-syl.	3-syl.	1-syl.	2-syl.	3-syl.	
Schizophrenic Ss														
Acute	20	11	7	15	.65	.35	.75	.80	.48	.76	.2750	.1750	.3750	NS
Chronic	20	15	11	17	.75	.65	.85	.71	.59	.70	.3750	.2750	.4250	NS
Thought disordered	17	21	13	20	1.23	.76	1.17	.81	.54	.70	.6176	.3823	.5882	NS
Non-thought disordered	13	1	2	4	.08	.15	.31	.26	.14	.60	.0385	.0769	.1538	NS
Paranoid	13	10	6	9	.77	.46	.69	.80	.50	.72	.3850	.2307	.3462	NS
Non-paranoid	27	16	12	23	.59	.44	.85	.78	.56	.75	.2963	.2222	.4259	NS

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Experiment 2

Table 10. Errors made to items with frequent (AA) or rare (1-10) object nouns

	N	No. of Errors AA	No. of Errors 1-10	Mean No. of Errors AA	Mean No. of Errors 1-10	Standard Deviations AA	Standard Deviations 1-10	Proportions of Errors AA	Proportions of Errors 1-10	P-level between AA and 1-10 words
<u>Schizophrenic Ss</u>										
Acute	20	14	19	.70	.95	.71	.85	.2333	.3167	NS
Chronic	20	20	23	1.00	1.15	1.14	1.15	.3333	.3833	NS
Thought disordered	17	26	28	1.53	1.64	.84	1.00	.5098	.5490	NS
Non-thought disordered	13	1	5	.08	.38	.84	.60	.0256	.1282	NS
Paranoid	13	10	15	.77	1.15	1.02	1.03	.2560	.3846	NS
Non-paranoid	27	24	27	.88	1.00	.88	1.23	.2962	.3333	NS

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Experiment 2

Table 11. Incorrect names given in the naming task

	N	No. incorrect names	Proportions of incorrect names
Schizophrenic Ss			
Acute	20	4	.0330
Chronic	20	5	.0416
Thought disordered	17	6	.0588
Non-thought disordered	13	1	.0128
Paranoid	13	4	.0512
Non-paranoid	27	5	.0308

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Experiment 2
Table 12

Appendix A
Experiment 2

Table 12. Types* of errors made

	N	No. of Errors (a)	(b)	(c)	(d)	(e)	Mean No. of Errors (a)	(b)	(c)	(d)	(e)	Standard Deviations (a)	(b)	(c)	(d)	(e)	Proportions of Errors (a)	(b)	(c)	(d)	(e)	Friedman P-level
Schizophrenic Ss																						
Acute	20	10	5	32	5	5	.50	.25	1.60	.25	.25	.86	.53	1.71	.53	.53	.0412	.0208	.1333	.0208	.0104	NS ($p < .1$)
Chronic	20	26	17	47	15	5	1.30	.85	2.35	.75	.25	1.67	1.31	2.57	1.57	.62	.1083	.0708	.1959	.0625	.0104	.02
Thought disordered	17	31	20	62	20	4	1.82	1.17	3.64	1.17	.23	1.62	1.33	2.15	1.61	.57	.1519	.0980	.3039	.0980	.0098	.001
Non-thought disordered	13	1	0	6	0	1	.07	0	.46	0	.07	.26	0	1.08	0	.26	.0064	0	.0384	0	.0032	NS
Paranoid	13	11	5	25	4	3	.84	.38	1.92	.30	.23	1.28	.73	2.16	.82	.57	.0705	.0320	.1602	.0256	.0096	NS ($p < .1$)
Non-paranoid	27	25	17	54	16	7	.92	.63	2.00	.59	.25	1.43	1.15	1.84	1.34	.58	.0771	.0524	.1667	.0493	.0108	.02

* (a) - phonetically similar at the beginning of the word
(b) - phonetically similar at the end of the word
(c) - related in meaning
(d) - irrelevant
(e) - rejection of the correct word

Appendix A
Experiment 2

Table 12A. Statistical comparison of the highest error score of each type with the second highest error score, and the second highest error score with the third highest error score, using the Wilcoxen Test (W) and the Sign Test (S)

Comparison of Types of Errors	P-levels (two-tailed) (c) and (a)		P-levels (two-tailed) (a) and (b)	
Schizophrenic Ss				
Acute	.01	W	NS	W
	.002	S	NS	S
Chronic	.01	W	NS	W
	.002	S	NS ($p <$ .070)	S
Thought-disordered	.01	W	NS	W
	.002	S	.022	S
Non-thought disordered	NS	W	NS	W
	NS	S	NS	S
Paranoid	.02	W	NS	
	.016	S	NS ($p <$ .062)	S
Non-paranoid	.01	W	NS	W
	.002	S	NS	S

APPENDIX B

Experiment 3.

Table 1. Errors made by accepting words of varying associational proximity.

Table 2. Errors made under the multiple (M) and single (S) choice conditions.

Table 3. Errors made by accepting words of varying associational proximity under the multiple choice condition.

Table 4. Errors made by accepting words of varying associational proximity under the single choice condition.

Experiment 4.

Table 5. Errors made under the multiple (M) and single (S) choice conditions.

APPENDIX B
Experiment 3
Table 1

Appendix B
Experiment 3

Table 1. Errors made by accepting words of varying associational proximity *

	N	No. of Errors 1st	2nd	3rd	4th	Rare	Proportions of Errors 1st	2nd	3rd	4th	Rare	Friedman P-level	P-level ** between common and rare associations
All schizophrenics	20	135	102	77	59	93	.3750	.2833	.2138	.1639	.0646	.001	.01
Acute	10	80	60	46	30	41	.4444	.3333	.2556	.1667	.0569	.001	.01
Chronic	10	55	42	31	29	52	.3056	.2333	.1722	.1611	.0722	.001	.01
Thought disordered	14	100	78	57	46	78	.3968	.3095	.2262	.1825	.0774	.001	.01
Non-thought disordered	3	12	10	5	5	6	.2222	.1923	.0926	.0926	.0278	NS	NS
Paranoid	5	26	12	16	6	9	.2889	.1333	.1778	.0667	.0250	.02	.01
Non-paranoid	15	109	90	61	53	84	.4037	.3333	.2259	.1963	.0778	.001	.01
Non-psychotic psychiatric patients	15	7	0	7	1	1	.0259	0	.0259	.0037	.0009	NS	.01
Normal subjects	20	21	8	10	3	3	.0583	.0222	.0278	.0083	.0021	.01	.01

* 1st - first closest association
2nd - second closest association
3rd - third closest association
4th - fourth closest association
Rare - rare associations

** using the Wilcoxen Test (two-tailed)

APPENDIX B
Experiment 3
Table 2

Appendix B
Experiment 3

Table 2. Errors made under the multiple (M) and single (S) choice conditions

	N	No. of Errors M	No. of Errors S	Mean No. of Errors M	Mean No. of Errors S	Standard Deviations M	Standard Deviations S	Proportions of Errors M	Proportions of Errors S	P-level * between M & S	
Schizophrenic Ss.											
Acute	10	43	72	4.30	7.20	6.19	3.03	.4770	.8000	.01 W;	.004 S
Chronic	10	31	60	3.10	6.00	6.14	6.32	.3444	.6667	.01 W;	.002 S
Thought disordered	14	55	98	3.93	7.00	7.89	5.31	.4365	.7778	.01 W;	.002 S
Non-thought disordered	3	6	15	2.00	5.00	2.30	3.46	.2222	.5556	NS W;	NS S
Paranoid	5	9	30	1.80	6.00	2.32	3.56	.2000	.0667	NS W;	.031 S
Non-paranoid	15	63	102	4.20	6.80	8.88	8.24	.4667	.7556	.01 W;	.001 S
Non-psychotic psychiatric patients	15	10	2	.67	.13	1.69	1.37	.0741	.0148	NS W;	NS S
Normal subjects	20	13	22	.65	1.10	3.81	4.51	.0722	.1222	NS W;	NS S

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

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Experiment 3
Table 3

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Experiment 3

Table 3. Errors made by accepting words of varying associational proximity* under the multiple choice condition

		No. of Errors					Proportions of Errors					P-level ** between common and rare associations
		1st	2nd	3rd	4th	Rare	1st	2nd	3rd	4th	Rare	
Schizophrenic Ss												
Acute	10	24	18	11	9	9	.2667	.2000	.1222	.1000	.0250	.01
Chronic	10	17	14	11	10	18	.1889	.1556	.1222	.1111	·0500	.01
Thought disordered	14	29	24	16	16	25	.2302	.1905	.1270	.1270	.0496	.01
Non-thought disordered	3	4	2	2	1	1	.1481	.0741	.0741	.0370	.0093	NS
Paranoid	5	6	1	3	0	1	.1333	.0222	.0667	0	.0056	NS
Non-paranoid	15	59	31	19	19	26	.4370	.2296	.1407	.1407	.0481	.01
Non-psychotic psychiatric patients	15	5	0	5	0	1	.0370	0	.0370	0	.0019	NS
Normal subjects.	20	9	3	2	2	0	.0500	.0167	.0111	.0111	0	NS

* 1st - first closest association
2nd - second closest association
3rd - third closest association
4th - fourth closest association
Rare - rare associations

** using the Wilcoxen Test (two-tailed)

APPENDIX B
Experiment 3
Table 4

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Experiment 3

Table 4. Errors made by accepting words of varying associational proximity* under the single choice condition

