EFFECT OF CHLORPROMAZINE (LARGACTIL) ON PORTEUS MAZE PERFORMANCE

by

MICHAEL JAMES QUINN

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ABSTRACT

This study was designed to assess the effect of chlorpromazine, a "tranquilizing" drug on Porteus Maze Performance, and to find whether such effect was permanent or transitory. The drug's effect on clinical behavior was also evaluated. Subjects were 44 adult, male, chronic psychotics from the Mental Hospital, British Columbia. Each pair was matched exactly on initial Maze scores and as closely as possible for age, hospital duration, education, occupation, and marital status. All subjects: had been diagnosed as schizophrenic; had not had chlorpromazine previously; had not been operated on psychosurgically; had been hospitalized for at least three years; showed no evidence of organic brain disease. Experimental subjects were selected by random method. The L-M Fergus Falls Behavior Rating Scale was used to evaluate clinical behavior. The experimental group received 300 mg. daily of chlorpromazine for 30 days, and the control group received 300 mg. daily of placebos for the same period. Maze scores and Behavior ratings were obtained for each subject before medication, during medication, and after medication. The results were treated statistically to find if there were any significant differences between the two groups. The conclusions were that chlorpromazine had no significant effect on either Maze performance or clinical behavior. The results were in the expected direction but the Maze decrement and the

clinical improvement attributable to chlorpromazine were too slight to have statistical significance. It was tentatively concluded: 1. that Maze decrements resulting from chlorpromazine are transitory; 2. that a decline in clinical behavior shown by the control group was due to placebo effect; 3. that the maximum effects of chlorpromazine were not achieved due to the composition of the group, the moderate dose, and the short duration of treatment.

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Department of Psychology

The University of British Columbia,
Vancouver 8, Canada.

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CHAPTER I

INTRODUCTION

The purpose of this study was to assess the effects of chlorpromazine,* a "tranquilizing" drug, on Porteus Maze Performance, and to determine whether such effects were permanent or transitory. Since the subjects to be studied were mental patients it was decided also to evaluate the effects of chlorpromazine on clinical behavior. The study was designed to use an experimental and a control group in which each pair of subjects was matched on several variables and in which the experimental subjects would receive chlorpromazine and the control subjects placebos.

The study was undertaken partly as a result of the timeliness of the topic; namely, that tranquilizing drugs are being used on an increasing scale in the treatment of mental illness; and partly as a result of previous findings. These findings (12, 22, 28-33) suggested that both chlorpromazine and lobotomy produced a significant decrement in Porteus Maze performance. This effect of chlorpromazine led Porteus (30) to term it "pharmacological lobotomy." Its tendency to weaken impulsion and reduce initiative caused Delay (9) to draw a similar conclusion when he referred to it as "medicated lobotomy."

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* This drug has the chemical designation 3-chloro-10 (3-dimethylaminopropyl) phenothiazine hydrochloride (20). Placebos are composed of a chemically inert substance.

The discovery of chlorpromazine in 1951 was hailed as the beginning of a new era in psychiatry. The general opinion was that here was a drug that would quiet and soothe the patient without causing stupor or impairment of consciousness. This discovery was followed by the development in 1954 of reserpine (9) a drug chemically different from chlorpromazine but similar in its clinical effects except that it is less powerful, slower acting, and less constant. Perphenazine is a relatively new drug and little research has been done on it but its potency is reported as 5 to 10 times greater than chlorpromazine (21). These are but three of several tranquilizing or neuroleptic drugs now on the market. Of these chlorpromazine is the best known and the most widely used. A substantial body of literature has been published related to its clinical effects and therapeutic value. As an example of the widespread use of chlorpromazine in the United States it has been estimated that up to the end of 1955 as many as 4 million patients had had it prescribed for them (26). All of these drugs act upon the central nervous system. They induce a state of relaxation and calm with a general diminution of somatic functions and inhibition of psychic efficiency level.

Despite the large body of literature relevant to the therapeutic value of neuroleptic drugs the reader is frequently left with the impression that the results of many of these studies are inconclusive. This is probably due to the fact

that many of them are little more than subjective evaluations of the drug's efficacy. In others, attempts have been made to set up experimental situations with some degree of control over extraneous variables but even here the results, although quantified, are often difficult to interpret owing to the lack of an objective criterion for assessing the drug's effectiveness. Therapeutic value is usually assessed in terms of improvement as measured by various rating scales but the scales themselves are seldom described nor the fallibility of raters taken into consideration. The general impression that emerges from a perusal of the literature is that these drugs are very useful in the symptomatic treatment of mental illness, and that certain types of mental patients respond more favourably than others. They do not provide a cure and the percentage of discharges that can be attributed to their use is extremely small.

In the following section an attempt is made to review a representative portion of the more important findings concerning the effects of tranquilizing drugs in general and chlorpromazine in particular.

CHAPTER II

REVIEW OF LITERATURE CONCERNING CLINICAL AND PSYCHOLOGICAL ASPECTS OF CHLORPROMAZINE THERAPY

The development of chlorpromazine in 1951 by French scientists was initiated by the search for a drug that would induce a state of natural sleep or "artificial hibernation" without at the same time producing hypnotic or sedative effects. Chlorpromazine appeared to possess some of the necessary requirements, namely, the property of inducing a state of calm and a reduction of tension without stupor. While under its influence the patient could be aroused without any apparent loss of consciousness or intellectual functioning.

The method of treatment varies with the nature and intensity of the disease, some psychiatrists preferring to use chlorpromazine alone while others use it in combination with barbiturates and other sedatives to produce prolonged sleep therapy. The dosage varies according to the patient's state and according to individual tolerance. It may range from 25 mg. to 2000 mg. a day but the average seems to be about 300 mg. or 400 mg. daily. The total daily amount is usually spread over three or four administrations daily (16). The drug may be administered by mouth or parenterally. When injected its use is somewhat limited owing to the fact that a smaller dose must be given than when taken orally and because the solution used irritates the tissues. A high initial dose may cause unpleasant

side effects and a too rapid lowering of dose may bring about relapse or a sudden flareup of pathologic symptoms. For this reason medication is usually started and terminated gradually. In most cases side effects are harmless and may be alleviated or prevented by the use of other drugs or by reducing or terminating the dose.

Chlorpromazine like other "tranquilizers" has a depressant effect on the nervous system. This sometimes results in a lowering of blood pressure during the early phase of treatment with possible subsequent fainting or palpitation and shortness of breath. Parkinsonian symptoms such as masklike face, tremor, salivation, and akinesis have been noted by several investigators (7, 8, 14, 16). Chlorpromazine is antiemetic. It usually produces an increase in appetite followed by an increase in weight.

Among the more unpleasant side effects have been noted allergic affections of the skin and in some cases jaundice. Some patients develop a peculiar susceptibility of the skin to solar irradiation. The majority of side effects appear to occur during the first two weeks of medication and most of the complications appear within the second two weeks. Side effects tend to be more intense when the drug is administered parenterally and when the oral doses are high. Drowsiness and lethargy are the most frequently noted side effects. Apathy, loss of interest in surroundings, and lack of initiative are common in patients who receive intramuscular doses exclusively and when the oral dose is 600 to 800 mg. daily (6).

Chlorpromazine therapy is not equally effective with all types of mental illness. Some of the most dramatic effects are reported to have occurred in hallucinosis or delirium resulting from acute schizophrenic episodes or alcohol (14, 42). In such patients hallucinations, delusions, and the need for maximum restraint all disappeared within hours after administration of the drug. Chronic patients require longer treatment and a higher dosage than acute cases, and although a majority of the chronic cases do not respond to the point where complete rehabilitation is possible they do show some improvement as evidenced by a reduction of the most serious psychotic manifestations. As evidence of improvement the literature frequently cites a reduction in violence and destruction, and less need for physical restraint. An important result of such improvement is the changed atmosphere of the wards and the changed attitudes and behavior of the nursing staff. Resentment, hostility, and negativism give way to friendly interest and cooperation which leads to increased interaction between patients and personnel and to a program of indirect psychotherapy.

In the treatment of manic-depressive psychoses chlorpromazine is more effective with the manic than with the depressive phase. The manic process does not subside as rapidly as the patient's overactivity. Depressives show little improvement with the drug alone but respond better to electro-convulsive therapy if used in conjunction with chlorpromazine.

Many excellent descriptions of the "tranquilizing" effects of chlorpromazine indicate general agreement that the drug produces a marked change in "pathological overactivity." However, in assessing behavioral change, few investigators have specified in advance the particular changes that would denote a reduction of pathological activity. Using a double blind technique Cutler et al (8) studied the effects of chlorpromazine on pathological activity in twelve psychotic patients. Twenty-eight specific signs of behavioral overactivity were specified in advance and quantified by actual count of the number of times they appeared per week. Hospital personnel were trained to observe the appearance and record the frequency of pathological symptoms characteristic of each patient. Inter-observer rank order correlations had a median p of .90. It was found that 600 mg. per day of chlorpromazine resulted in a statistically significant reduction of pathological activity ($p < .01$). However, this reduction in pathological activity appears to have been achieved at the expense of wakefulness as the patient tended to sleep more while taking the drug.

A study by Rees and Lambert (35) based on 150 out-patients with anxiety states suggests that the usefulness of chlorpromazine with this group may be largely restricted to short term symptomatic treatment and management. Marked or moderate improvement was reported for 54 per cent of the group but after a few weeks two thirds of these relapsed despite continued medication. Assessment of improvement was based on

subjective reports by the patient, appearance, behavior, and clinical examination. Patients reported a reduction in anxiety, tension, and apprehension, accompanied by a feeling of calmness.

Feldman et al (11) carried out an experimental study to assess the effects of chlorpromazine in the treatment of 22 psychotic patients who were considered "management problems." Most of these patients were schizophrenics and most had failed to respond favorably to other therapies. Degree of improvement was assessed according to psychiatric evaluations and the Ferguson Rating Scale. Dosage was from 200 to 400 mg. a day for three months. Nine out of eleven chlorpromazine patients showed improvement and four of eleven placebo patients improved. There was a low positive correlation between the Ferguson scale ratings and the clinical evaluations. As found by other investigators the ward behavior of patients showed a marked change for the better. There was a reduction in restraints and sedation, an improvement in eating and sleeping and an increase in adjunctive therapy activities. The only side effect of any significance was drowsiness.

A review of the following literature (2, 4, 8, 10, 38) suggests: A general effect of chlorpromazine is to reduce tension. Tense, excited schizophrenics respond more favorably to the drug than depressed or less agitated schizophrenics. With prolonged treatment (3 to 6 months) the effects of the drug usually persist for 2 to 5 months after medication is terminated.

In general, depressed patients do not respond well to chlorpromazine, and those who do show some improvement usually relapse after the drug is stopped.

