Schizothymia-Cyclothymia As a Dimension of Personality:

II. Experimental[1]

H. J. EYSENCK
Psychological Department, Institute of Psychiatry, Maudsley Hospital

INTRODUCTION

IN THE FIRST PART of this paper (4), a description has been given of the main hypotheses underlying Kretschmer's system of typology (7) and of various ways in which Kretschmer and his associates and students have attempted to supply proof of its validity It was also shown that while certain criticisms frequently made of this system rest mainly on ignorance or misunderstanding, yet the methods of proof used by Kretschmer, although ingenious and extremely interesting, are not completely convincing In this part of the paper an attempt will be made to carry out an empirical test of Kretschmer's hypothesis, using the method of "criterion analysis" specially developed by the writer for use with problems of typology and taxonomy generally (3)

In order to use the hypothetico-deductive method in this field,

[1] The writer is indebted to Miss Sybil Rostal, who carried out all the testing of both normal and psychotic subjects reported in this paper To anyone who is at all familiar with the difficulties which arise in attempting to make a large number of psychotics undergo *every one* of a long and tiresome battery of psychological tests, it will be sufficient comment on Miss Rostal's unusual capacities in this direction to say that out of well over a hundred patients tested only one or two failed to finish the whole battery of tests This is an important point as the experimenter's original sampling can be distorted very badly through refusals on the part of certain patients originally selected to finish the testing sessions It may be said with confidence that no such distortion has taken place in the present experiment

We are also indebted to Mr A Jonckheere, Mr A Lubin, and Miss J May, who carried out most of the statistical work involved, and to the London School of Economics, which permitted us to use its Hollerith equipment Miss D Campbell, Mr J Singleton, and Miss I Wiltshire performed and checked all computations Thanks are due to the Superintendent of West Park Hospital, for his kind permission to test a small number of depressive patients there Acknowledgment should be made of the co-operation of psychiatrists at the Maudsley and Bethlem Royal Hospitals, who helped in the selection of cases and spent much time in clarifying diagnoses Lastly, we wish to thank Col L Bootle-Wilbraham, D S O, M C, for his kindness in allowing us to use soldiers under his command as subjects

it is particularly important to state the hypotheses to be tested quite clearly, and to make deductions from them which can be tested empirically. As explained before, there are two main hypotheses involved in Kretschmer's system (1) The functional psychoses (schizophrenic and manic-depressive insanity) are not qualitatively different from normal mental states, but form one extreme of a continuum which goes all the way from the perfectly normal, rational to the completely insane, psychotic individual All possible intermediate steps are represented on this continuum

(2) The two main functional psychoses (schizophrenia and manic-depressive insanity) show patterns of traits which are observable in nonpsychotic persons also, although in a less extreme degree, and which give rise to a continuum running from the extreme schizothyme to the extreme cyclothyme, again with all intermediate steps being represented on this continuum These continua are presumed to be orthogonal to each other

A third hypothesis is frequently identified with Kretschmer's system, but does not appear essential to it, although Kretschmer himself has made considerable use of it in his own attempt to supply proof of his general system This is the hypothesis that the schizothymic-cyclothymic continuum is correlated with body-build, schizothymes being leptosomatic, cyclothymes being pyknic with respect to their bodily habitus This third hypothesis, being logically independent of the other two, will not be tested in the present experiment

We have attempted to state Kretschmer's hypotheses in such a way that a statistical and experimental test of them becomes possible, while we believe that in stating them in this fashion we have not misrepresented him in any way, and while we believe that these views are held by him, explicitly or implicitly, it should be borne in mind that in thus reducing a complex and difficult system to two brief fundamentals we may have done violence to this system Whether this be so or not, the reader must decide for himself on the basis of Kretschmer's own writings, and those of his students, a bibliography of which will be found appended to the first part of this paper (4).

The method of criterion analysis, which we propose to use in connection with the present problem, has been discussed in detail

elsewhere (3), with particular application to the problem of a continuum linking normal with neurotic states, here we shall merely indicate briefly the principles underlying it as applied to the two hypotheses under discussion Let the line AB in Figure 1 represent the normal-psychotic continuum, and let the line I, I' cut off at point X that part of the continuum containing mental states conventionally diagnosed "psychotic" by psychiatrists (The distribution of the total population has been tentatively included in the figure in the form of a normal curve of distribution As the actual form of the distribution is irrelevant to the argument, which merely hypothesizes a continuous distribution, any other form of rectilinear or curvilinear distribution might be substituted for the normal form without affecting the argument) Let n objective psychological tests (a, b, c, n) be given to the two populations separated by the line I, I', i e, to a normal group and to a psychotic group (The term "normal" here means nothing but "not under psychiatric care for mental disorders", it does not imply anything more positive than this absence of demonstrable and demonstrated mental disorder.) Let us assume that each of these n tests distinguishes significantly between the normal and the psychotic groups (In actual practice, n + x tests would have to be given in all, so that tests not distinguishing at the chosen level of significance could be rejected)