		No. of Errors					Proportions of Errors					P-level ** between common and rare associations
		1st	2nd	3rd	4th	Rare	1st	2nd	3rd	4th	Rare	
Schizophrenic Ss												
Acute	10	56	42	35	21	32	.6222	.4667	.3889	.2333	.0889	.01
Chronic	10	38	28	20	19	34	.4222	.3111	.2222	.2111	.0944	.01
Thought disordered	14	71	52	42	30	53	.5635	.4127	.3333	.2381	.1052	.01
Non-thought disordered	3	8	8	3	4	5	.2963	.2963	.1111	.1481	.0463	NS
Paranoid	5	20	11	13	6	8	.4444	.2444	.2889	.1333	.0444	NS
Non-paranoid	15	74	59	42	34	58	.5481	.4370	.3111	.2519	.1074	.01
Non-psychotic psychiatric patients	15	2	0	3	1	0	.0148	0	.0222	.0074	0	NS
Normal subjects	20	12	5	8	1	3	.0667	.0278	.0444	.0056	.0042	NS

* 1st - first closest association
2nd - second closest association
3rd - third closest association
4th - fourth closest association
Rare - rare associations

** using the Wilcoxen Test (two-tailed)

APPENDIX B
Experiment 4
Table 5

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Experiment 4

Table 5. Errors made under the multiple (M) and single (S) conditions

	N	No. of Errors M	No. of Errors S	Mean No. of Errors M	Mean No. of Errors S	Standard Deviations M	Standard Deviations S	Proportions of Errors M	Proportions of Errors S	P-level between M & S
Schizophrenic Ss										
Acute	10	0	3	0	.30	0	1.51	0	.0500	NS
Chronic	10	1	4	.10	.40	.18	1.77	.0167	.0667	NS
Thought disordered	11	1	6	.09	.55	.51	1.96	.0152	.0909	NS
Non-thought disordered	6	0	1	0	.17	0	.96	0	.0278	NS
Paranoid	10	1	3	.10	.30	.56	1.64	.0167	.0500	NS
Non-paranoid	10	0	4	0	.40	0	.88	0	.0667	NS
Normal subjects	20	1	0	.05	0	.22	0	.0083	0	NS

Experiment 7.

Table 1. Errors made under the pointing (P) condition and under the saying (S) condition.

Table 2. Types of errors made under the pointing (P) conditions and under the saying (S) condition.

Experiment 8.

Table 3. Errors made under the multiple choice condition with two, five and nine alternatives offered.

Table 4. Errors made under the single choice condition with two, five and nine alternatives offered.

Experiment 9.

Table 5. Errors made under the four conditions involving aids to boundary formation.

Table 5A. Statistical comparison between the most difficult condition and the second most difficult condition, and comparisons between the other conditions, using The Wilcoxen Test (W) and the Sign Test (S).

Table 6. Associational proximity under four conditions involving aids to boundary formation.

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Experiment 7

Table 1. Errors made under the pointing (P) condition and under the saying (S) condition.

	N	No. of Errors P	No. of Errors S	Mean No. of Errors P	Mean No. of Errors S	Standard Deviations P	Standard Deviations S	Proportions of Errors P	Proportions of Errors S	P-level * between P & S
Schizophrenic Ss										
Acute	10	56	45	5.60	4.50	2.63	3.83	.6222	.5000	NS W; NS S
Chronic	10	38	37	3.80	3.70	2.85	2.53	.4222	.4111	NS W; NS S
Thought disordered	16	77	63	4.81	3.93	2.93	3.25	.5347	.4375	NS W; NS S
Non-thought disordered	2	14	10	7.00	5.00	2.00	4.00	.7778	.5555	NS W; NS S
Paranoid	6	33	24	5.50	4.00	2.81	3.36	.6111	.4444	NS W; NS S
Non-paranoid	14	61	51	4.35	3.64	2.86	3.22	.4841	.4047	NS W; NS S
										All schizophrenics NS W; NS S

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

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Experiment 7

Table 2

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Experiment 7

Table 2. Types * of errors made under the pointing (P) conditions and under the saying (S) condition

		No. of Errors										Proportions of Errors										Friedman P-level	
		(a)		(b)		(c)		(d)		(e)		(a)		(b)		(c)		(d)		(e)			
	N	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S
Schizophrenic Ss																							
Acute	10	19	20	15	13	76	58	3	2	5	3	.0527	.0555	.0417	.0361	.2111	.1611	.0083	.0056	.0139	.0083	.02	NS
Chronic	10	17	13	12	6	42	47	7	2	7	3	.0472	.0361	.0333	.0167	.1167	.1306	.0194	.0056	.0194	.0083	.05	.05
Thought disordered	16	32	32	26	18	94	90	10	4	8	4	.0556	.0556	.0451	.0313	.1632	.1563	.0174	.0069	.0139	.0069	.05	.05
Non-thought disordered	2	4	1	1	1	22	15	0	0	2	0	.0556	.0139	.0139	.0139	.3056	.2083	0	0	.0278	0	NS	NS
Paranoid	6	9	11	10	6	42	33	6	3	2	1	.0417	.0509	.0463	.0278	.1944	.1528	.0278	.0139	.0093	.0046	NS	NS
Non-paranoid	14	27	22	17	13	76	72	4	1	10	5	.0536	.0437	.0337	.0258	.1508	.1429	.0079	.0198	.0198	.0099	NS	NS
																						All schizophrenics .05	.05

* (a) phonetically similar at the beginning of the word
(b) phonetically similar at the end of the word
(c) related in meaning
(d) irrelevant
(e) rejection of the correct word

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Experiment 8

Table 3. Errors made under the multiple choice condition with two, five and nine alternatives offered

	N	No. of Errors two	five	nine	Proportions of Errors two	five	nine	Friedman P-level
All schizophrenics	20	14	21	29	.2333	.0875	.0604	.01
Acute	10	8	12	17	.2667	.1000	.0708	.02
Chronic	10	6	9	12	.2000	.0750	.0500	NS
Thought disordered	9	9	12	16	.3333	.1111	.0741	.01
Non-thought disordered	8	2	5	6	.0834	.0521	.0313	NS
Paranoid	6	4	6	9	.2222	.0833	.0250	NS
Non-paranoid	14	10	15	20	.2381	.0893	.0595	NS

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Experiment 8

Table 4. Errors made under the single choice condition with two, five and nine alternatives offered

	N	No. of Errors			Proportions of Errors			Friedman P-level
		two	five	nine	two	five	nine	
All schizophrenics	20	21	37	63	.3500	.1541	.0895	.01
Acute	10	8	19	23	.2666	.1416	.0958	NS
Chronic	10	13	18	20	.4333	.1500	.0833	.02
Thought disordered	9	14	23	23	.5185	.2129	.1065	.01
Non-thought disordered	8	3	9	12	.1250	.0938	.0625	NS
Paranoid	6	6	10	14	.3333	.1389	.0972	NS
Non-paranoid	14	15	27	29	.3571	.1607	.0863	NS

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Table 5. Errors made under the four conditions * involving aids to boundary formation.

	N	No. of Errors 1	2	3	4	Mean No. of Errors 1	2	3	4	Standard Deviations 1	2	3	4	Proportions of Errors 1	2	3	4	Friedman P-level
<u>Schizophrenic Ss</u>																		
Acute	10	34	17	15	10	3.40	1.70	1.50	1.00	2.65	4.07	3.79	2.52	.8500	.3250	.3750	.2500	.02
Chronic	10	32	15	14	8	3.20	1.50	1.40	.80	2.33	4.10	3.42	3.03	.8000	.3750	.3500	.2000	.01
Thought disordered	11	41	28	23	15	3.73	2.55	2.09	1.36	2.99	4.09	3.77	3.07	.9318	.6363	.5227	.3409	.02
Non-thought disordered	7	18	2	4	3	2.57	.29	.57	.43	2.25	1.47	1.29	1.18	.6428	.0714	.1428	.1071	.05
Paranoid	5	14	3	4	1	2.80	.60	.80	.20	2.50	1.60	1.42	.71	.7000	.1500	.2000	.0500	.01
Non-paranoid	15	52	29	25	17	3.47	1.93	1.67	1.13	2.45	4.08	3.57	3.01	.8666	.4833	.4166	.2833	.01

* Condition No: 1 - no preparation
2 - reading list of irrelevant words
3 - reading list of associated words
4 - discussing list of associated words

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Experiment 9

Table 5A. Statistical comparison between the most difficult condition and the second most difficult condition, and comparisons between the other conditions,* using The Wilcoxen Test (W) and the Sign Test (S)

	N	1 & 2	1 & 3	2 & 3	2 & 4	3 & 4
All schizophrenics	20	.01 W .002 S		NS W NS S	.05 W NS S	NS W p= .058 S
Acute	10		.01 W .008 S	NS W NS S	NS W NS S	NS W NS S
Chronic	10	.05 W .032 S		NS W NS S	NS W NS S	NS W p= .070 S
Thought disordered	11	.05 W .032 S		NS W NS S	NS W NS S	NS W NS S
Non-thought disordered	7		NS W p=.062 S	NS W NS S	NS W NS S	NS W NS S
Paranoid	5		NS W NS S	NS W NS S	NS W NS S	NS W NS S
Non-paranoid	15	.01 W .004 S		NS W NS S	NS W NS S	NS W NS S

* Conditions: 1 - no preparation
2 - reading list of irrelevant words
3 - reading list of associated words
4 - discussing list of associated words

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Table 6

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Experiment 9

Table 6. Associational proximity * under four conditions involving aids to boundary formation.