Tenenblatt and Spagno (38) carried out a controlled study of the effects of chlorpromazine on 100 negro women patients, all of whom were considered disturbed. Their main conclusions are worth quoting:

1. Chlorpromazine is effective in the treatment of chronic psychotic patients, since 90% of the controls remained unchanged as compared to 20% of the patients on chlorpromazine.

2. The age of the patient, duration of illness, and previous therapy have no effect on the response to the drug.

3. Chlorpromazine is not effective in the treatment of involutional psychoses or general paresis.

4. It is most effective in the treatment of manic and schizophrenic patients, particularly catatonic and paranoid, although the other types showed some response.

5. The most effective dose and duration of therapy must be determined for the individual patient by trial and error method, but from all indications if there is no response after 6 weeks of therapy, there will probably not be any response from prolonging the treatment.

In this study lactation (noted by other investigators) occurred in 36 per cent of the experimental group. An overall effect of the project was an increase in morale of the hospital personnel and patients' relatives so that management improved and many more patients were permitted privileges. This aspect of chlorpromazine therapy has frequently been noted by other observers.

These findings may be summarized as follows: Chlorpromazine is a new drug found to be useful in the treatment of mental illness. Its main therapeutic value is to reduce tension and anxiety and alleviate various psychotic manifestations without causing stupor or unconsciousness. It alleviates psychotic symptoms but does not alter the underlying problems. Since it acts as a depressant it is more effective in reducing overactivity than in relieving depression.

Comparison of Chlorpromazine with Reserpine and Perphenazine

Like chlorpromazine, reserpine's action is inhibitory and consists of a reduction of the activity of the central sympathetic mechanism (3, 25). Perphenazine is similar to chlorpromazine and has the same effect but is more potent. The site and mode of action of these drugs is still largely hypothetical. Chlorpromazine and perphenazine are thought to affect principally the "alerting" system of the brain (21). Reserpine is believed to be mediated, in part, through the cortex as opposed to the midbrain structures for the other two drugs.

Goldman (15) found chlorpromazine more effective than reserpine in relieving paranoid symptoms, but neither drug was very effective in depressive reactions. There was no clear distinction in effectiveness between the two drugs with schizophrenics hospitalized for six months or less but chlorpromazine was more effective than reserpine with schizophrenics of longer hospital duration.

Kovitz et al (17) found chlorpromazine slightly more effective than reserpine with schizophrenics. Chlorpromazine acts more rapidly than reserpine but its side effects are more unpleasant. Both drugs produce essentially symptomatic improvement.

Effect of Chlorpromazine on Various Mental Tests

Very little significant research has been reported in which psychological tests have been used to assess the effects of chlorpromazine and other "tranquilizing" drugs. An attempt is made here to summarize briefly a few of the more important findings in this area.

Primac et al (34) found that chlorpromazine resulted in a significant lowering of scores on the Continuous Performance Test, a test designed to measure sustained attention. Petrie and Le Beau (27) reported that chlorpromazine patients showed no loss on the Wechsler-Bellevue Intelligence Test or the Porteus Maze Test. Lehmann and Hanrahan (20) reported a similar finding. Bair and Herold (4) investigated the effects of chlorpromazine on hyperactive, mentally retarded children. Their results, based on ten matched pairs, showed a significant gain of 10.4 I.Q. points for the experimental group after 60 days of medication. The control group, which received no medication of any kind, showed no significant change. The measure of intelligence used was the Columbia Mental Maturity Scale. Mason-Browne and Borthwick (21) compared the effects of perphenazine and chlorpromazine on five separate measures. These

measures were designated as Rating Scale, Tapping and Dotting, Wechsler-Bellevue Digit Symbol, and Digit Span, and the Porteus Maze Test. Their results show that both perphenazine and chlorpromazine patients improved on all measures except the Porteus Maze, on which both groups showed a slight but statistically insignificant decrement. The only two tests that showed a significant variation were Tapping and Dotting, the improvement being significant for perphenazine but not for chlorpromazine.

This review suggests that the findings are not consistent as regards the effect of chlorpromazine on various tests. However, the trend appears to be in the direction of improvement on most tests. Tests like the Continuous Performance Test and the Porteus Maze appear to be exceptions due perhaps to the similarity of functions they are supposed to measure. But even here the findings are not unanimous. Studies concerning the effect of chlorpromazine on Porteus Maze performance are reviewed in Chapter IV.

Summary of Clinical Findings on Chlorpromazine

This brief review of current thinking on the clinical efficacy of chlorpromazine may be summarized as follows:

Chlorpromazine has the capacity to bring about sedation and quiet without significant impairment of consciousness. Serious side effects are rare and nearly always reversible. There is general agreement that the drug reduces psychomotor

activity, assaultiveness, hostility, and negativism; that patients are less restless, more cooperative, and more manageable. They show considerable reduction in anxiety, appear to be in better contact with their environment, and are less disturbed by their hallucinations and delusions. This means that some patients, previously inaccessible, become amenable to other therapies such as psychotherapy, occupational therapy, and recreational therapy. Chlorpromazine reduces the need for shock therapy as well as the need for restraints and seclusions.

It appears to be most useful in the treatment of the paranoid and catatonic schizophrenias, and the manic phase of manic-depressive psychosis but much less effective in the treatment of deteriorated schizophrenics and agitated depressives. The age of the patient and the duration of illness seem to make little difference as far as the outcome of chlorpromazine therapy is concerned, but on this point agreement is not unanimous. The effect on the ward is marked. There is less annoyance, less antagonism, and in general an increased friendliness and cooperation between all concerned. Neither chlorpromazine nor reserpine nor any of the known tranquilizers is basically curative, but from the clinical point of view they are very useful in alleviating various symptoms without producing sedative or hypnotic effects. They thus add greatly to the comfort of the patient and of those about him.

Most of the literature related to the effects of these

drugs emphasizes the gain in "social improvement" following or during their use. However, the criteria of improvement and the methods of assessing it are often open to question owing to the absence of adequate controls and failure to specify the standard that permits the placement of patients in various "improvement" categories. Considerable subjectivity and numerous invalidities are bound to be present when unknown and unstandardized rating methods are used to assess the effects of various drugs. For these reasons many of the reports are equivocal or difficult to interpret.

A general opinion among investigators is that chlorpromazine leaves all intellectual functions clear and intact, and that it ameliorates disturbing symptoms that are principally dependent on feelings for their origin and maintenance. In the investigations reviewed in this chapter a few have attempted to assess intellectual change using various mental tests including tests of general intelligence such as the Wechsler-Bellevue. The results appear to be in general agreement with the above observation that chlorpromazine leaves intellectual functioning unimpaired.

The Porteus Maze has been used in several investigations into the effects of chlorpromazine and lobotomy, and in most cases chlorpromazine and lobotomy patients are reported to have shown a significant decrement in Maze Performance. This test is claimed by its author to be a test of planning capacity and

foresight, two important aspects of intellectual functioning. If this claim is valid, and if the findings reported for the Maze are substantiated, this would suggest that chlorpromazine may have an adverse effect on these particular aspects of intellectual functioning. The literature relating to the Porteus Maze Test is reviewed in the following chapter.

CHAPTER III

THE PORTEUS MAZE TEST

The Porteus Maze Test had its first public description at a meeting of the British Association for the Advancement of Science in Melbourne in 1914. The test is a series of pencil-paper maze designs of graduated difficulty ranging from the three year level to the 17 year level. Between 1915 and 1924 the test was administered to several thousand children including mental defectives, normals, clinic cases, selected and unselected school children, representing different age levels and different socio-economic classes. In these standardization studies the Maze test was validated against the Goddard Revision of the Binet test and later against the 1916 Revision of the Stanford-Binet. The scoring was revised several times between 1914 and 1933 and in 1933 a procedure was introduced which provided for a ceiling performance of 17 years.

A qualitative scoring system (Q) pertaining to personality rather than intelligence was introduced in 1942 but no significant changes were made in the quantitative scale until 1955 when the extension series (a parallel test) was published. The extension series has no tests below the 7 year level and Porteus recommends that both series be used in combination for subjects 14 years and older. When the subject is less than 14

years old it is recommended that the original series be used alone according to the procedures published in 1950 (29, 30).

The procedures used in administering and scoring the test in the present study are shown in Appendix A. These rules may be summarized briefly as follows: The test consists of eight levels of difficulty; years 7, 8, 9, 10, 11, 12, 14, and Adult. The subject begins with a credit of 6 years of mental age and is allowed an additional year of mental age for each test successfully passed from year 7 through 11. He is allotted two years of mental age each for years 12, 14, and Adult. He is allowed two trials on each test from year 7 through 11, four trials each on years 12 and 14, and three trials on the Adult test. If he fails all the allotted trials on a given test (year level) he is regarded as having failed that test. Testing is continued until two successive failures above 9 years have been recorded or any three failures. When any test is failed, e.g. year 10, and the following test, year 11, is passed, year 11 is inverted and presented again. If the inverted form is passed within the allotted number of trials the subject is given credit for year 11. If the inverted form is failed the subject receives no credit for that year level. The test is scored by deducting one-half year for each unsuccessful trial throughout the series.

Nature of the Test and its Uses

Porteus has consistently claimed that his test is a measure of planning and foresight, two elements of intellectual

function that are included in most definitions of intelligence. He defines intelligence as " . . . the capacity for making planned responses to an increasing range of relevant stimuli." (29, p. 10). The Maze test purports to measure both concrete and abstract planning at a simple fundamental level. It is not claimed to be a substitute for tests such as the Stanford-Binet (S-B) or the Wechsler-Bellevue (W-B) but a valuable diagnostic supplement. The fact that the inter-correlations between the Maze and numerous other tests are at a relatively high level indicates " . . . an extreme catholicity of relationship . . . not shown by any other performance test. . . ." (29, p. 32).

Porteus reasons that this relationship can be accounted for by assuming that planning is a factor common to all these tests, a factor which the Maze specifically measures. Tizard (39) notes that of 28 correlations reported between the Porteus Maze and the Stanford-Binet the median r. for a narrow chronological age range was .54 and the median r. for a wide chronological age range was .69. Sex differences revealed by the Maze led Porteus to conclude that such differences were probably " . . . due to the more temperamental, less intellectual traits involved in performance." (29, p. 33). This discovery as well as notable differences between the Maze scores of normal subjects as opposed to delinquents and psychopaths led to the concept of the Maze as a measure of social adaptability, and subsequently, to the development of a qualitative score of social or industrial capacity. Since the present study is concerned

with the quantitative scale only, the Q-scale will not be discussed. A detailed treatment of the Q-scale is contained in the 1950 and 1955 Maze test manuals (29, 30).

Studies Concerning the Effect of Lobotomy on Maze Performance

The main evidence for the claimed validity of the Maze test as a measure of planning capacity and foresight comes from studies related to the effects of lobotomy (leucotomy) on test performance.