	N	Condition 1 (no preparation) No. of Errors 1st	2nd	3rd	4th	Rare	Proportions of Errors 1st	2nd	3rd	4th	Rare	P-level ** between common and rare associations
Acute	10	17	18	12	9	11	.4250	.4500	.3000	.2250	.0687	.01
Chronic	10	17	15	13	11	15	.4250	.3750	.3250	.2750	.0937	.01
Thought disordered	11	27	21	15	11	17	.6136	.4772	.3409	.2500	.0965	.01
Non-thought disordered	7	5	7	7	7	6	.1785	.2500	.2500	.2500	.0535	NS (p= .062, Sign Test)
Paranoid	5	6	6	5	4	3	.3000	.3000	.2500	.2000	.0375	NS
Non-paranoid	15	28	27	20	16	23	.4667	.4500	.3333	.2667	.0958	.01
All schizophrenics	20	34	33	25	20	26	.4250	.4125	.3125	.2500	.0831	.01

	Condition 2 (reading list of irrelevent words) No. of Errors 1st	2nd	3rd	4th	Rare	Proportion of Errors. 1st	2nd	3rd	4th	Rare	P-level ** between common and rare associations
Acute	12	12	8	7	5	.3000	.3000	.2000	.1750	.0312	.02
Chronic	13	11	8	3	6	.3250	.2750	.2000	.0750	.0375	.05
Thought disordered	24	19	15	8	11	.5454	.4318	.3409	.1818	.0625	.01
Non-thought disordered	1	1	0	1	0	.0357	.0357	0	.0357	0	NS
Paranoid	2	2	1	0	0	.1000	.1000	.0500	0	0	NS
Non-paranoid	23	21	15	10	11	.3833	.3500	.2500	.1667	.0458	.01
All schizophrenics	25	23	16	10	11	.3125	.2875	.2000	.1250	.0343	.01

	Condition 3 (reading list of associ No. of Errors 1st	2nd	3rd	4th	Rare	Proport 1st
Acute	11	10	7	6	10	.2750
Chronic	8	11	6	7	10	.2000
Thought disordered	13	19	10	9	20	.2954
Non-thought disordered	6	0	3	3	0	.2142
Paranoid	5	2	2	2	0	.2500
Non-paranoid	14	19	11	11	20	.2333
All schizophrenics	19	21	13	13	20	.2375

* 1st - first closest association
2nd - second closest association
3rd - third closest association
4th - fourth closest association
Rare - rare associations

** using The Wilcoxen Test (two-tailed)

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Table 6

· (reading list of associated words)									Condition 4 (discussing list of associated words)										
·rs			Proportions of Errors					P-level ** between common and rare associations	No. of Errors					Proportions of Errors					P-level ** between common and rare associations
rd	4th	Rare	1st	2nd	3rd	4th	Rare		1st	2nd	3rd	4th	Rare	1st	2nd	3rd	4th	Rare	
7	6	10	.2750	.2500	.1750	.1500	.0625	.01	6	4	2	4	2	.1500	.1000	.0500	.1000	.0125	.02
6	7	10	.2000	.2750	.1500	.1750	.0625	.01	6	3	2	5	2	.1500	.0750	.0500	.1250	.0125	NS
10	9	20	.2954	.4318	.2272	.2045	.1136	.01	11	4	3	8	3	.2500	.0909	.0681	.1818	.0170	.01
3	3	0	.2142	0	.1071	.1071	0	.02	1	3	0	1	1	.0357	.1071	0	.0357	.0089	NS
2	2	0	.2500	.1000	.1000	.1000	0	NS	1	0	0	1	1	.0500	0	0	.0500	.0125	NS
11	11	20	.2333	.3167	.1833	.1833	.0833	.01	11	7	4	8	3	.1833	.1167	.0667	.1333	.0125	.01
13	13	20	.2375	.2625	.1625	.1625	.0625	.01	12	7	4	9	4	.1500	.0875	.0500	.1125	.0124	.01

APPENDIX D

Experiment 10.

Experiment 11.

Experiment 12.

APPENDIX D (continued)

Experiment 12

Table 15. Types of errors made under the slow condition.

Table 15A. Statistical comparison of the highest error scores of each type with the second highest error scores of each type, and the second highest error scores of each type with the third highest error scores, using The Wilcoxen Test (W) and the Sign Test (S), under the slow condition.

Table 16. Associations made to written or to spoken stimulus words.

APPENDIX D

Experiment 10

Table 1

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Experiment 10

Table 1. Errors made under the multiple (M) and single (S) choice conditions.

	N	No. of Errors		Mean No. of Errors		Standard Deviations		Proportion of Errors		P-level * between M & S
		M	S	M	S	M	S	M	S	
Schizophrenic Ss										
Acute	10	5	22	.50	2.20	.50	2.03	.0830	.3660	.05 W; NS S
Chronic	10	14	23	1.40	2.30	1.11	2.05	.2330	.3830	NS W; NS S
Thought disordered	13	12	31	.92	2.38	.89	2.28	.1539	.3973	.05 W; .032 S
Non-thought disordered	5	2	11	.40	2.50	.49	1.02	.0667	.3667	NS W; NS S
Paranoid	2	0	5	0	2.50	0	2.50	0	.4167	NS W; NS S
Non-paranoid	18	19	40	1.06	2.22	.74	2.06	.1759	.3703	.01 W; NS S
Normal subjects	10	2	0	.20	0	.40	0	.0333	0	NS W; NS S
										All schizophrenics .05 W; .092 S

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

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Experiment 10
Table 2

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Experiment 10

Table 2. Errors made to items with object nouns of one, two or three syllables.

	N	No. of Errors			Mean No. of Errors			Standard Deviations			Proportions of Errors			P-level * between 1 & 3 syllable words
		1-syl	2-syl	3-syl	1-syl	2-syl	3-syl	1-syl	2-syl	3-syl	1-syl	2-syl	3-syl	
Schizophrenic Ss														
Acute	10	2	13	12	.20	1.30	1.20	.40	1.81	.87	.0500	.3250	.3000	.05 W; NS S
Chronic	10	10	12	15	1.00	1.20	1.50	.28	1.25	1.28	.2500	.3000	.3750	NS W; NS S
Thought-disordered	13	10	15	18	.77	1.15	1.38	.85	1.57	1.31	.1923	.2884	.3461	.05 W; .070 S
Non-thought disordered	5	1	6	6	.20	1.20	1.20	.4	1.16	.74	.0500	.3000	.3000	NS W; NS S
Paranoid	2	0	3	2	0	1.50	1.00	0	1.50	1.00	0	.3750	.2500	NS W; NS S
Non-paranoid	18	12	22	25	.67	1.22	1.39	.78	1.70	1.04	.1667	.3055	.3472	.01 W; .066 S
Normal subjects	10	0	0	2	0	0	.20	0	0	.40	0	0	.0500	NS W; NS S

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two-tailed)

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Table 3

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Experiment 10

Table 3. Errors made to items with frequent (AA) or rare (1-10) object nouns.

	N	No. of Errors		Mean No. of Errors		Standard Deviations		Proportions of Errors		P-level between AA & 1-10 words
		AA	1-10	AA	1-10	AA	1-10	AA	1-10	
Schizophrenic Ss										
Acute	10	12	10	1.20	1.00	.48	.37	.3000	.2500	NS
Chronic	10	10	13	1.00	1.30	.28	1.48	.2500	.3250	NS
Thought disordered	13	14	16	1.08	1.23	1.11	1.33	.2192	.3076	NS
Non-thought disordered	5	1	6	.20	1.20	0	.74	.0500	.3000	NS
Paranoid	2	0	2	0	1.00	0	1.00	0	.2500	NS
Non-paranoid	18	22	21	1.22	1.17	.57	1.35	.3055	.2916	NS
Normal subjects	10	2	0	.20	0	.40	0	.0500	0	NS

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Experiment 10

Table 4. Incorrect names given in the naming task

	N	No. of incorrect names	Mean No. of incorrect names	Standard Deviations	Proportions of incorrect names
Schizophrenic Ss					
Acute	10	3	.30	.90	.0250
Chronic	10	7	.70	.90	.0583
Thought disordered	13	10	.77	1.04	.0641
Non-thought disordered	5	0	0	0	0
Paranoid	2	0	0	0	0
Non-paranoid	18	10	.56	.82	.0462
Normal subjects	10	0	0	0	0

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Experiment 10

Table 5. Overall errors for each group

	N	No. of Errors	Mean No. of Errors	Standard Deviations	Proportions of Errors
Schizophrenic Ss					
Acute	10	27	2.70	2.19	.2250
Chronic	10	37	3.70	2.64	.3083
Thought disordered	13	43	3.31	3.04	.2767
Non-thought disordered	5	13	2.60	1.35	.2166
Paranoid	2	5	2.50	2.50	.2083
Non-paranoid	18	59	3.28	2.77	.2731
Normal subjects	10	2	.20	.40	.0167

P-levels of difference between groups using the Mann Whitney U-Test (two-tailed)

Acute and Chronic schizophrenics	=	NS
Thought disordered and Non-thought disordered schizophrenics	=	NS
Paranoid and Non-paranoid schizophrenics	=	NS
All schizophrenics and Normal subjects	=	.002

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Table 6

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Experiment 10

Table 6. Types * of errors made.