The patient's condition following lobotomy is variously described as: emotional childhood, indifference, apathy, mental confusion, lacking in initiative, lack of planning and foresight, short attention span, et cetera (12, 29, 36, 37). In contrast to the inadequacy of social behavior, as demonstrated by these effects, intellectual functioning, as measured by most psychological tests, appears to be unimpaired. With few exceptions performance on the Porteus Maze has declined following psychosurgery.

In 1944 Porteus and Kepner (29) reported the pre-operative and post-operative Maze scores for 17 lobotomy patients and 17 controls. The net loss for the lobotomy groups was 1.97 years while the control group made an average gain of 1.94 years, this gain being attributed to practice. A follow-up study on another group of 13 psychosurgical patients showed that the average loss was still 2.2 years several months after the operation. Only five of the group showed any improvement over their

initial post-operative scores although some of these had had four or five applications of the test. These and similar findings led Porteus and Kepner to conclude in 1944 that " ... lobotomy patients test 4 years below what might be expected if ordinary practice effects had operated." (29, p. 80). This value of four years represents the average loss shown by lobotomy patients plus the average gain shown by control subjects.

In a later investigation, Porteus and Peters (28), using a larger group (55 lobotomy patients and a control group of 55 unoperated prisoners) confirmed the previous results. The average post-operative loss for the patients was 1.65 years and affected 81 per cent of the group at the first post-operative or some subsequent testing as against an average gain for the control group of 1.6 years. Allowing for the effects of practice, the comparative loss for the lobotomy group was 3.25 years. Repeated applications of the test showed that 67.3 per cent of the control group improved their scores as against 7.3 per cent for the lobotomy cases. In order to determine whether social recovery was reflected in Maze performance the lobotomy subjects were divided into three groups: 1. unimproved; 2. improved; and 3. those who had recovered sufficiently to be discharged or placed on long-term parole. Following the operation groups 2 and 3 showed greater initial loss than group 1. Repeated applications of the Maze suggested a relationship between degree of social recovery and Maze test pattern, namely, a pronounced initial

loss on the first post-operative test followed by successive gains up to and beyond the pre-operative level.

The Maze was part of a test battery used in the extensive Columbia-Greystone investigations into the effects of psychosurgery (22). The Maze was administered to 32 patients divided into a control group of 13 and an experimental group of 19. Both groups were equated for sex, age, education, I.Q. (W-B), and Maze scores. Each patient received one pre-operative application and three post-operative applications of the Maze test. On the first post-operative testing the experimental group showed an average loss of 1.21 years while the control group showed a slight gain. On the third post-operative testing, eight months after the operation, the experimental group had recovered their loss and were slightly above their pre-operative level but still below the control group.

Sheer, in reporting the effects of lobotomy on 36 patients, states with reference to the Maze: " . . . the data indicated a significantly greater decrement for the operated patients in the immediate postoperative period than at the 30 or 90 day testing periods." (19, p. 64). The average Maze loss for the total group of 36 patients examined ten days after the operation was 3.78 years; for those examined thirty days after the operation the loss was 1.84 years, and for those examined ninety days afterwards the loss was 1.92 years.

As well as confirming previous findings of marked initial loss after the operation followed by gradual improvement

these studies showed also that Maze performance varied according to the severity of the operation. The more anterior the operation the less was the Maze decrement.

At the third Research Conference on psychosurgery held in New York in 1951 Landis summed up the situation as follows:

> In the battery of tests which was used in the first Greystone, the second Greystone, and the New York State Project, we included both the standard Wechsler-Bellevue and the Porteus Maze test. In the test-by-test analysis of the results which we obtained, the only intelligence test which showed a uniform or almost uniform loss during the first month after operation compared to the preoperative performance on this battery of tests was the Porteus Maze Test. . . . We confirmed his [Porteus] finding that a brain operation on the frontal lobes gives rise to an immediate postoperative loss in mental age of 1 to 2 years in some 80 per cent of psychosurgery patients. (18, p.109)

As these studies progressed it became apparent that a certain amount of improvement in Maze performance could be attributed to practice. In the Columbia-Greystone project the experimental group's return to its pre-operative level was interpreted as indicating no permanent loss due to the operation but this interpretation appears to have been made without due consideration of practice effects. It was this difficulty of determining whether Maze decrements following psychosurgery were permanent or transitory that prompted Porteus to develop a second series of tests.

The extension series, published in 1955 (30), is similar in design to the standard series except that some of the pathways have been lengthened and the number of blind alleys

increased, making the test slightly more difficult than the original. The new series was standardized against the original using 300 subjects divided into six groups of 50 each. The subjects were intermediate and high-school students, 150 of each sex, and represented both rural and urban districts with a distribution of socio-economic level. Each group was tested on the same day with the extension applied immediately after the original. The agreement between the scores on both series of the test was found to be very close. The largest mean difference in score between the two tests for groups of 50 subjects was .17 of a year. For groups of 100 the largest mean difference was .085 of a year, and for the total group of 300 cases the mean difference was .02 of a year.

Porteus points out that while these figures prove the equivalence of the two versions of the test for a specific segment of the population only, " . . . there is good evidence for the assumption that the Maze is less affected by cultural level than any other test in common use, and cultural level includes education." (30, p. 31).

Whether the two forms of the test are also equivalent for psychotic subjects has yet to be established. The only studies available in which both the original and extension series have been applied to psychotic subjects seem to be those reported by Porteus and Barclay (32). These are considered in the following chapter, but for the present it may be noted that in two of these the controls showed a loss on

the extension Maze of 0.10, and 0.04 of a year. In a third study the controls showed a gain on the extension maze of 0.20 of a year. These observations are reported here merely to suggest that the two forms of the Maze may be less equivalent for a psychotic than for a "normal" population.

In this chapter the literature concerning the development of the Porteus Maze Test and its use in assessing the effects of lobotomy has been reviewed. According to these studies the Maze was found to be consistently sensitive to mental changes induced by psychosurgery. In the following chapter the literature concerning the effect of chlorpromazine on Maze performance is considered.

CHAPTER IV

PREVIOUS STUDIES OF PORTEUS MAZE PERFORMANCE DURING CHLORPROMAZINE THERAPY

While extremely little research has been done concerning the effects of neuroleptic drugs on Maze performance the available findings suggest a marked parallel between chlorpromazine and psychosurgery.

Both chlorpromazine and psychosurgery are used to relieve intractable pain; both reduce anxiety and tension. Terms descriptive of the lobotomy patient's behavior: decreased vigilance, increased somnolence, apathy, indifference, improved appetite, increase in body weight, are frequently noted in the literature related to chlorpromazine therapy. If Maze reactions are found to be similar following the two methods of treatment then the analogy between psychosurgery and chlorpromazine would be more complete.

In a comparison of chlorpromazine and reserpine Gardner et al (13) reported that 4 out of 9 chlorpromazine patients improved in Maze scores, 8 out of 10 reserpine patients improved, and 2 out of 10 placebo patients improved. In this study the original series of the Maze appears to have been used before and after treatment so that an indeterminate amount of recovery may have been due to practice effects. Four of the W-B subtests that were found to be sensitive to

drug-induced changes were: Arithmetic, Similarities, Vocabulary, and Picture Completion. No figures are given but all the differences reported were said to be statistically significant.

Porteus (31) reported the results of a study based on fifteen male psychotics, and 7 female psychotics in which both the original and practice-free Mazes were used. After four months of chlorpromazine therapy the average Maze decrement for the 22 cases was 2.08 years with over 68 per cent of the group affected.

In three later investigations by Porteus and Barclay (32) both series of the Maze were again used. In the first of these they found that after six weeks of chlorpromazine therapy the experimental group (N = 35) showed a loss of 1.89 years as against 0.1 year for the controls (N = 25). The difference for the experimental group was significant at the 5 per cent level.

In the second study of this series twenty pairs of subjects were matched exactly on pre-medication Maze scores. On the first post-medication testing with the practice free Maze the experimental group showed an average loss of 2.2 years (significant at the 5% level) while the controls gained 0.2 years over their pre-medication scores.

In the third investigation the Maze was applied three times to unmatched groups of 21 experimental and 21 control subjects. The standard Maze was applied before medication,

the extension Maze during medication, and the extension Maze inverted (i.e. rotated 180 degrees) at a still later stage of medication. On the first post-medication testing the experimental group showed an average loss of 1.5 years as against a loss for the controls of 0.04 years. On the second post-medication testing (extension Maze inverted) the experimental group was 2.09 years below its pre-medication level while the control group had exceeded its pre-medication score by 1.07 years. The results of this investigation show that prolonged use of the drug widens rather than decreases the gap between experimental and control patients, at least as regards Maze scores.

The literature reviewed in this chapter represents the only available studies published to date that have been concerned primarily with the effects of chlorpromazine on Maze performance. Although the studies are few in number and the samples small the implications of the findings are clear. They are that chlorpromazine affects the central nervous system in a manner similar to certain types of psycho-surgery. This effect of chlorpromazine is reflected in reduced ability to perform the Porteus Maze Test, which is claimed to be a valid measure of planning capacity and foresight.

The present thesis stems from the foregoing studies. This thesis is that chlorpromazine, administered to psychotic patients, can be expected to produce a deficit in the Maze performance of the majority, and at the same time an improvement in their clinical behavior.

CHAPTER V

EXPERIMENTAL DESIGN

This study is designed to provide an answer to the following questions:

1. Does chlorpromazine produce a significant decrement in Porteus Maze performance?
2. If it does produce such a decrement is this decrement permanent or transitory?
3. Does chlorpromazine produce significant improvement in clinical behavior?

In an attempt to answer these questions the study makes use of experimental and control groups in which each pair of subjects is matched exactly on pre-medication Maze scores and as closely as possible on several other variables. The experimental method thus employed is known as the "matched pairs" method (1). The logic of this experimental design as described by Andrews (1) and Townsend (40) and as applicable to the present investigation may be summarized as follows:

Pairs of subjects are selected so that the members of each pair are comparable in all respects believed to be related to the performance of a given task (e.g. Maze performance). Using random methods one member of each pair is assigned to either the experimental or control group. The experimental group is given some kind of treatment which it is believed will

influence its performance of the task in question. (In the present study the experimental treatment is chlorpromazine and the task is Maze performance.) The control group may or may not be given some kind of treatment but in either event it is assumed that whatever is done or happens to the control group will also have been done or will have happened to the experimental group. Thus the "treatment" of the experimental group is the only independent variable that distinguishes it from the control group. In other words the control group serves as the base line against which the experimental group's performance, under the experimental condition, is compared. The two groups are then given the same task and if their mean performance differs significantly this difference is assumed to be due to the influence of the experimental treatment on the experimental group.

In the present study an attempt is made to exercise more rigid control over the experimental procedure and to more clearly define the sample used than has been reported in previous studies of the same problem.

In brief, the investigation proceeded along the following lines: Subjects were selected according to certain predetermined criteria. Each subject received three applications of the Porteus Maze Test: 1. before medication; 2. after 30 days on medication; and 3. after 30 days without medication. Medication means either chlorpromazine or placebo treatment. Prior to the start of medication subjects were matched exactly

on initial Maze scores and as closely as possible for age, hospital duration, education, occupation, and marital status. When matching was completed subjects were assigned by a random method to either the experimental or the control group.