	N *	No. of Errors (a)	(b)	(c)	(d)	(e)	Mean No. of Errors (a)	(b)	(c)	(d)	(e)	Standard Deviations (a)	(b)	(c)	(d)	(e)	Proportions of Errors (a)	(b)	(c)	(d)	(e)	Friedman P-level
Schizophrenic Ss																						
Acute	10	16	11	24	10	3	1.60	1.10	2.40	1.00	.30	2.90	2.70	3.46	2.68	.46	.0667	.0458	.1000	.0416	.0250	.05
Chronic	10	23	9	16	3	7	2.30	.90	1.60	.30	.70	3.50	.70	1.43	0	1.26	.0959	.0375	.0667	.0125	.0581	.02
Thought disordered	13	30	16	33	13	4	2.31	1.21	2.54	1.00	.31	3.92	2.35	3.17	.17	.37	.0961	.0128	.1057	.0416	.0128	.02
Non-thought disordered	5	6	2	5	0	2	1.20	.40	1.00	0	.40	.75	.37	.63	0	.48	.5000	.0167	.0416	0	.0167	NS
Paranoid	2	2	2	1	0	0	1.00	1.00	.50	0	0	1.00	1.00	.50	0	0	.0416	.0416	.0208	0	0	NS
Non-paranoid	18	37	18	38	13	10	2.06	1.00	2.11	.72	.56	3.32	2.05	2.82	2.13	1.03	.0856	.0416	.0819	.0300	.0231	NS
Normal subjects	10	0	0	2	0	0	0	0	.20	0	0	0	0	.45	0	0	0	0	.0083	0	0	NS

* (a) phonetically similar at the beginning of the word
(b) phonetically similar at the end of the word
(c) related in meaning
(d) irrelevant
(e) rejection of the correct word

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Experiment 10

Table 6A. Statistical comparison of the highest error score of each type * with the second highest error score

	Wilcoxen Test (c) and (a)	Sign Test (c) and (á)
Acute	NS	NS
Chronic	NS	NS
Thought disordered	NS	NS
Non-thought disordered	NS	NS
Paranoid	NS	NS
Non-paranoid	NS	NS
Normal subjects	NS	NS

* Types:

(a) phonetically similar at the beginning of the word
(b) phonetically similar at the end of the word
(c) related in meaning
(d) irrelevant
(e) rejection of the correct word

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Experiment 11

Table 7. Errors made under the multiple (M) and single (S) choice conditions

	N	No. of Errors M	No. of Errors S	Mean No. of Errors M	Mean No. of Errors S	Standard Deviations M	Standard Deviations S	Proportions of Errors M	Proportions of Errors S	P-level * between M & S	
Schizophrenic Ss											
Acute	10	2	30	.20	3.00	.40	2.00	.0333	.5000	.01 W;	.004 S
Chronic	10	5	27	.50	2.70	.92	2.19	.0833	.4500	.02 W;	.016 S
Thought-disordered	9	5	27	.56	3.00	.93	1.94	.0925	.5000	.02 W;	.016 S
Non-thought-disordered	8	0	18	0	2.25	0	1.85	0	.3750	.05 W;	.032 S
Paranoid	3	1	7	.33	2.33	.48	2.64	.0556	.3889	NS W;	NS S
Non-paranoid	17	6	50	.35	2.95	.77	1.79	.0588	.4902	.01 W;	.002 S
Normal subjects	10	0	0	0	0	0	0	0	0		

* W - Wilcoxen Test (two-tailed)
S - Sign Test (two tailed)

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Table 8

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Experiment 11

Table 8. Errors made to items with object nouns of one, two or three syllables.

		No. of Errors			Mean No. of Errors			Standard Deviations			Proportions of Errors			P-level between 1 & 3 syllable words
	N	1-syl	2-syl	3-syl	1-syl	2-syl	3-syl	1-syl	2-syl	3-syl	1-syl	2-syl	3-syl	
Schizophrenic Ss														
Acute	10	11	7	14	1.10	.70	1.40	.94	.78	.66	.2750	.1750	.3500	NS
Chronic	10	11	11	10	1.10	1.10	1.00	1.30	.94	1.18	.2750	.2750	.2500	NS
Thought disordered	9	13	8	11	1.44	.89	1.22	1.34	.72	.74	.3611	.2222	.3055	NS
Non-thought disordered	8	5	5	8	.63	.63	1.00	.87	.87	.86	.1500	.1500	.2500	NS
Paranoid	3	3	2	3	1.00	.67	1.00	1.00	.91	.81	.2500	.1667	.2500	NS
Non-paranoid	17	19	16	21	1.12	.94	1.24	1.09	.94	.81	.2794	.2352	.3088	NS
Normal subjects	10	0	0	0	0	0	0	0	0	0	0	0	0	-

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Experiment 11

Table 9. Errors made to items with frequent (AA) or rare (1-10) object nouns.

	N	No. of Errors AA	No. of Errors 1-10	Mean No. of Errors AA	Mean No. of Errors 1-10	Standard Deviations AA	Standard Deviations 1-10	Proportions of Errors AA	Proportions of Errors 1-10	P-level between AA & 1-10 words
Schizophrenic Ss										
Acute	10	11	15	1.10	1.50	.83	.67	.2750	.3700	NS
Chronic	10	12	11	1.20	1.10	.97	1.22	.3000	.2750	NS
Thought disordered	9	10	13	1.11	1.44	.62	1.30	.2777	.3611	NS
Non-thought disordered	8	6	8	.75	1.00	.78	.70	.1875	.2500	NS
Paranoid	3	1	4	.33	1.33	.45	.98	.0833	.3333	NS
Non-paranoid	17	22	22	1.29	1.29	.84	1.00	.3235	.3235	NS
Normal subjects	10	0	0	0	0	0	0	0	0	-

Appendix D
Experiment 11

Table 10. Incorrect names given in the naming task.

	N	No. incorrect names	Mean No. Incorrect names	Standard Deviations	Proportions of incorrect names
Schizophrenic Ss					
Acute	10	6	.60	.66	.0500
Chronic	10	4	.40	.91	.0303
Thought disordered	9	9	1.00	.87	.0833
Non-thought disordered	8	0	0	0	0
Paranoid	3	1	.33	.45	.0277
Non-paranoid	17	9	.53	.86	.0441
Normal subjects	10	0	0	0	0

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Experiment 11

Table 11. Overall errors for each group.

	N	No. of Errors	Mean No. of Errors	Standard Deviations	Proportions of Errors
Schizophrenic Ss					
Acute	10	35	3.50	.59	.2916
Chronic	10	32	3.20	2.78	.2667
Thought disordered	9	32	3.56	2.34	.2963
Non-thought disordered	8	18	2.25	1.86	.1874
Paranoid	3	8	2.67	2.24	.2222
Non-paranoid	17	56	3.29	2.22	.2745
Normal subjects	10	0	0	0	0

P-levels of difference between groups using the Mann Whitney U-Test (two-tailed)

Acute and Chronic schizophrenics = NS

Thought disordered and Non-thought disordered schizophrenics = NS

Paranoid and Non-paranoid schizophrenics = NS

All schizophrenics and Normal subjects = .002

APPENDIX D

Experiment 11

Table 12

Appendix D
Experiment 11

Table 12. Types * of errors made.

	N	No. of errors					Mean No. of Errors					Standard Deviations					Proportions of Errors					Friedman P-level
		(a)	(b)	(c)	(d)	(e)	(a)	(b)	(c)	(d)	(e)	(a)	(b)	(c)	(d)	(e)	(a)	(b)	(c)	(d)	(e)	
Schizophrenic Ss																						
Acute	10	8	10	24	15	3	.80	1.00	2.40	1.50	.30	1.07	.89	1.42	1.56	.45	.0333	.0416	.1050	.0625	.0250	NS
Chronic	10	7	13	18	10	4	.70	1.30	1.80	1.00	.40	1.00	1.73	1.66	1.78	.48	.0291	.0542	.0750	.0416	.0332	NS
Thought disordered	9	8	10	20	14	4	.89	1.11	2.22	1.56	.44	1.09	1.52	1.42	2.02	.53	.0370	.0462	.0920	.0648	.0370	NS
Non-thought disordered	8	6	8	15	8	1	.75	1.00	1.88	1.0	.13	1.05	1.00	1.66	1.49	.11	.0312	.0416	.0781	.0416	.0104	NS
Paranoid	3	2	3	3	2	1	.66	1.00	1.00	.66	.33	.91	.81	1.41	.91	.75	.0277	.0416	.0416	.0277	.0276	NS
Non-paranoid	17	13	20	39	23	6	.76	1.18	2.29	1.35	.35	1.00	1.06	1.53	1.72	.26	.0318	.0490	.0955	.0563	.0294	NS
Normal subjects	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

* (a) phonetically similar at the beginning of the word
(b) phonetically similar at the end of the word
(c) related in meaning
(d) irrelevant
(e) rejection of the correct word

Appendix D
Experiment 12

Table 13. Errors made under the fast (F) condition and the slow (S) condition.

	N	No. of Errors F	S	Mean No. of Errors F	S	Standard Deviations F	S	Proportions of Errors F	S	P-level * between F & S
Schizophrenic Ss										
Acute	10	17	8	1.70	.80	1.00	.60	.1887	.0889	.01 W; .032 S
Chronic	10	20	17	2.00	1.70	.14	1.02	.2222	.1889	NS W; NS S
Thought disordered	13	21	16	1.61	1.23	1.07	1.20	.1794	.1367	NS W; .062 S
Non-thought disordered	6	12	8	2.00	1.33	.94	.64	.2222	.1481	NS W; NS S
Paranoid	8	15	11	1.88	1.38	1.40	.85	.2083	.1528	NS W; NS S
Non-paranoid	12	22	14	1.83	1.17	1.06	1.20	.2037	.1296	NS W; NS S
										All schizophrenics .01 W; .002 S

* W - Wilcoxen Test (two-tailed)

S - Sign Test (two-tailed)

APPENDIX D
Experiment 12
Table 14

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Experiment 12

Table 14. Types * of errors made under the fast condition.

	N	No. of Errors (a)	(b)	(c)	(d)	(e)	Proportions of Errors (a)	(b)	(c)	(d)	(e)	Friedman P-levels
All schizophrenics	20	4	11	27	1	3	.0111	.0306	.0750	.0028	.0167	.01
Acute	10	2	2	15	0	1	.0111	.0111	.0833	0	.0111	.05
Chronic	10	2	9	12	1	2	.0111	.0500	.0667	.0056	.0222	NS
Thought disordered	13	2	8	19	0	0	.0085	.0342	.0812	0	0	NS
Non-thought disordered	6	1	4	5	1	2	.0093	.0370	.0463	.0093	.0370	NS
Paranoid	8	2	5	12	1	1	.0139	.0347	.0833	.0069	.0278	NS
Non-paranoid	12	2	6	15	0	2	.0095	.0278	.0694	0	.0185	NS

* (a) phonetically similar at the beginning of the word
(b) phonetically similar at the end of the word
(c) related in meaning
(d) irrelevant
(e) rejection of the correct word

Appendix D
Experiment 12

Table 14A. Statistical comparison of the highest error scores of each type * with the second highest error scores, and the second highest error scores of each type with the third highest error scores, using the Wilcoxen Test (W) and the Sign Test (S), under the fast condition.