Each subject's clinical behavior was assessed on the L-M Fergus-Falls Behavior Rating Scale (23) at approximately the same time and in the same order as his Maze behavior.

The results were analyzed statistically and probability values of 5 per cent were regarded as significant.

Selection of Subjects

All the subjects in this study were selected from a group of male chronic psychotics at the Provincial Mental Hospital, British Columbia. Since the purpose of the study was to assess the effects of chlorpromazine on Maze performance certain criteria had to be met in the selection of subjects. It was reasoned that if any significant changes were evident after treatment, factors other than the treatment that might have contributed to such change would have to be controlled. Such factors might include the nature of the illness, the effects of previous therapies and fluctuations of psychotic mood.

The initial criteria for the selection of subjects was as follows: The study would include only those patients; 1. who had not been operated on psychosurgically, 2. who had not had previous medication (tranquilizers), 3. who had been

diagnosed as schizophrenic, 4. who had been hospitalized for at least three years.

Psychosurgery and medication were ruled out because previous investigations had shown that these treatments depressed Maze scores. Schizophrenia is a broad classification including several sub-categories, most of which are represented in the present sample. The main purpose served in selecting schizophremics was to rule out organic disease and various brain syndromes any or all of which might have produced changes in the patient's condition over a period of time thereby contaminating the final results.

It was reasoned that patients who had been hospitalized for a minimum of three years would be relatively stable as far as changes in the psychotic process were concerned, so that if significant changes did occur during the investigation, the probability that they were due to the treatment would be increased. Further, such patients could no longer be regarded as acute cases since they would have had ample opportunity to benefit from other therapies.

The present sample was selected from six different wards. The wards may be roughly divided into three levels, each representing a stage of progress in the patient's recovery. One level may be conceived as a rehabilitation level, representing the highest stage of progress, in which most of the patients have regular hospital jobs and ground privileges.

The second level represents a lesser stage of progress with fewer patients having regular responsibilities or freedom of the grounds. The third level houses mainly "deteriorated" patients who are incapable of assuming even minor responsibilities and who are constantly under supervision.

The initial screening procedure in selecting these subjects consisted of obtaining from the chief psychiatric nurse in each ward the names of patients who were not receiving medication and who, as far as he could determine, had not received medication previously. Approximately 400 names were obtained in this manner. Following this initial screening each name was checked against the patient's clinical record for evidence of previous medication, psychosurgery, or organic disease. If evidence for any of these was found, that patient was excluded from the study. At the same time, other information needed to match the experimental and control subjects was obtained from the record, information such as date of admission, age, occupation, education, and marital status. Subsequently, 192 patients were found who met the essential criteria. All the pertinent information was entered on a 5 x 8 card which bore the patient's name, hospital number, and ward number.

Double Blind Technique

The psychological effects of giving a mental patient a pill or increased attention are not too well known. The patient may assume or be told that the pill will do him good,

and in some cases placebo patients do show a marked change in behavior either favorable or unfavorable. The nursing staff's knowledge of what a certain pill or other method of treatment is supposed to do undoubtedly influences not only its perception of the patient receiving the treatment but indirectly the patient's reaction to the treatment.

This being the case it was decided to reduce such effects as far as possible by using what has come to be known as the "double blind" technique. With this technique the control group receives a placebo tablet identical in size, shape, and color, to the chlorpromazine tablets received by the experimental subjects. Even the containers and method of administration are identical so that no individual directly involved in the study knows which patient receives the placebo and which the drug. Each ward contained both experimental and control subjects whose identity remained a secret until completion of the project. The details of how this was achieved are given in the section below describing the medication procedure.

Matching Procedure

An attempt was made to administer the original Maze to the 192 patients who were regarded as suitable for the study. Some of these refused to attempt the test; others tried but the results were meaningless; still others were bed-patients or otherwise physically incapacitated. A few had been transferred to different units of the Hospital; released on parole;

or were undergoing other forms of therapy. Eventually, the number was reduced to some 140 patients for whom Maze scores were obtained.

An attempt was then made to match these 140 patients exactly on initial Maze scores and as closely as possible on age, hospital duration, education, occupation, and marital status. The purpose of matching was to reduce the influence of factors other than chlorpromazine on the criterion scores. It was not known definitely to what extent these variables correlated with Maze performance but it was assumed that if both experimental and control subjects were relatively equal in these respects then any significant change following medication could be attributed to medication with a greater degree of confidence than would otherwise be the case. The matching procedure resulted in a further reduction of the sample to 80 subjects who were matched as indicated above.

Selection of the Experimental Group

When matching was completed the names were listed in pairs and the list presented to an individual not involved in the study. This person was instructed to assign at random a code number from 1 to 80 to each name. The same person then transferred each pair of code numbers to a blank sheet of paper and gave it to the investigator. At the same time this individual sealed the coded list of names in an envelope. This coded list was not seen by the investigator or by any person

directly involved in the study until the investigation was completed. The list of code numbers (without names), each number representing a subject, was used by the investigator to select the experimental group by entering a table of random numbers. The sealed list of coded names and the randomly selected list of code numbers were then presented to the chief pharmocologist at the Hospital with appropriate instructions for their interpretation and use in assigning patients to the chlorpromazine and placebo groups.

Medication Procedure:

Chlorpromazine and placebo tablets each weighing 25 mg. and sufficient for the period of medication were placed in identical individual containers, and each container labelled with the patient's name and the word "Largactil." The word "Largactil" was considered necessary to enable the nursing staff to distinguish the present project from other medication programs then in progress. The decision to continue medication for thirty days was made because of the limited time available for the completion of the investigation. It was decided to limit the dose to 300 mg. daily since this was the dosage employed by Porteus and Barclay (32) and was regarded as a more or less routine amount. The fact that the tablets were in 25 mg. size made this dose convenient to administer. It was the opinion of the nursing staff and the clinical director that the more tablets a patient had to take the more reluctant he would be to cooperate. As it was, the

patient was expected to take a total of 12 tablets daily.

The medication was carried out in a routine manner. Under medical supervision the nursing staff administered chlorpromazine and placebo tablets in equal amounts four times daily. The patient received 75 mg. in the morning, 75 mg. at noon, 75 mg. at night, and 75 mg. again just before going to bed. The dose was gradually increased from 100 mg. on the first day to the maximum of 300 mg. on the fourth day. On the 33rd day of medication the dose was abruptly terminated without any tapering off.

Rating Scale

The Rating Scale used to assess behavioral change in this study is shown in Appendix B. Commenting upon the reliability of this Scale the authors, Meyer and Lucerno, (23, 24) report agreements between raters of from 87% to 92%. They report a positive rank order correlation of .92 between two male raters who rated 20 patients and a positive correlation of .94 between two female raters who rated the same patients. The Scale consists of eleven categories, each category being divided into five statements descriptive of mental patients' behavior. Values range from 1 for very retarded or abnormal behavior to 5 for relatively normal behavior. One advantage of this scale is that the descriptive terms are easily understood by psychiatric aides and nurses.

In the present investigation it was arranged to have the

same pair of raters on each ward rate the same given patients throughout the study. The raters were selected on the basis of experience and training. Most of the twelve raters chosen were graduates of the hospital's training program for nurses. A few had had equivalent training elsewhere. Only one of the raters had been employed at this hospital for less than a year but he was adequately trained and had had previous experience with mental patients.

Prior to the week for which a Rating was required, each rater was provided with a mimeographed instruction sheet and an appropriate number of rating sheets. An attempt was made to ensure that raters understood what was required and to impress upon them the necessity to work independently. The Rating Scale was modified slightly to meet the requirements of the present study. One of the eleven categories was left out as being irrelevant ("F" response to electric or insulin therapy), and another ("E" response to doctors, social workers, psychologists) could have been excluded as it was never used. It was felt that one important advantage of having nurses rather than more highly trained personnel do the rating stemmed from the fact that the former were in closer contact with the patients and hence their evaluations were likely to be more reliable.

Interval between Measures

All the Maze tests were administered and scored by the same person partly out of necessity and partly as a method of

controlling the influence of different examiners on test results. The procedure used in administration and scoring was that recommended in the Maze Test Manual published in 1955 (30). This procedure has been summarized and is shown in Appendix A.

The first Maze scores (Original Series) were obtained during the three weeks immediately preceding the start of medication. The second Maze scores (Extension Series) were obtained during the final three days of medication. These three days were additional to the thirty day period of medication previously decided upon so that no patient received less than thirty days medication. The third set of Maze scores (Extension Inverted) was obtained after all subjects had been without medication of any kind for from 30 to 33 days. No aspect of the qualitative scale was considered in this study. Each patient was tested in his own ward and an attempt was made to standardize external conditions as much as possible by always testing in the same place. However, this was not always possible.

In order to derive some estimate of rater reliability two ratings were obtained for each patient prior to the start of medication. The interval between these two ratings was two weeks. The patient's initial rating score or behavioral level was based on the second of these two ratings. The next rating assessed the patient's ward behavior for the last ten days of medication, and the final rating assessed it for the week following the end of the no-medication period.

CHAPTER VI

RESULTS

The experiment was designed so as to rule out, as far as possible, factors other than the medication that might be assumed to influence subsequent Maze performance and clinical behavior. Since the groups were closely equated before medication began by pairing subjects, it could reasonably be assumed that any significant differences observed between them during medication could be attributed to the pharmacological effects of chlorpromazine, since there were no grounds for assuming that placebo treatment had any pharmacologic effect on either Maze performance or clinical behavior.

Composition of the Final Sample

The size of the final sample which completed the project was reduced to 22 matched pairs, a somewhat greater loss than had been anticipated. These losses occurred as follows. Fifteen patients refused to take the tablets; four were transferred to a different unit of the hospital during the first week of medication; two developed subjectively unpleasant side effects during the second and third weeks of medication and refused to continue, and two developed side effects severe enough to warrant their withdrawal from the study. Just prior to the start of medication it was discovered that one patient

had received chlorpromazine previously and another was due for nine days' leave during the third week of medication. Both of these patients were excluded from further study. The remainder were allowed to continue and their Maze scores and Rating scores were recorded but since they were unmatched their results were not included in any of the calculations other than the initial estimate of Rater reliability.

It is of interest to note that most of the patients who refused medication were from the better wards and hence relatively well adjusted to their environment. Some refused on the grounds that they did not need "pills", others did not "believe in doctors", and still others "had no time."

Refusal to take the drug by mouth could have been met by administering is parenterally but it was felt that this would have interfered with the purpose of the investigation because parenteral administration necessitates a smaller dose and results in more pronounced side effects. Another reason why parenteral administration was not considered feasible was that it would have revealed to the patient, the nursing staff, and the examiner, which patient was receiving chlorpromazine and which patient was not. This would have defeated the purpose of placebo control which, though Porteus (31) questions its value as a control device, was the best available under the present circumstances.

The composition of this final sample of 44 patients is shown in Appendix C. The mean score for the total group of 44

patients on the pre-medication Maze test was 12.88 years. The mean age was 56.43 years with a range of from 33 to 78 years. The average length of time spent in the hospital was 15.43 years with a range of from 3 to 28 years. The mean educational level was 6.38 years of schooling with a range of from 3 to 14 years. Only 7 out of the 44 patients had had ten or more years of formal schooling. Over 75 per cent of the group was classed as unmarried, and as regards occupational level over 81 per cent may be considered as unskilled.

The Matching Variables

Since it was not possible to match each pair exactly on all the variables it was decided to compute the correlation between Maze scores (on which they were exactly matched), and each of the other variables to find if there was any significant correlation between them. The results are shown in Table I.

Table I shows that there is no significant correlation between Maze scores and any of the other variables. All the correlations are positive but too low to have statistical significance. The one variable which might be expected to correlate significantly with Maze scores is education, which correlates only .28.

The only variable for which a measure of relationship with Maze scores could not be computed was occupational level. For this variable the appropriate statistical measure of its

TABLE I

CORRELATION OF MAZE SCORES WITH THE DIFFERENT VARIABLES

Variable	N	Mean	S D	Correlation with Maze Scores
Age	44	56.43	11.6	+ .041
Hospital Duration	44	15.43	7.37	+ .15
Years of Schooling	44	6.38	2.85	+ .281
Marital Status	44	-	-	+ .189*

* Point biserial correlation

relationship with Maze scores is chi square but this value could not be computed owing to the fact that several of the expected frequencies are less than 5, a value below which chi square is not recommended. In the present case some of the expected frequencies are too small even when certain categories of occupational level are combined or eliminated.

However, failure to overcome this difficulty is not considered too important owing to the fact that such a large percentage of the group is uniform as regards occupation. It should be pointed out also that in the clinical record the patient's occupation is stated simply as farmer, logger, miner, et cetera. In the present study the investigator arbitrarily divided these

occupations into three levels: skilled, semi-skilled, and unskilled. Most of the patients seemed to fit best into the unskilled category but it is recognized that others may not necessarily agree with this classification. Over 90 per cent of the patients used in this study might well be placed in the unskilled category without distorting the data contained in their clinical records.

When all the data had been collected and tabulated, the key to the identity of the experimental and the control groups was revealed to the investigator. The mean scores of both groups on the Maze test and Behavior Ratings, as well as on the different variables, were compared and t-tests of the significance of the mean differences computed.

A comparison of the two groups in terms of age, length of hospitalization, and years of schooling is shown in Table II. These results show that no significant differences exist between the two groups on these three variables. Mean differences as large or larger than those obtained could be expected to occur more than 40 per cent of the time as a result of sampling fluctuation.

Chi square was computed for the variable of occupational level. The results are shown in Table III. The chi square for this variable was computed according to a method proposed by Yates (41) which makes it possible to compute chi square when the expected frequencies in some of the cells is less than five. But since this method is applicable only to a 4-cell

TABLE II

COMPARISON OF EXPERIMENTAL AND CONTROL GROUPS ON VARIABLES OF AGE, HOSPITAL DURATION, AND YEARS OF SCHOOLING

Measure	Exper. Group		Control Group		$M_{Diff.}$	SE_{MD}	t	df	P
	Mean	SD	Mean	SD					
Age	56.8	11.09	56.5	11.70	+0.3	0.98	0.306	21	> .7
Hospital Duration	16.04	6.85	14.81	7.98	+1.23	1.47	0.836	21	> .4
Years of Schooling	6.35	2.39	6.80	2.22	-0.45	0.57	0.789	21	> .4

N = 22 pairs of subjects

TABLE III

ACTUAL AND EXPECTED FREQUENCIES OF EXPERIMENTAL AND CONTROL SUBJECTS IN TWO OCCUPATIONAL LEVELS

Occupational Level	Experimental		Control		
	Actual	Expected	Actual	Expected	Total
Unskilled	19	17.83	16	17.09	35
Semiskilled and Skilled	3	4.09	5	3.90	8
Total	22	21.92	21	20.99	43

Degrees of freedom = 1
Chi square = .222
$P > .5$

* * * * *

TABLE IV

ACTUAL AND EXPECTED FREQUENCIES OF EXPERIMENTAL AND CONTROL SUBJECTS IN MARRIED AND UNMARRIED CATEGORIES

Marital Status	Experimental		Control		
	Actual	Expected	Actual	Expected	Total
Married	5	5.5	6	5.5	11
Unmarried	17	16.5	16	16.5	33
Total	22	22.0	22	22.0	44

Degrees of freedom = 1
Chi square = .120
$P > .7$

contingency table two of the categories, semi-skilled and skilled, are combined in Table III. With one degree of freedom the value of chi square equals 0.222, a value which could be expected more than 50 per cent of the time as a result of sampling fluctuation. In other words the discrepancy between observed and expected frequencies is not significant.

The chi square for marital status was computed according to the usual method since the smallest expected frequency was 5 or greater. With one degree of freedom the obtained chi square of 0.120 could be expected more than 70 per cent of the time as a result of sampling fluctuation. The results are shown in Table IV.

Effect of Medication on Maze Performance

The following terms are used to describe the results of the Maze tests and Behavior ratings. The term "pre-medication" (pre-med.) refers to Maze scores and Behavior ratings obtained before the start of chlorpromazine and placebo treatment. The term "medication" (med.) refers to Maze scores and ratings obtained during chlorpromazine and placebo treatment. And the term "post-medication" (post-med.) refers to Maze scores and ratings obtained 30 to 33 days after chlorpromazine and placebo treatment had been terminated.

The Maze performance of both groups is shown graphically in Figure 1. As this graph shows, the experimental group's Maze deficit during medication was slightly greater than that shown by the controls. Also, the experimental group's post-

medication recovery was slightly in excess of the controls' recovery. These changes suggest that chlorpromazine may have produced a slight decrement in Maze performance. The experimental group's post-medication recovery suggests also that with the present subjects the effect of chlorpromazine on Maze performance was transitory.

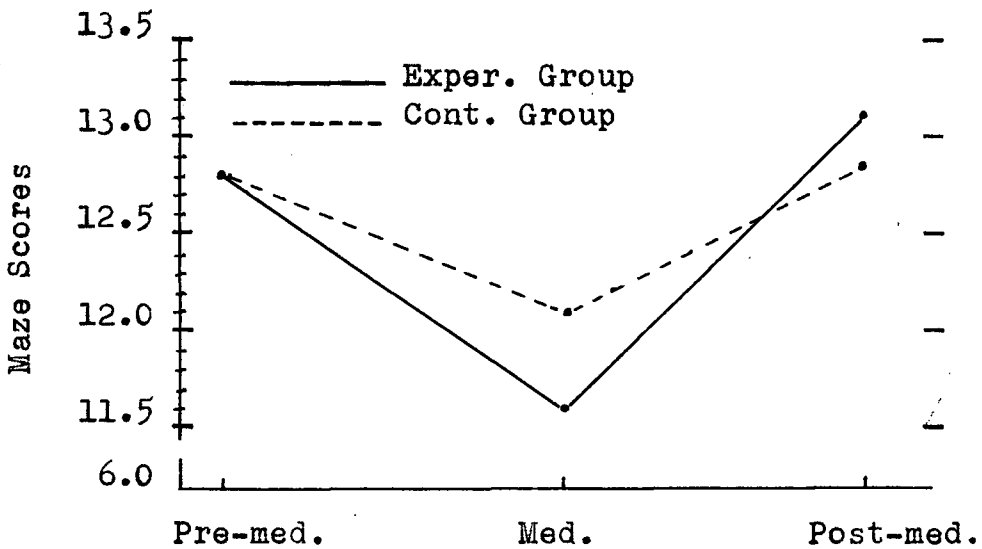

Figure 1. Experimental and Control Groups' Means on Three Applications of The Maze Test

On the basis of the findings reported by Porteus (31) and Porteus and Barclay (32), that chlorpromazine depressed Maze scores, it had been hypothesized that the experimental group's Maze performance would be significantly poorer than

that of the control group during medication. The results, shown in Table V on the following page, show that the Maze performance of both groups declined during medication. The deficit was slightly greater for the experimental group: the actual mean difference between the two groups was 0.47 of a year. This difference is statistically insignificant, the probability being greater than 25% ($P > .25$) that a difference as large or larger would occur as a result of sampling variability.

In terms of the logic of the experiment these results offer no evidence that chlorpromazine had any significant effect on Maze performance. Subjects were matched before medication and randomly assigned to experimental and control groups on the assumption that subsequent significant differences between them, if any, could be accounted for only in terms of the effect of chlorpromazine. The Maze performance of the two groups did not differ significantly on either the medication or post-medication tests. Both changed in the same direction. Thus both groups lost during medication and recovered on the post-medication Maze test. The Maze deficit shown by both groups during medication could have been due to any one of several factors or a combination of these factors, e.g. the psychological effects of being given a pill or of increased attention. This deficit could have been due also to the greater difficulty of the extension Maze. In any event, it must be assumed that the same factor or factors affected both

TABLE V

COMPARISON OF MAZE SCORES OF EXPERIMENTAL AND CONTROL GROUPS FOR THREE APPLICATIONS OF THE MAZE TEST

Maze	Exper. Gp. Mean	SD	Cont. Gp. Mean	SD	$M_{Diff.}$	SE_{MD}	t	df	P
Pre-med. Maze	12.88	3.12	12.88	3.12	0.00				
Med. Maze	11.66	3.43	12.13	2.60	-0.47	0.71	0.662	21	> .25
Post-med. Maze	13.16	3.23	12.88	3.31	+0.28	0.79	0.354	21	> .7

N = 22 pairs of subjects

groups, and the pharmacological effect of chlorpromazine was insufficient in comparison to distinguish the experimental from the control group to a significant degree.

For the post-medication test the extension series was inverted, i.e., it was the medication test rotated 180 degrees in front of the subject. The recovery shown by both groups in this application of the Maze could also have been due to several unknown factors such as termination of medication, increased familiarity with the testing situation, or practice effect.

In the studies reported by Porteus and Barclay (32) conclusions were based on a comparison of the experimental group's Maze performance before and during chlorpromazine therapy, and similar comparisons for the control group. The mean difference between the experimental and control groups was not reported. While their interpretation of their findings appears to be correct, because the control group showed an increment in Maze score while the experimental group showed considerable deficit, they appear to have overlooked the basic logic of the experiment employing a control group.