	N	(c) & (b)		(b) & (e)	
All schizophrenics	20	.05	W	NS	W
		NS (p= .18)	S	NS	S
Acute	10	.02	W	NS	W
		.016	S	NS	S
Chronic	10	NS	W	NS	W
		NS	S	NS	S
Thought disordered	13	NS	W	NS	W
		NS	S	NS	S
Non-thought disordered	6	NS	W	NS	W
		NS	S	NS	S
Paranoid	8	NS	W	NS	W
		NS	S	NS	S
Non-paranoid	12	NS	W	NS	W
		NS	S	NS	S

* see Table 14 for description of types of errors

Appendix D
Experiment 12

Table 15. Types * of errors made under the slow condition.

	N	No. of Errors (a)	(b)	(c)	(d)	(e)	Proportions of Errors (a)	(b)	(c)	(d)	(e)	Friedman P-levels
All schizophrenics	20	5	2	26	0	0	.0139	.0056	.0722	0	0	.001
Acute	10	2	0	10	0	0	.0111	0	.0556	0	0	.05
Chronic	10	3	2	16	0	0	.0167	.0111	.0889	0	0	.02
Thought disordered	13	4	2	15	0	0	.0175	.0085	.0641	0	0	.001
Non-thought disordered	6	1	0	9	0	0	.0093	0	.0833	0	0	.001
Paranoid	8	3	1	12	0	0	.0208	.0069	.0833	0	0	.01
Non-paranoid	12	2	1	14	0	0	.0095	.0046	.0648	0	0	.01

* (a) phonetically similar at the beginning of the word
(b) phonetically similar at the end of the word
(c) related in meaning
(d) irrelevant
(e) rejection of the correct word

Appendix D
Experiment 12

Table 15A. Statistical comparison of the highest error scores of each type * with the second highest error scores of each type, and the second highest error scores of each type with the third highest error scores, using the Wilcoxen Test (W) and the Sign Test (S), under the slow condition.

	N	(c) & (a)		(a) & (b)	
All schizophrenics	20	.01	W	NS	W
		.002	S	NS	S
Acute	10	.02	W	NS	W
		.016	S	NS	S
Chronic	10	.02	W	NS	W
		.016	S	NS	S
Thought disordered	13	.02	W	NS	W
		.016	S	NS	S
Non-thought disordered	6	.05	W	NS	W
		.032	S	NS	S
Paranoid	8	.05	W	NS	W
		.032	S	NS	S
Non-paranoid	12	.01	W	NS	W
		.004	S	NS	S

* see Table 15 for description of types of errors.

APPENDIX D
Experiment 13
Table 16

Appendix D
Experiment 13

Table 16. Associations made to written or to spoken stimulus words.

		No. of associations		Mean No. of associations		Standard Deviations	
	N	Written	Spoken	Written	Spoken	Written	Spoken
Acute	10	283	280	28.30	28.00	30.67	35.67
Chronic	10	133	126	13.30	12.60	21.67	23.27
Thought disordered	6	116	132	19.33	22.00	37.01	39.62
Non-thought disordered	8	188	185	23.50	23.13	12.56	10.86
Paranoid	6	115	113	19.17	18.83	27.64	10.78
Non-paranoid	14	301	293	21.50	20.93	27.06	38.90
Normal subjects	10	476	487	47.60	48.70	16.71	21.67

APPENDIX E

Experiment 14.

Table 1. Errors made under four conditions of speed.

Table 1A. Statistical comparisons of the four conditions of speed using the Mann Whitney U-Test (two-tailed).

Table 2. Repeats made under the four conditions of speed.

Table 3. Errors and repeats made to frequent (F) or rare(R) commands, under four conditions of speed.

Table 4. Errors made to commands of different lengths, under four conditions of speed.

APPENDIX E
Experiment 14
Table 1

Appendix E
Experiment 14

Table 1. Errors made under four conditions of speed*.

	No. of Subjects				No. of Errors				Mean No. of Errors				Standard Deviations				Proportions of Errors			
	S	O	F	E	S	O	F	E	S	O	F	E	S	O	F	E	S	O	F	E
All schizophrenics	20	20	20	20	24	28	64	41	1.20	1.40	3.20	2.05	2.77	2.98	3.17	3.07	.1000	.1167	.2667	.1708
Acute	10	10	10	10	4	10	29	26	.40	1.00	2.90	2.60	2.65	2.52	3.20	3.59	.0333	.8333	.2417	.2167
Chronic	10	10	10	10	20	18	35	15	2.00	1.80	3.50	1.50	2.72	2.79	4.76	1.32	.1667	.1500	.2167	.1250
Thought disordered	10	9	5	13	24	22	23	31	2.40	2.44	4.33	2.38	2.34	3.14	4.92	3.47	.2000	.2037	.3833	.1260
Non-thought disordered	7	8	6	5	0	3	16	7	0	.38	2.67	1.40	0	1.31	2.10	1.41	0	.0313	.2083	.1167
Non-psychotic psychiatric patients	10	10	10	10	3	3	14	20	.30	.30	1.40	2.00	1.32	1.32	2.00	2.00	.0250	.0250	.1167	.1667

* S - Slow speed condition
O - Ordinary speed condition
F - Fast speed condition
E - Edited speed condition

Appendix E
Experiment 14

Table 1A. Statistical comparisons of the four conditions of speed using the Mann Whitney U-Test (two-tailed).

P - levels

Speed Conditions	Slow & Ordinary	Slow & Fast	Slow & Edited	Ordinary & Fast	Ordinary & Edited	Fast & Edited
All schizophrenics	NS	.02	.05	.02	.05	NS
Acute	NS	.05	.05	.05	.05	NS
Chronic	NS	.05	NS	.05	NS	.05
Thought disordered	NS	.05	NS	.05	NS	.05
Non-thought disordered	NS	.001	.001	.02	.007	NS
Non-psychotic psychiatric patients	NS	.05	.05	.05	.05	.05

All schizophrenics compared with Non-psychotic psychiatric patients in the Slow Condition : NS
All schizophrenics compared with Non-psychotic psychiatric patients in the Ordinary Condition: NS
All schizophrenics compared with Non-psychotic psychiatric patients in the Fast Condition: p .05
All schizophrenics compared with Non-psychotic psychiatric patients in the Edited Condition: NS

APPENDIX E
Experiment 14
Table 2

Appendix E
Experiment 14

Table 2. Repeats made under four conditions of speed.*

	No. of Subjects				No. of Repeats				Mean No. of Repeats				Standard Deviations			
	S	O	F	E	S	O	F	E	S	O	F	E	S	O	F	E
All schizophrenics	20	20	20	20	64	148	206	169	3.20	7.40	10.30	8.45	10.03	22.04	27.77	25.67
Acute	10	10	10	10	17	55	66	59	1.70	5.50	6.60	5.90	3.92	10.09	11.76	10.01
Chronic	10	10	10	10	47	93	140	110	4.70	9.30	14.00	11.00	6.16	18.65	21.10	13.85
Thought disordered	10	9	5	13	42	94	39	130	4.20	10.44	7.40	10.00	6.07	18.72	12.10	18.87
Non-thought disordered	7	8	6	5	16	27	31	30	2.28	3.38	5.12	6.00	3.01	4.42	7.43	9.17
Non-psychotic psychiatric patients	10	10	10	10	29	16	8	22	2.90	1.60	.80	2.20	7.92	3.57	2.02	7.07

* S - Slow speed condition
O - Ordinary speed condition
F - Fast speed condition
E - Edited speed condition

APPENDIX E

Experiment 14

Table 3

Appendix E
Experiment 14

Table 3. Errors and repeats made to frequent (F) or rare (R) commands, under four conditions of speed*.

	No. of Subjects				No. of Errors								Proportions of Errors								P-level** between F & R (errors)				No. of Repeats							
	S	O	F	E	S		O		F		E		S		O		F		E		S	O	F	E	S		O		F		E	
All					F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R					F	R	F	R	F	R	F	R
schizophrenics	20	20	20	20	11	13	12	16	22	42	16	25	.0917	.0183	.1000	.1333	.1833	.3500	.1333	.2083	NS	NS	NS	NS	29	35	79	69	106	100	87	82
Acute	10	10	10	10	2	2	5	5	10	19	10	16	.0333	.0333	.8333	.8333	.1667	.3167	.1667	.2667	NS	NS	NS	NS	6	11	38	17	32	34	32	27
Chrbnic	10	10	10	10	9	11	7	11	12	23	6	9	.1500	.1833	.1167	.1833	.2000	.3833	.1000	.1500	NS	NS	NS	NS	23	24	41	52	74	66	55	55
Thought disordered	10	9	5	13	11	13	10	12	8	15	13	18	.1833	.2167	.1852	.2222	.2667	.5000	.1667	.2307	NS	NS	NS	NS	23	19	51	43	23	16	70	60
Non-thought disordered	7	8	6	5	0	0	1	2	5	11	2	5	0	0	.1218	.1417	.1389	.3056	.0667	.1667	NS	NS	NS	NS	4	12	12	15	14	17	15	15
Non-psychotic psychiatrid patients	10	10	10	10	1	2	1	2	7	7	10	10	.0167	.0333	.0167	.0333	.1167	.1167	.1667	.1667	NS	NS	NS	NS	22	7	10	6	4	4	9	13

* S - Slow speed condition
O - Ordinary speed condition
F - Fast speed condition
E - Edited speed condition

** using the Wilcoxen Test (two-tailed)

APPENDIX E
Experiment 14
Table 4

Appendix E
Experiment 14

Table 4. Errors made to commands of different lengths, under four conditions of speed.