It is of interest to note that, if the logic employed by Porteus and Barclay (32) was applied in the present experiment, a false conclusion might be arrived at. The mean difference for the controls between pre-medication and medication Maze scores was -0.75 of a year, which is found to be

statistically insignificant ($P > .1$). For the experimental group the mean difference was -1.22 years, which yields a $t = 1.876$, and employing the appropriate one-tailed test ($P < .05$). From these values one might therefore conclude that (a) the placebo had no significant effect upon the control group, but (b) the chlorpromazine significantly depressed the Maze scores of the experimental subjects.

From the discussion above it will be evident that such a conclusion is not validly supported by the data, and that such treatment is not appropriate.

Effect of Medication on Behavior Ratings

The extent to which raters agreed in their evaluations of patients' behavior prior to the start of medication had been determined by computing the rank order correlation between raters. The results are shown in Table VI. Two independent ratings were obtained for each patient throughout the investigation on the assumption that the average of two estimates was more reliable than either estimate taken alone. The correlations shown in Table VI are in fairly close agreement with those reported by the authors of the Scale (23, 24). In obtaining ratings a given patient was rated by the same pair of raters throughout the study.

Previous findings provided a basis for hypothesizing significant improvement in the experimental group's clinical

TABLE VI

RANK ORDER CORRELATIONS BETWEEN RATERS FOR RATINGS OBTAINED APPROXIMATELY TWO WEEKS APART AND BEFORE THE START OF MEDICATION

Ward	Raters	N	Correlations	
			First Rating	Second Rating
1	M-W	10	+.822	+.652
2	H-P	10	+.849	+.597
3	G-P	14	+.910	+.930
4	B-W	22	+.922	+.847
5	C-F	15	+.945	+.812
6	W-P	7	+.822	+.715

behavior during medication. The same findings suggested also that no significant change could be expected in the control group.

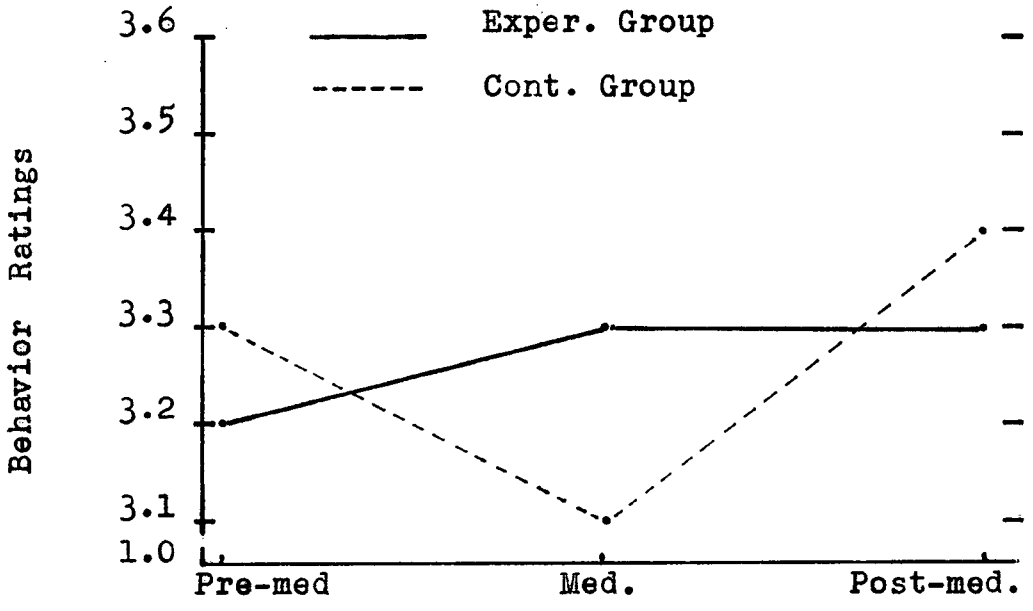

Figure 2. Experimental and Control Groups' Means on Three Behavior Ratings

The behavior ratings of both groups are shown graphically in Figure 2. As this graph indicates the groups were not equated on the pre-medication rating, the control group's mean being slightly higher than that of the experimental group. During medication the experimental group improved slightly while the controls worsened. On the post-medication rating the experimental group was unchanged from its previous level while the controls improved over their previous level.

These results are tabulated in Table VII on the following page. The mean difference between the two groups of 0.13 of a point on the pre-medication rating was not significant ($P > .3$). The mean difference on the medication rating was 0.16 of a point ($P > .3$), and the mean difference on the post-medication rating was 0.08 of a point ($P > .6$). In other words the two groups did not differ significantly on any of the ratings.

Summary of Findings

The findings concerning the effects of chlorpromazine on Maze performance and clinical behavior may be summarized as follows: There were no significant differences between the experimental and control groups on any of the Maze tests or Behavior ratings. As regards the Maze, both groups showed a loss during medication and subsequent recovery after medication. As regards clinical behavior the experimental group improved slightly during medication and the controls

TABLE VII

COMPARISON OF BEHAVIOR RATINGS OF EXPERIMENTAL AND CONTROL GROUPS

Rating	Exper. Gp. Mean	Exper. Gp. SD	Cont. Gp. Mean	Cont. Gp. SD	Diff.	SE_D	t	df.	P
Pre-med Rating	3.21	0.65	3.34	0.72	-0.13	0.14	0.928	21	> .3
Med. Rating	3.28	0.69	3.12	0.92	+0.16	0.18	0.888	21	> .3
Post-med Rating	3.28	0.68	3.36	0.96	-0.08	0.19	0.421	21	> .6

N = 22 pairs of subjects

worsened but the mean difference between the groups was not statistically significant. Within the terms and limitations of the study the results offer no evidence that chlorpromazine had any significant effect on either Maze performance or clinical behavior.

CHAPTER VII

DISCUSSION

The present findings offer no evidence that chlorpromazine had any significant effect on Maze performance. Prior to medication subjects were matched exactly on Maze scores and as closely as possible for age, hospital duration, education, occupation, and marital status. In addition, all subjects were males and all had been diagnosed as schizophrenic. Subjects were allocated to the experimental and control groups by reference to a table of random numbers and a double blind procedure obscured the identification of every individual within a particular group. Statistical analysis showed that the differences between the two groups on the variables of age, hospital duration, education, occupation, and marital status, were all insignificant. In all these respects, then, the two groups were relatively equal. It could reasonably be assumed that they were relatively equal also on certain other variables such as physical health, and adjustment to environment.

It may be taken, then, that the two groups were equivalent with regard to any factors that might be expected to influence subsequent Maze performance. In order to establish that chlorpromazine resulted in a significant Maze decrement it would be necessary to show that the experimental group's Maze

performance was significantly worse, during medication, than the control group's Maze performance during the same period. Similarly, in order to establish that the effects of chlorpromazine on Maze performance were either permanent or transitory it would be necessary to show that the experimental group's post-medication Maze Performance was either significantly worse than or equal to that of the controls on the same testing.

Analysis of the results show that the differences between the experimental and control groups were not statistically significant either on the medication or post-medication Maze tests. It is concluded, therefore, that in the present investigation chlorpromazine did not produce a significant decrement in Maze performance.

The fact that the control group showed a maze deficit of 0.75 of a year on the medication Maze test suggests that the extension series may be more difficult for a psychotic population than previous studies indicate. Porteus and Barclay (32) report three studies in which the extension Maze was applied after the original Maze to psychotic subjects being employed as controls. In two of these studies the controls showed a Maze decrement of 0.10, and 0.04 of a year, and in the third they showed a gain of 0.20 of a year. Compared with these figures, the Maze decrement shown by the control group in the present study is quite large. Within the logic of the present experiment it must be assumed that a

similar decrement would be shown by the experimental subjects had chlorpromazine been administered.

As regards the gains shown by both groups on the post-medication Maze test it appears possible that these were due to practice effect including increased familiarity with the testing situation. Again, with reference to the findings of Porteus and Barclay (32), in one of the studies mentioned their subjects were given a third application of the Maze (the extension series inverted). In this case the controls showed a gain of 1.11 years over their previous level on the non-inverted extension form, and a gain of 1.07 years over their original Maze or pre-medication level. In view of these considerations it is possible that the post-medication improvement in Maze performance shown by experimental and control subjects in the present investigation was largely due to practice effect.

Turning now to a consideration of the Behavior ratings, the results offer no evidence that chlorpromazine had any significant effect on clinical behavior. A comparison of the mean rating scores of experimental and control groups showed that they did not differ significantly on either the pre-medication, the medication, or the post-medication ratings.

An interesting development concerns the control group's worsening of behavior during medication, and its post-medication recovery. In trying to account for these changes

several possibilities suggest themselves. One obvious difficulty in trying to obtain an accurate evaluation of clinical behavior is the fallibility of raters. Another difficulty is the sensitivity of the measuring instrument. If a particular category or statement should appear ambiguous the rater's evaluation is likely to be made at random. The same result is likely if a rater has no clear idea how a patient behaves relative to a given category. Another consideration, perhaps the most important, concerns "placebo effect."

When a patient is given a pill he assumes or is told it will do him good. An expectation is thus created, not only in the patient but in the nursing staff as well, which, if it is not fulfilled, may well lead to results opposite to those intended. If the anticipated improvement is not evident the patient may assume he is beyond help and his behavior may actually worsen. The rater, also anticipating improvement in the patient and not finding it, may conclude that behavior has either worsened or not improved. In either case the result is likely to be a lower rating. It is conceivable that any or all of these factors may have operated to produce a decline in the control group's clinical behavior in the present study. The fact that the patient was required to take twelve tablets daily may have strengthened this effect. The initial expectations of the experimental subjects were, of course, indistinguishable from those of the control group

but for the experimental group the expectations were met to some extent at least. The physiological effects of chlorpromazine such as initial somnolence, increased appetite, and antiemesis, would constitute evidence of the drug's efficacy. Thus, as far as the patient was concerned the pills were doing him some good. This change, while less evident to the rater than to the patient, might not be sufficient to produce a marked clinical improvement but it would satisfy certain expectations and thus tend to prevent a decline or worsening of behavior.

In any event, it is concluded that, in the present investigation, chlorpromazine had no significant effect on clinical behavior, while placebo medication did result in a worsening of behavior.

The fact that these results do not confirm previous findings may perhaps be accounted for in terms of the composition of the sample, the dose, and duration of treatment. The literature on the clinical efficacy of chlorpromazine suggests that chronic and deteriorated schizophrenics respond less readily to moderate doses of chlorpromazine and short duration of treatment than do certain other psychotic patients. Moreover, previous findings indicate a wide variation in individual reactions to the drug, some patients not responding at all even with prolonged treatment.

The present sample was comprised of chronic schizophrenics some of them deteriorated, and most of them of long standing.