Slow Speed Condition

LENGTH*	N	No. of Errors n	an	n n	an an	n n n	an an an	Proportions of Errors n	an	n n	an an	n n n	an an an
All schizophrenics	20	2	2	4	5	8	3	.0500	.0500	.1000	.1250	.2000	.0750
Acute	10	0	0	1	0	2	1	0	0	.0500	0	.1000	.0500
Chronic	10	2	2	3	5	6	2	.1000	.1000	.1500	.2500	.3000	.1000
Thought disordered	10	2	2	3	6	8	3	.1000	.1000	.1500	.3000	.4000	.1500
Non-thought disordered	7	0	0	0	0	0	0	0	0	0	0	0	0
Non-psychotic psychiatric patients	10	0	0	0	0	2	1	0	0	0	0	.1900	.0500

Ordinary Speed Condition

LENGTH*	N	No. of Errors n	an	n n	an an	n n n	an an an	Proportions of Errors n	an	n n	an an	n n n	an an an
All schizophrenics	20	3	2	4	6	7	6	.0750	.0500	.1000	.1500	.1750	.1500
Acute	10	2	1	1	2	2	2	.1000	.0500	.1000	.1000	.1000	.1000
Chronic	10	1	1	3	4	5	4	.0500	.0500	.1500	.2000	.2500	.2000
Thought disordered	9	2	2	3	5	6	4	.1111	.1111	.1667	.2777	.3333	.2222
Non-thought disordered	8	1	0	1	0	1	0	.0625	0	.0625	0	.0625	0
Non-psychotic psychiatric patients	10	0	0	0	0	1	2	0	0	0	0	.0500	.1000

Fast Speed Condition

LENGTH*	N	No. of Errors n	an	n n	an an	n n n	an an an	Proportions n	an
All schizophrenics	20	9	9	7	9	13	17	.2250	.2250
Acute	10	3	4	3	5	7	7	.1500	.2000
Chronic	10	6	5	4	4	6	10	.3000	.2500
Thought disordered	5	4	4	2	3	3	7	.4000	.4000
Non-thought disordered	6	4	2	3	2	3	2	.3333	.1667
Non-psychotic psychiatric patients	10	1	0	1	4	3	5	.0500	. 0

* n - one noun
an - one adjective, one noun
{n n} - two nouns
{an an} - two adjectives, two nouns
{n n n} - three nouns
{an an an} - three adjectives, three nouns

APPENDIX E
Experiment 14
Table 4

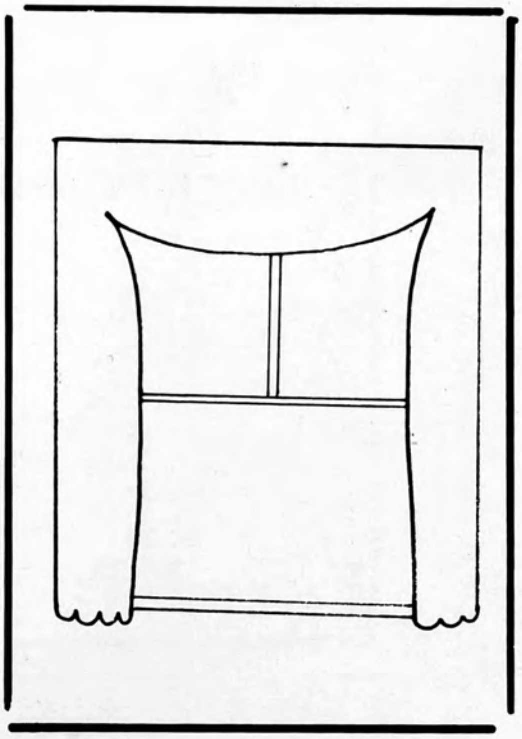
...on	Proportions of Errors						Edited Speed	No. of Errors				Condition		Proportions of Errors					
an an an	n	an	n n	an an	n n n	an an an	N	n	an	n n	an an	n n n	an an an	n	an	n n	an an	n n n	an an an
17	.2250	.2250	.1750	.2250	.3250	.4250	20	6	5	8	10	5	7	.1500	.1250	.2000	.2500	.1250	.1750
7	.1500	.2000	.1500	.2500	.3500	.3500	10	4	4	4	5	4	5	.2000	.2000	.2000	.2500	.2000	.2500
10	.3000	.2500	.2000	.2000	.3000	.5000	10	2	1	4	5	1	2	.1000	.0500	.2000	.2500	.0500	.1000
7	.4000	.4000	.2000	.3000	.3000	.7000	13	5	4	6	5	5	6	.1923	.1538	.2307	.1923	.1923	.2307
2	.3333	.1667	.2500	.1667	.2500	.1667	5	1	1	2	3	0	0	.1000	.1000	.2000	.3000	0	0
5	.0500	. 0	.0500	.2000	.1500	.2500	10	2	0	5	5	4	4	.1000	0	.2500	.2500	.2000	.2000

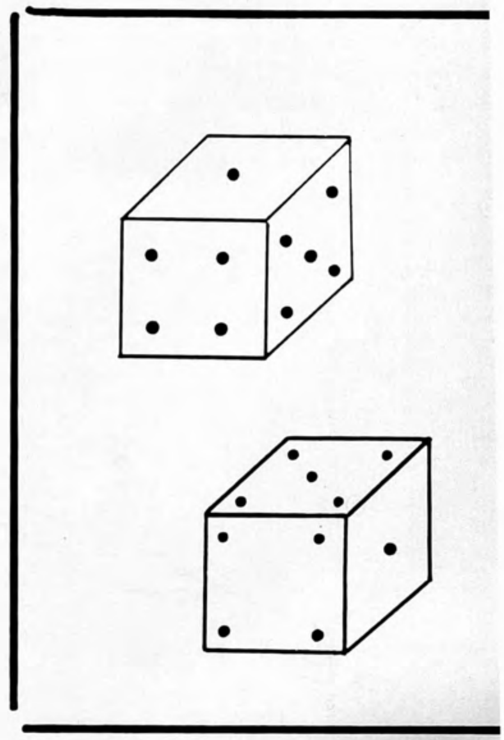
APPENDIX F

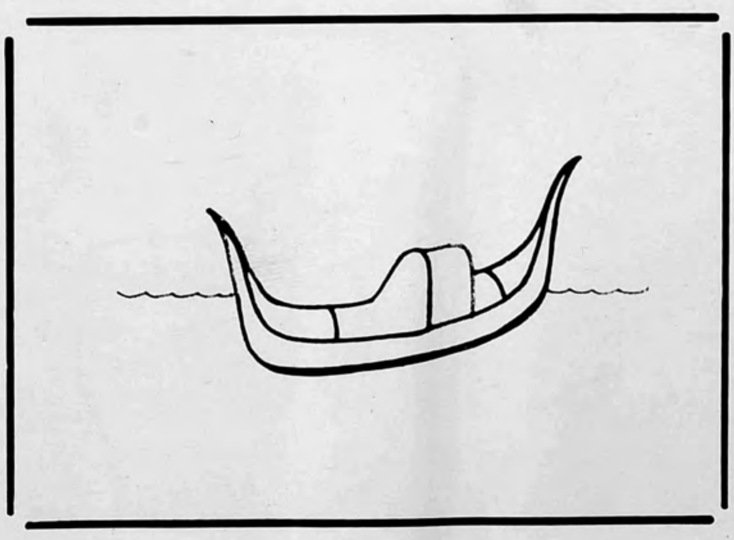
Part i - Stimulus pictures from Experiment 1.

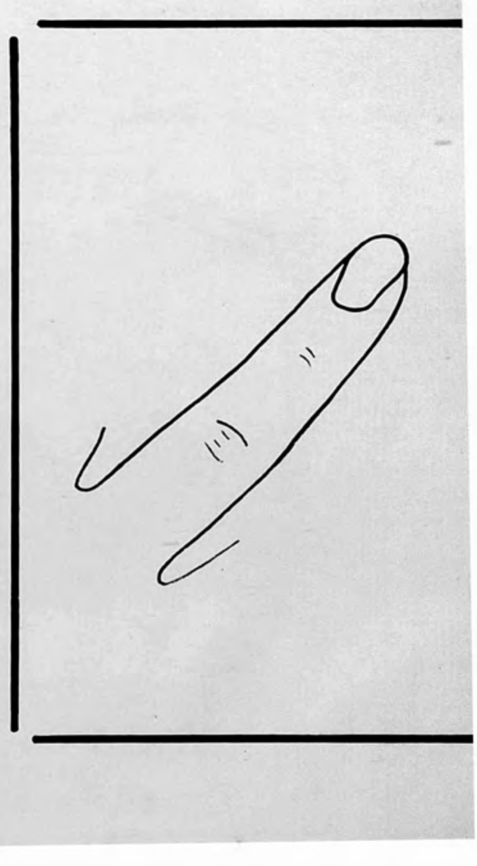
Part ii - Stimulus pictures from Experiment 2.