The dose, 300 mg. a day, while the same as that administered by Porteus and Barclay (32) must be regarded as quite moderate for these particular patients. The duration of treatment was brief — somewhat shorter than that reported by Porteus and Barclay (32). In view of these considerations it is conceivable that in the present study the maximum effects of the drug were not achieved. However, this is only a suggestion that might be explored further. It is equally possible that these patients would not manifest a much greater change even if the dose were increased and the duration of treatment prolonged.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

A review of the literature concerning the clinical efficacy of chlorpromazine suggested that the drug is useful in the symptomatic treatment of certain types of mental illness. The literature concerning the Porteus Maze Test was also reviewed, and this suggested that chlorpromazine, like psychosurgery, produces a significant decrement in Maze performance. The present study was designed, then, to find what effects chlorpromazine has on Maze Performance, and whether such effects are permanent or transitory. In addition, it was decided to assess the effects of chlorpromazine on clinical behavior by using a Behavior Rating Scale.

The subjects were 22 pairs of adult, male, chronic psychotics from the Mental Hospital, British Columbia. Each pair was matched exactly on initial Maze scores and as closely as possible for age, hospital duration, education, occupation, and marital status. There was no significant correlation between Maze scores and any of the matching variables, nor did the two groups differ significantly on any of the matching variables.

The experimental group was given 300 mg. of chlorpromazine daily for thirty days, and the control group received 300 mg. of placebo tablets daily for thirty days. A double blind

technique was used, the identification of individual subjects being thus obscured. Maze scores and Behavior ratings were obtained for each subject before medication, during medication, and after medication. The original Maze was applied before medication, the extension Maze during medication, and the extension Maze inverted after medication. All subjects in a given ward, e.g. Ward 1, were rated independently on clinical behavior by the same pair of raters, e.g. raters M and W, throughout the investigation. Raters H and P rated the subjects in Ward 2, and so on for the rest of the wards. The average of these two ratings was taken as indicative of the subject's clinical behavior. The results of the Maze tests and the Behavior ratings were treated statistically to evaluate the significance of the mean differences between the two groups.

It was hypothesized that chlorpromazine would produce a significant decrement in Maze performance and a significant improvement in clinical behavior. However, since there were no significant differences between the experimental and control groups on any of the Maze tests or Behavior ratings this hypothesis was considered untenable. Both experimental and control groups showed a decrement in Maze performance during medication and an improvement following termination of medication. The loss shown during medication and subsequent recovery after medication may have been due to any one of several factors such as the psychological effects of being experimental subjects, greater difficulty of the extension

Maze, and practice effect. It is therefore very unlikely that the decrease in Maze performance of the experimental group was due to the effect of chlorpromazine.

During medication the experimental group's clinical behavior improved very slightly while that of the controls worsened considerably. It was speculated that the changes observed for the controls during medication may have been due to placebo effect. In view of these findings it is concluded that chlorpromazine has no significant effect on either Maze performance or clinical behavior.

Since these results appear to contradict previous findings, two possible explanations are suggested. One is that in the present investigation the maximum effects of chlorpromazine may not have been achieved owing to the composition of the sample, the moderate dose, and the short duration of treatment. The other is that chlorpromazine was relatively ineffective for the present subjects, and that even with increased dosage and prolonged treatment significantly greater change would not occur. These considerations suggest the need for further studies.

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A P P E N D I C E S

APPENDIX A

PROCEDURE FOR ADMINISTERING AND SCORING THE QUANTITATIVE SCALE OF THE PORTEUS MAZE TEST

The procedures given in the 1950 (29) and 1955 (30) Manuals for testing adults do not appear to be explicit enough to avoid some confusion. This confusion seems to arise partly from the fact that the Maze test may be scored on both a quantitative and a qualitative scale. A quantitative score may be derived from a qualitative score, but the reverse is not the case, since a quantitative score is based on only two kinds of errors whereas the qualitative score is based on at least six kinds of errors.

The present study is concerned only with the quantitative scale as applied to abnormal adults and the procedures outlined below are based on the 1955 manual. The instructions issued in 1950, which have reference to the original series only, still apply when the subject being tested is under 14 years of age. The rules published in 1955 and outlined below apply to both series of the test.

The test consists of 8 levels of graduated difficulty: Years VII, VIII, IX, X, XI, XII, XIV, and Adult. The following directions for administration are given in the manual (30).

1. With all subjects 14 years or older begin with the VII year level. (There are no tests below the VII year level in the extension series.)

2. Give 2 trials in each test through year XI, 4 trials each in years XII and XIV, and 3 trials in the Adult test.

3. When a given year level is failed in all the allotted trials and the one immediately following it is passed within the allotted number of trials, invert the latter and score the worse performance. To "invert" means to rotate the test blank 180 degrees and present as a new test. For example, if year IX is failed in both trials, and year X is passed in one or two trials, invert year X and present as a new test. If the inverted test is failed no credit is given for that year level. The purpose of this procedure is to reduce the probability of a chance success following a failure.

4. Discontinue the test after 2 successive failures above year IX or after any 3 failures.

5. Give the Adult test if there are no successive failures above year IX or in the absence of any 3 failures.

In the 1955 manual (30) the initial instructions are given in terms of driving a car. While this is appropriate for normal subjects, the method poses several problems when used with seriously disturbed mental patients. Many adult psychotics of long standing have never driven a car and they may use this as an excuse for not attempting the test. Others

may take the suggestion quite literally and become so preoccupied with imaginary stop signs, speeding, and driving on the right and wrong side of the road that they lose sight of the goal and either fail to complete the maze or take an exceedingly long time to do so. Because all this can be very confusing to a mental patient, as well as time consuming, it seemed advisable to exclude the idea of a vehicle from the initial instructions.

Another point worth noting, and not mentioned in the manual, is that of using pencils without erasers. Many psychotic subjects, as soon as they become aware of an error, attempt to erase it and then continue as if nothing had happened. The practice of eliminating erasers saves time and makes scoring easier and more accurate, and was therefore adopted.

The initial procedure adopted with psychotic adults was as follows:

> Begin with the VII year test. (In the case of primitive, deaf, or linguistically handicapped subjects, the V and VI year tests of the original series may be used for demonstration purposes.) After some degree of rapport has been established place the test blank before the subject with the print towards him. The horizontal lines should be roughly perpendicular to his writing arm. The subject's visual acuity should be considered, i.e. if he ordinarily wears glasses he should wear them when he

attempts the test. The examiner should keep the fingers of one hand pressed against the top of the test blank to prevent it being rotated. At the same time he should be careful not to cover any part of the design with his fingers or unintentionally indicate an exit.

Say to the subject: "I want you to suppose that these are streets and all the lines are solid stone walls. Take your pencil and start here (indicate entrance), and find your way out to here (indicate exit in VII year test only). But you have to be careful because some of these are dead-end streets and if you go into one you will be stuck and won't be able to get out. You can stop anywhere and look as long as you like, but don't lift your pencil until you are right outside, and be sure not to bump into any of the walls. This is how you do it. Start here and make a mark like this, right down the middle of the street, around the corner, and so on until you come out here." The examiner draws a line slowly and carefully from the entrance arrow and around the first corner, being sure to keep in the middle of the printed lines and making a right-angle turn. He should make sure he has the subject's attention.

The examiner indicates the exit in the VII year test but in no other test. If the subject, in any other test, asks where the exit is or complains that there is no exit, he should be told, gently but firmly, that there is only one way out and he must find it himself. These instructions should be given slowly and clearly with the examiner

sitting opposite the subject and with a fairly narrow table between them.

In subsequent tests the examiner indicates the starting point and says: "start here and find your way out." No further elaboration or repetition of instructions should be given with the exception of the warning against lifting the pencil, which is not a quantitative error.

As soon as an error is made the test blank should be withdrawn and a new one substituted. However, before the blank is withdrawn the subject should be informed of his error if he has not already discovered it for himself. In no case, however, should the correct pathway be pointed out nor should the subject be allowed to continue or return to a new route after making an error.

An important restriction and one that is difficult to enforce with psychotic subjects is to prevent pre-tracing of the Maze. This should not be mentioned to the subject until it occurs spontaneously at which time the examiner places his hand over the design and warns against it. Enforcement of the rule against lifting the pencil helps to prevent pre-tracing. With some subjects it may be necessary to repeat these two rules (i.e. against lifting the pencil, and pre-tracing) several times throughout a test.

There are only two kinds of errors which are scored in the quantitative scale:

1. An error occurs when the subject crosses an imaginary line at the entrance to a dead-end street to the extent of at least one-sixteenth (1/16) of an inch.

2. An error occurs when the subject crosses a line to an opening instead of pursuing the proper course, or when he crosses a line to an adjacent correct pathway, instead of following the original pathway to its proper exit or turning point.

Ordinarily, the initial instructions may not be repeated if the application of the extension follows immediately or within a year of giving the original. But an exception to this rule may be made in the case of psychosurgical patients or patients on medication to whom the original is given before treatment and the extension after treatment. It is then permissible to repeat the instructions for the second or third applications of the Maze if the subject says he does not remember the test.

In the 1950 (29) manual test ages were calculated by adding credits to a basic score. In the 1955 (30) manual the procedure is to deduct one-half year for every unsuccessful trial. The results are the same but the latter method is much simpler. The scoring procedure now is as follows:

1. Take as maximum credit 17 years if the adult test is passed and deduct one-half year for each unsuccessful trial throughout the series.

2. Take as maximum credit 15 years (a) if the adult test is failed or (b) if it is not counted because of previous failures. In either case (a) or case (b) deduct one-half year for each unsuccessful trial in all tests prior to the adult level. In the adult test no credit is given or deduction made.

3. Take as maximum credit the highest test passed and deduct one-half year for each unsuccessful trial in all tests prior to and including the highest test passed.

The procedure for administering the quantitative scale to psychotic adults may be summarized as follows:

1. With subjects 14 years or older begin with the VII year test.

2. Allow two trials in each test through year XI, four trials each in years XII and XIV, and three trials in the adult test.

3. When a test is failed, and the test immediately following it is passed, invert the latter and score the worse performance.

4. Continue testing until two successive failures above year IX or any three failures have been recorded.

5. Administer and score the adult test if there are no successive failures above year IX or in the absence of any three failures.

6. A trial is failed as soon as a quantitative error

is made. A quantitative error consists of (a) entering a blind alley to the extent of 1/16 of an inch, (b) crossing a line to an opening, or crossing a line and proceeding along an adjacent pathway instead of pursuing the proper course.

7. Take as maximum credit (a) 17 years, or (b) 15 years, or (c) the highest test passed, according to the instructions given above.

The scoring method results in a test age or mental age. To convert these into I.Q.'s, 14 years should be used as the divisor for cases at that age or above.

The foregoing procedure is to be used with both the original and the extension series but it should be noted that it applies only to the quantitative scale and to a specific population, namely, psychotic adults.

APPENDIX B

The L-M Fergus Falls Behavior Rating Scale

PROCEDURE FOR SCORING BEHAVIOR RATING SCALE

Each category consists of five separate statements and each statement is given a weighted value as follows: 1 for the first statement, which represents the poorest behavior; 2 for the second, which represents a type of behavior superior to 1, and so on up to 5 for the fifth statement, which represents behavior that is relatively normal. The rater places a check mark beside the statement he considers represents a given patient's behavior in a particular category, or beside more than one statement if he deems it necessary. The weighted value or values are then summed and the average taken as indicative of the patient's behavior in a given category, e.g. A (work).