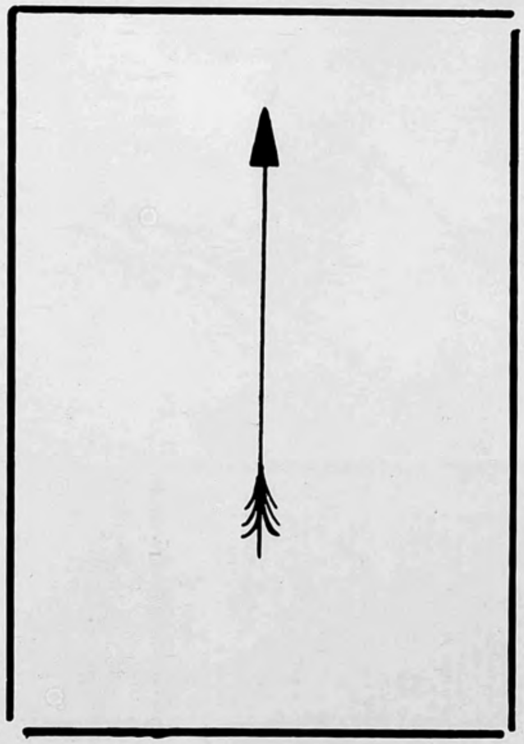
Part i

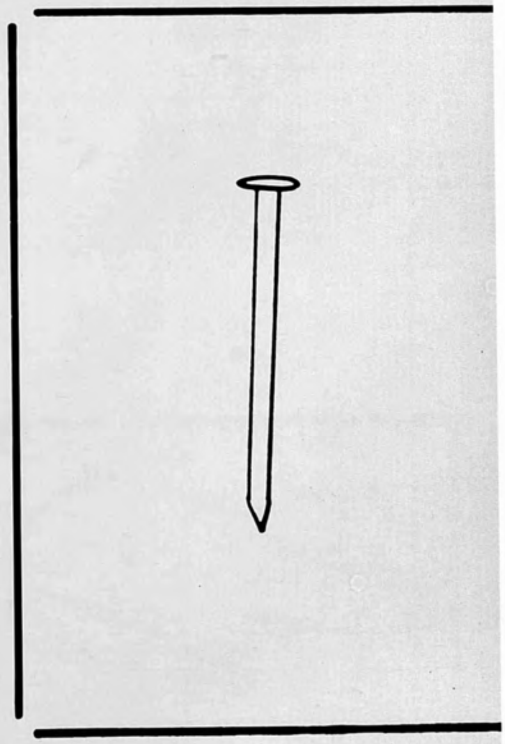


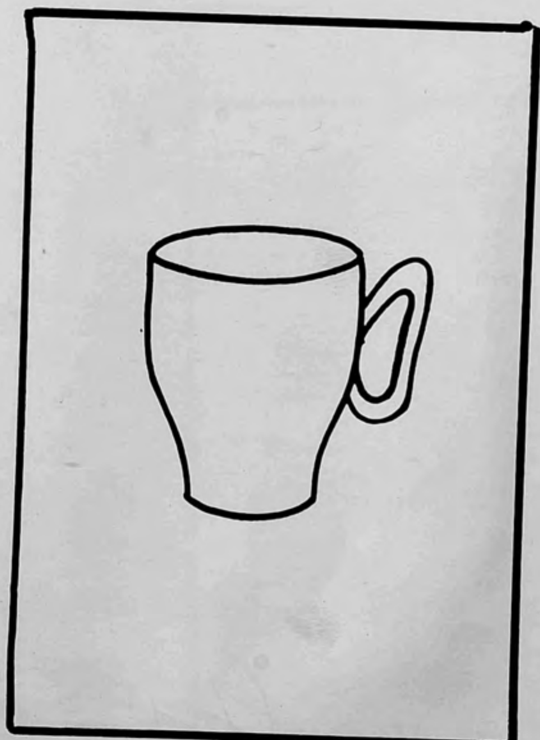


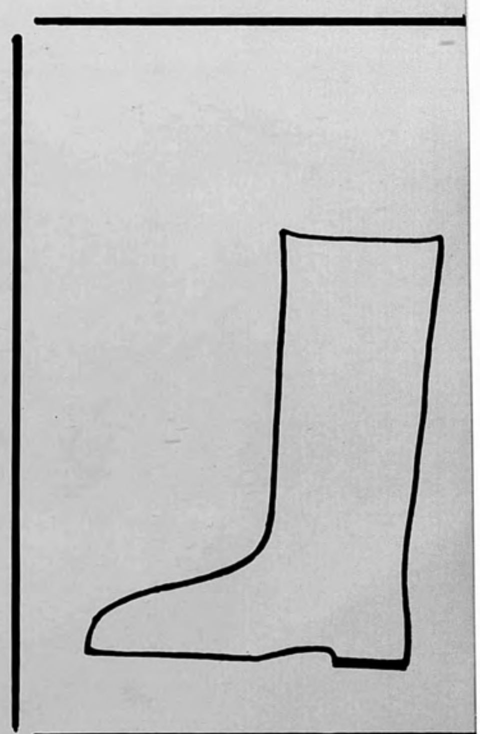


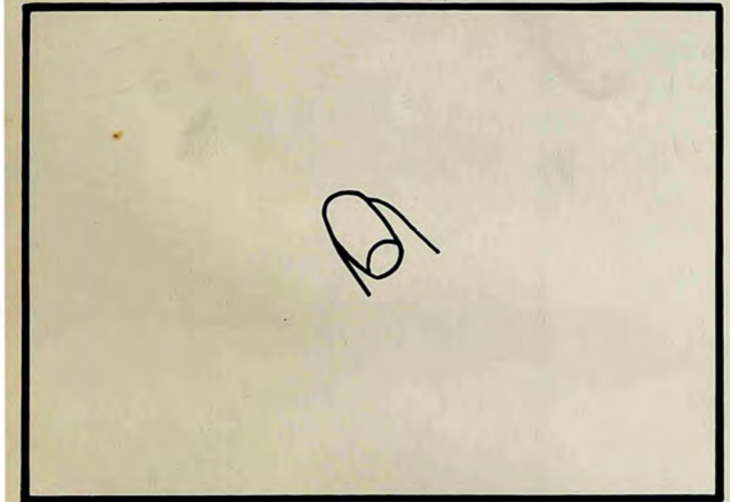


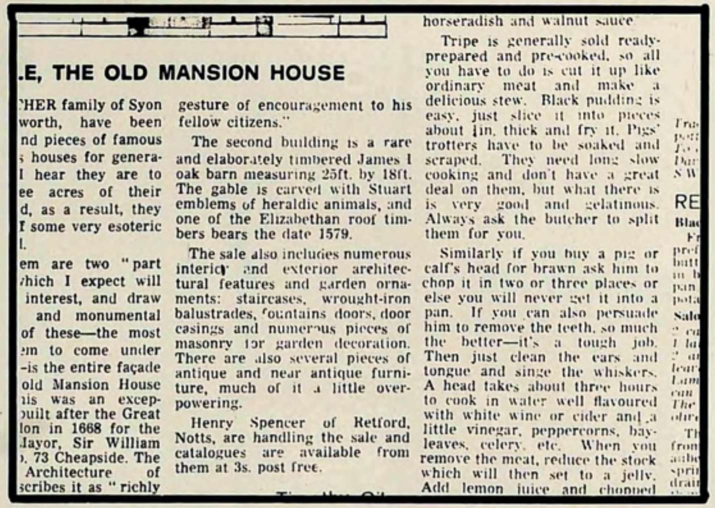












.E, THE OLD MANSION HOUSE

'HER family of Syon worth, have been nd pieces of famous houses for genera- I hear they are to ee acres of their d, as a result, they I some very esoteric l.

em are two "part which I expect will interest, and draw and monumental of these—the most em to come under -is the entire façade old Mansion House nis was an excep- built after the Great lon in 1668 for the Mayor, Sir William). 73 Cheapside. The Architecture of scribes it as "richly

gesture of encouragement to his fellow citizens."

The second building is a rare and elaborately timbered James I oak barn measuring 25ft. by 18ft. The gable is carved with Stuart emblems of heraldic animals, and one of the Elizabethan roof timbers bears the date 1579.

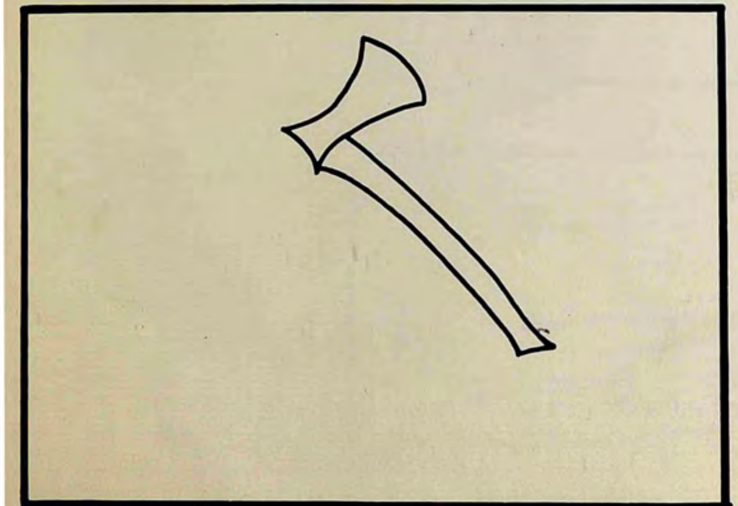
The sale also includes numerous interior and exterior architectural features and garden ornaments: staircases, wrought-iron balustrades, fountains doors, door casings and numerous pieces of masonry for garden decoration. There are also several pieces of antique and near antique furniture, much of it a little overpowering.

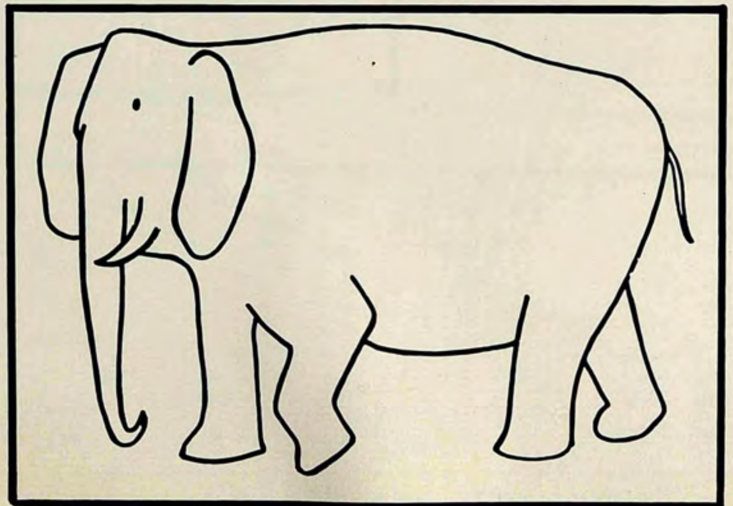
Henry Spencer of Retford, Notts, are handling the sale and catalogues are available from them at 3s. post free.

horseradish and walnut sauce

Tripe is generally sold ready-prepared and pre-cooked, so all you have to do is cut it up like ordinary meat and make a delicious stew. Black pudding is easy, just slice it into pieces about ½in. thick and fry it. Pigs' trotters have to be soaked and scraped. They need long slow cooking and don't have a great deal on them, but what there is is very good and gelatinous. Always ask the butcher to split them for you.