A quantitative value of from 1 to 5 is thus obtained for each category on which a patient is rated. Some patients may be rated on all eleven categories; others may be rated on fewer than eleven. In the present study, for example, no patient was receiving electric or insulin therapy hence no subject was rated on that category (E). Certain other patients did not work or took no part in recreational or occupational therapy and so could not be rated on these categories. The ratings obtained on each category are summed and the average of these is taken as representing the patient's clinical behavior.

INSTRUCTIONS FOR FILLING OUT BEHAVIOR RATING SHEET

At the top of the Behavior Rating Sheet write in the patient's name and number, the ward, and your own name. Below you will find ten different groups of descriptions of a particular type of behavior. Place a check (X) by the description that comes closest to telling how this particular patient has behaved for _____ . If the patient's behavior has changed in this period, then check the description which tells how the patient has behaved most of the time. If the patient's behavior is evenly divided, then check two descriptions (or more, if necessary). Look at each group of descriptions separately, do not try to give an overall impression at any time because, as you well know, a certain patient may be a very good worker but he may not speak at all. If you feel that you don't know enough about a certain bit of behavior (example, you haven't seen the patient eat) then leave that part out, it is far more important to have true descriptions than to have many descriptions. There will be other descriptions that you will have to leave out. (Examples: if patient isn't getting insulin or electric treatments, you can't rate that particular patient. If patient is bedridden, he can't be rated for amount of activity.)

APPENDIX B

L-M Fergus Falls Behavior Rating Sheet

Patient's Name Number Ward Rater

A. WORK

____ Does no work - refuses - extremely negativistic.
____ Does a little work with a lot of urging. Constant supervision is necessary.
____ May have a regularly assigned job--and supervision may be necessary.
____ Enthusiastic participation in all types of work - asks for work.
____ Normal interest in work - i.e., interested in some kinds of work more than others (will do other kinds than main interest if called upon to do so).

B. RESPONSE TO MEALS

____ Has to have special attention, as eats too much, spoon fed or tube fed.
____ Eats by self, is sloppy--may need coaxing.
____ Eats by self using knife, fork and spoon properly. May show some finickyness.
____ Passes and asks for things to be passed, but will not carry on table conversation.
____ Would not stand out among normal people for eating habits.

C. RESPONSE TO OTHER PATIENTS

____ Stays all alone or may strike out at other patients.
____ Will be with other patients only for a short while and with urging.
____ Some signs of friendliness - speaks to patients - may have a friend.
____ Some spontaneity in making contacts with other patients. May initiate play or work of a social relatively high order type. (Card game, washing dishes)
____ Helpfulness expressed toward other patients--or non-hostile recognition of their being mentally ill and making allowances.

D. RESPONSE TO PSYCHIATRIC AIDES AND NURSES

____ Negativistic - hostile (can include striking) - doesn't do anything requested.
____ Will do a few things if asked or pushed - shows no open hostility.
____ Will do most things when asked - will ask for simple things - "I want my tooth-brush."
____ Extremely cooperative -- will do anything when asked.
____ Normal give and take relationship. Speaks spontaneously to nurses about things of not immediate importance. (weather, baseball games, etc.)

E. RESPONSE TO DOCTORS, SOCIAL WORKERS, PSYCHOLOGISTS.

____ Hostile
____ Passively negativistic (would rather not have anything to do with them but will not resist).
____ Will speak when spoken to.
____ Seeks advice.
____ Understands, accepts, and asks for therapy.

F. RESPONSE TO ELECTRIC OR INSULIN THERAPY

____ Hostile, etc.
____ Anxious, apprehensive, but not overly hostile.
____ Passively accepts.
____ Accepts positively--(May say, "I feel better after").
____ Asks for, understands necessity for.

G. OCCUPATIONAL THERAPY AND RECREATIONAL THERAPY (WALKS DON'T COUNT)

____ Does not participate at all - negativistic - hostile.
____ Participates with urging for short periods.
____ Participates when asked - some spontaneity.
____ Shows interest--participates in all types wholeheartedly without discriminating very much between different types - looks forward to.

G. continued

____ Interested in many varied activities - normal selectivity (likes some kinds more than others.)

H. ATTENTION TO DRESS AND PERSON

____ Has to be dressed - needs special attention of one kind or another.
____ Dresses self but is sloppy.
____ Some interest in looks - fairly neat.
____ Cares about looks and dress; will ask for shaving equipment etc., inconsistently. (Not an overall balance.)
____ Normal (for culture) - would not stand out in a crowd.

I. PSYCHOMOTOR ACTIVITY (NOT INCLUDING GOING TO THE BATHROOM, OR MEALS)

____ Stays in one place unless pushed, or hyperactive, (seclusion necessary, etc.)
____ Moves around a little (one chair to another) or if hyperactive, the activity is not of a type making seclusion or other restrictions necessary.
____ Some activity resulting from the influence of the illness (moves around because voices say to) and some purposeful behavior.
____ Still moves around a little fast or a little slow.
____ Normal activity - would not stand out among normal people.

J. SPEECH

____ Mute or speaks a lot but it doesn't make sense.
____ A few words that make sense ("yes" or "no")
____ Speaks in short clear sentences, "can I have my toothbrush."
____ Speaks normally except a little fast or slow.
____ Speaks normally.

K. TOILET BEHAVIOR

____ Untidy anytime during the day and/or more than twice a week nightly.
____ Untidy once or twice a week nightly - brushes teeth and washes only when told to do so.
____ Not untidy - toilet behavior somewhat sloppy - brushes teeth and washes once a day without being told.
____ Toilet behavior normal except for being too neat or too much time spent at one thing or occasionally sloppy.
____ Toilet behavior normal.

APPENDIX C

Tabulation of Raw Data

Pair	E=Experimental C=Control	Porteus Maze Score: Pre-medication Maze Scores	Porteus Maze Score: Medication Maze Scores	Porteus Maze Score: Post-medication Maze Scores	Behavior Rating: Pre-medication Ratings	Behavior Rating: Medication Ratings	Behavior Rating: Post-medication Ratings	Matching Variables: Age	Hospital Duration	Years of Schooling	Occupation *	M=Married S=Unmarried	Diagnosis **
1	E	16.5	16.5	16.5	2.9	3.3	3.2	48	7	8	1	S	U
	C	16.5	16.5	16.5	2.9	2.6	2.7	44	9	10	1	S	U
2	E	16.5	15.0	17.0	3.4	3.3	3.5	50	19	11	1	S	D
	C	16.5	12.5	15.0	4.4	4.4	4.3	53	7	8	1	M	P
3	E	16.5	15.5	15.5	2.3	2.2	2.3	64	20	3	3	M	D
	C	16.5	15.5	14.5	3.7	4.0	6.7	67	24	6	1	M	P
4	E	15.5	14.5	14.5	2.7	2.7	2.8	45	11	5	1	S	S
	C	15.5	16.0	16.5	2.6	2.7	3.2	41	3	9	1	S	U
5	E	15.5	10.5	13.0	3.8	3.7	3.4	59	20	3	1	S	S
	C	15.5	17.0	16.0	4.4	4.4	4.5	65	21	4	1	S	P
6	E	15.5	16.0	16.5	2.2	2.0	2.3	47	18	11	1	M	S
	C	15.5	10.5	13.4	2.2	1.9	2.3	45	23	12	2	S	U
7	E	15.5	9.0	13.0	3.2	3.3	3.3	66	5	8	3	M	D
	C	15.5	10.0	15.5	4.3	4.5	4.6	66	7	4	1	S	U
8	E	15.0	9.0	15.5	3.4	3.5	3.6	65	7	5	1	S	S
	C	15.0	12.5	10.0	3.3	3.0	2.8	58	16	5	1	S	U
9	E	14.5	9.0	8.0	3.5	3.6	4.1	48	16	10	1	M	D
	C	14.5	12.5	13.5	3.2	3.1	3.3	46	19	6	1	S	U
10	E	14.5	17.0	16.0	2.9	3.4	3.3	42	16	7	1	S	P
	C	14.5	12.5	16.0	3.5	3.9	4.4	47	10	9	2	S	U
11	E	14.5	11.5	12.0	2.4	2.5	2.3	58	19	4	1	S	P
	C	14.5	13.0	11.0	2.0	2.1	1.9	59	17	6	1	M	U
12	E	14.0	15.0	16.0	3.9	4.0	3.6	74	20	6	1	S	P
	C	14.0	13.5	15.0	3.7	3.1	4.1	75	28	6	1	S	C
13	E	13.5	15.5	17.0	4.7	4.9	4.9	73	10	8	1	S	P
	C	13.5	11.5	16.5	4.2	4.2	3.8	72	16	5	1	M	U
14	E	12.5	9.5	12.0	2.7	2.8	2.8	61	24	5	3	S	U
	C	12.5	12.5	15.0	3.9	3.4	3.6	60	5	8	1	S	U
15	E	10.5	11.5	15.0	3.0	3.2	3.7	67	26	6	1	M	U
	C	10.5	13.5	10.5	3.4	3.5	3.6	76	20	6	1	S	P
16	E	10.5	7.5	10.5	2.5	2.3	2.4	40	7	7	1	S	D
	C	10.5	9.0	6.5	2.5	2.7	2.6	33	10	5	3	S	D
17	E	10.5	6.0	9.0	2.9	2.9	2.8	60	6	4	1	S	C
	C	10.5	11.5	11.0	4.1	3.8	3.8	54	3	5	?	M	P
18	E	10.0	7.0	8.5	4.2	4.1	3.8	78	24	5	1	S	S
	C	10.0	12.0	16.5	3.9	3.6	3.7	69	18	10	2	S	S
19	E	9.5	12.5	16.5	3.7	3.9	4.4	56	11	00	1	S	P
	C	9.5	9.5	8.0	2.6	2.6	2.5	59	7	14	3	M	D
20	E	8.0	10.5	9.0	3.7	3.5	3.4	55	24	5	1	S	S
	C	8.0	7.0	9.0	2.5	1.8	2.4	51	24	6	1	S	D
21	E	7.5	8.0	9.5	2.9	3.1	3.0	41	19	6	1	S	U
	C	7.5	9.5	9.0	3.0	3.0	3.2	34	11	6	1	S	P
22	E	7.0	10.0	9.0	3.7	3.9	3.3	55	24	0	1	S	D
	C	7.0	9.0	8.5	3.5	2.7	2.8	59	28	4	1	S	U

* 1 = Unskilled
2 = Semi-skilled
3 = Skilled

** U = Undifferentiated Schizophrenia
P = Paranoid Schizophrenia
D = Deteriorated Schizophrenia
S = Simple Schizophrenia
D = Catatonic Schizophrenia