Similarly if you buy a pig or calf's head for brawn ask him to chop it in two or three places or else you will never get it into a pan. If you can also persuade him to remove the teeth, so much the better—it's a tough job. Then just clean the ears and tongue and singe the whiskers. A head takes about three hours to cook in water well flavoured with white wine or cider and a little vinegar, peppercorns, bay-leaves, celery, etc. When you remove the meat, reduce the stock which will then set to a jelly. Add lemon juice and chopped





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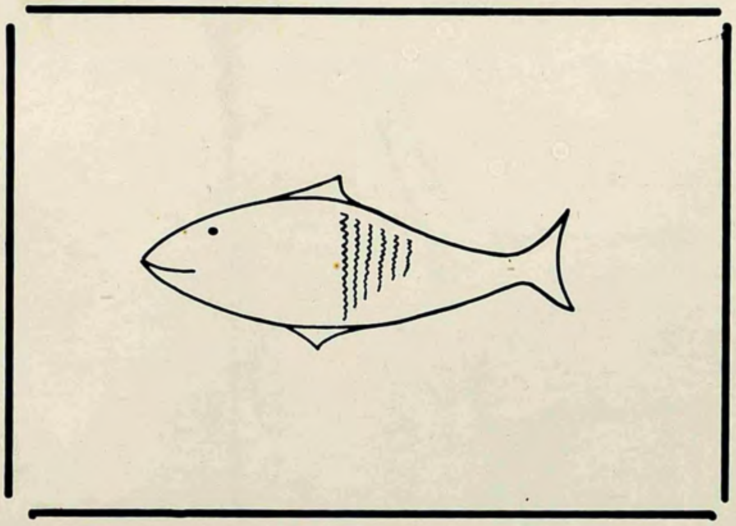

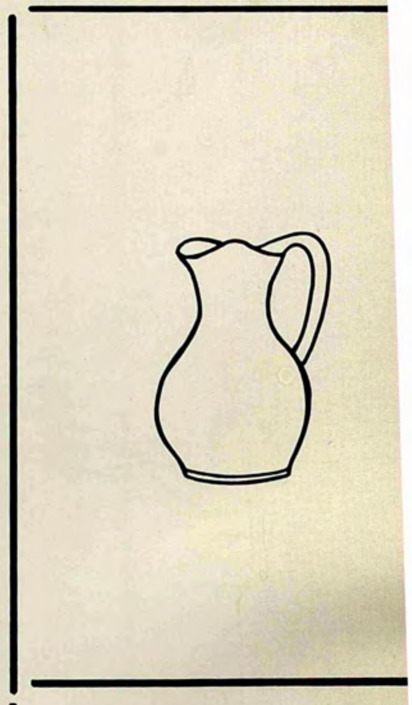

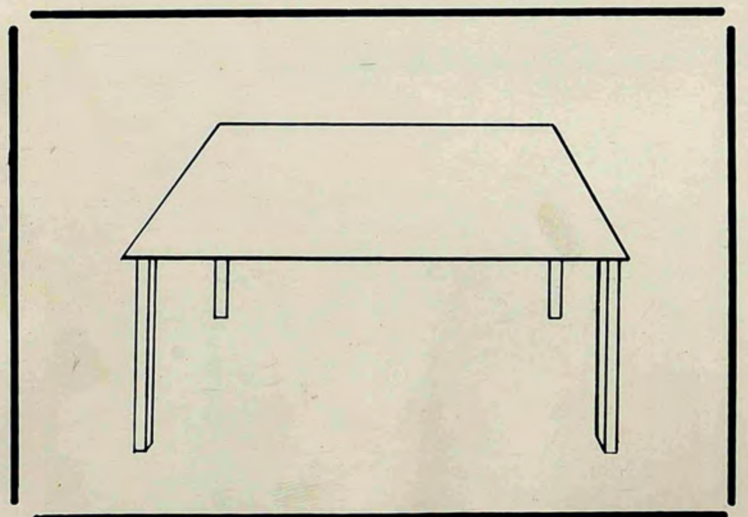

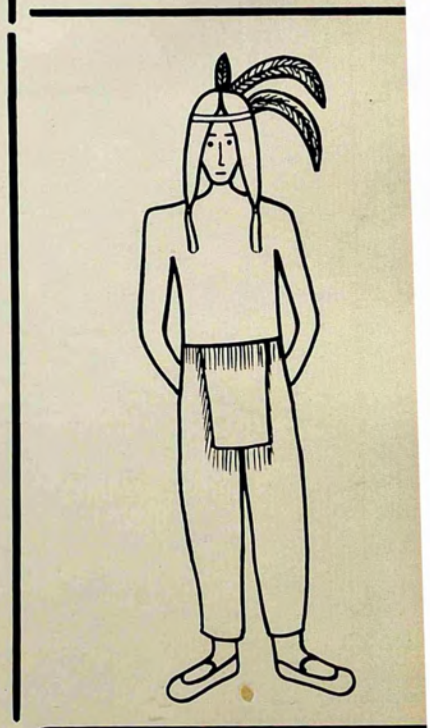

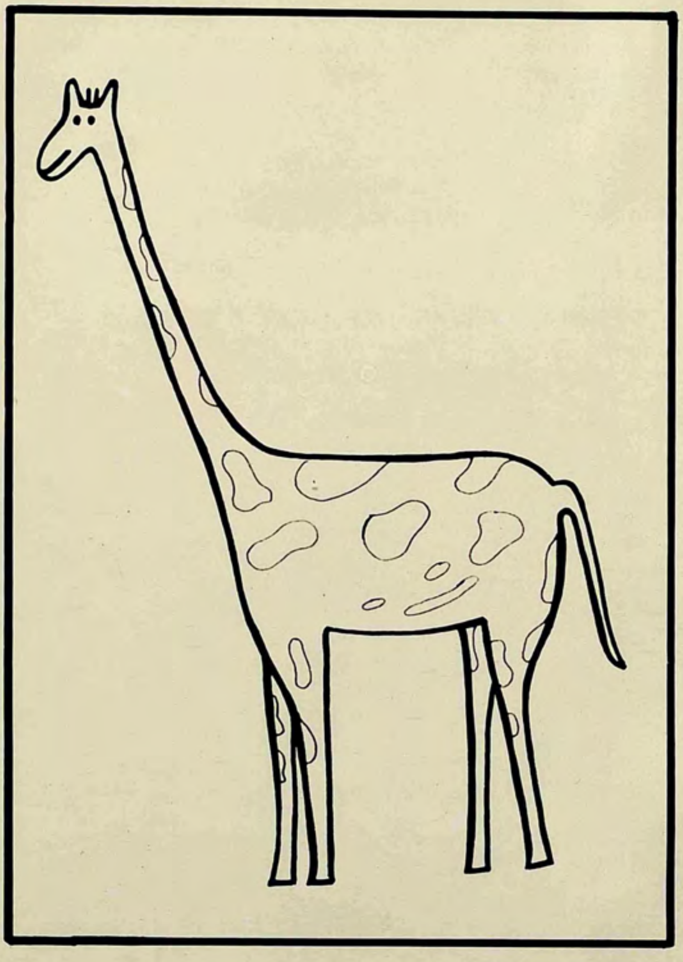

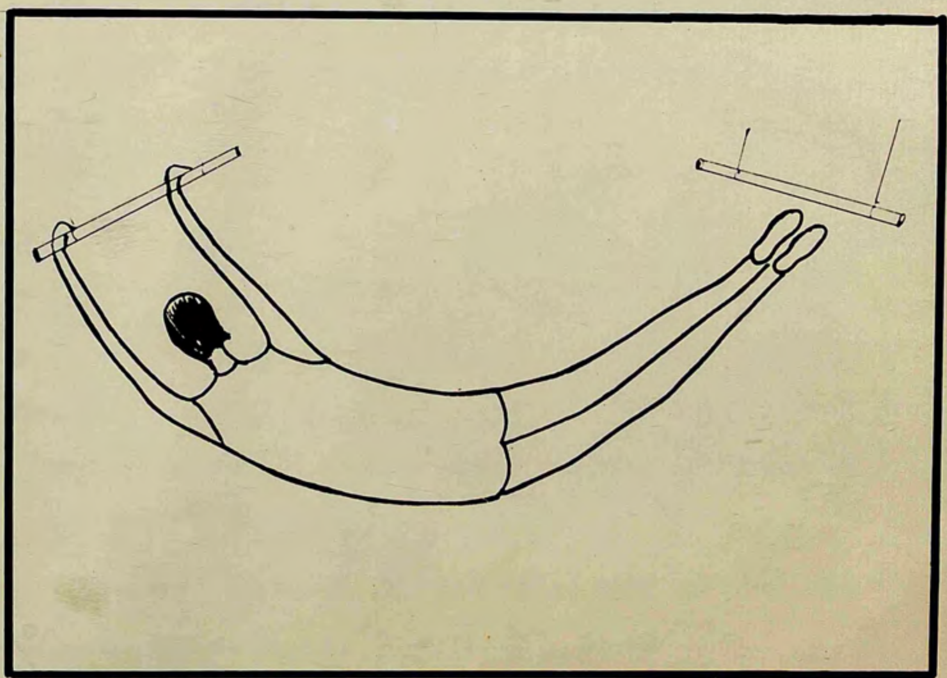

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