Now let us divide the normal group into two parts, by making a cut at point L on the line AX, similarly, let us make a cut at point M on the line XB, thus subdividing the psychotic group also (Points L and M may be anywhere between A and X, and X and B, respectively, there is no implication that they should divide the respective populations into equal halves) On the hypothesis that AB represents a true continuum, we have now divided both the normal and the psychotic groups into two parts, one of them more normal, the other more psychotic Group AL is more normal that LX, group XM is more normal than group MB If AB is a true continuum (the hypothesis to be tested), and if each of our n tests is related to that continuum in a linear fashion (supplementary hypothesis), then it would follow that on these n tests group AL would differ from group LX in the same way that group AX differed originally from group XB Similarly, group XM would differ from group MB in the same way that AL differed from LX.

We may put these arguments in a form which permits of their being tested If tests a and b differentiate significantly between groups AX and XB, then it would follow according to our hypothesis that they should differentiate also between AL and LX Similarly, they should differentiate between XM and MB This deduction, unfortunately, does not permit of any direct test, as there is no known method of determining points L and M, and therefore of differentiating the groups under discussion However, we can transform the concept of "differentiate" into the concept of "correlate" and test our hypothesis in this fashion If on tests a and b the normal group does better than the psychotic group, it would follow, as explained above, that group AL should do better on both tests than group LX Similarly, group XM should do better on both tests than group MB But these statements are synonymous with saying that *for both the normal and the psychotic groups separately, there should be a positive correlation between tests a and b*

This argument can be extended to n tests, and implies as one consequence that *tests which differentiate significantly between normals and psychotics should give positive intercorrelations when these correlations are run for the normal or the psychotic groups separately* Here then we would have a possible test of our hypothesis But we can refine this test a little by pointing out that not only should these correlations be positive, but also that they should be proportional to the power of each test to differentiate between the normal and psychotic groups originally We may express this differentiating power in terms of a biserial correlation for each test with the normal-psychotic dichtomy, denoting the column of n correlations between tests and criterion the *Criterion Column* ($C^{n,p}$) We may then say that the average of the intercorrelations of a test with all the other tests in the battery, for either the normal or the psychotic group, should be proportional to the correlation of that test with the criterion, i e , the normal-psychotic dichotomy

Instead of averaging correlations, it would appear more suitable to perform a factor analysis on the intercorrelations between our n tests Let us assume that we extract two factors from each of our two matrices, the sets of intercorrelations for the normal and the psychotic groups respectively, which we may call F_n and F_n' for the

normal and F_p and F_p' for the psychotic group It would follow from our hypothesis and our selection of tests that F_n and F_p should be proportional to each other, and to our Criterion Column, $C_{n,p}$ Here, then, we have reached the final and crucial test We have made a hypothesis as to the existence of a general factor underlying the pattern of variances and covariances of test performances of normal and psychotic groups, and deduced certain consequences which would follow if our hypothesis were true, and which would not follow on any tenable counterhypothesis In so far as these deductions are verified, we may consider our hypothesis as supported, in so far as these deductions are not verified, we may consider our hypothesis as disproved

It will be clear that a similar procedure could be used with respect to our second hypothesis What would be required there would be a set of n tests which discriminate between schizophrenic and manic-depressive patients, the Criterion Column in this case would consist of the biserial correlations of each test with this new column Apart from these changes, the procedure as outlined above is applicable to just the same extent as it is in respect to our first hypothesis The continuum in question is hypothesized in the first part of this paper (4, p 128), on the basis of Kretschmer's hypothesis we would expect factors F_n' and F_p' to be proportional to each other, and also to the new Criterion Column, $C_{s,d}$

Both hypotheses can be tested at the same time, using n tests which differentiate significantly (using Fisher's F test) between the three groups involved the normal, schizophrenic, and manic-depressive The two criterion columns, $C_{n,p}$ and $C_{s,d}$, could then be calculated quite easily by running point biserial correlations between each of the n tests and the normal vs psychotic dichotomy for $C_{n,p}$ (using the combined schizophrenic and manic-depressive groups to form the psychotic group), and by running point biserial correlations between each of the n tests and the schizophrenic-manic-depressive dichotomy for $C_{s,d}$ Product-moment correlation would then be run between the n tests for the normal and the psychotic groups separately, thus giving us two separate matrices These, when factor analyzed according to either the centroid or the summation method, or indeed any of the current methods, should

result in two factors each, F and F', which would be proportional to each other and to the respective criterion columns

This, in brief, is the method which has been used in the present experiment Its rationale, and the more detailed explanation of the working methods used, are given elsewhere (3), here we have only attempted to set down the logical basis underlying its use Some further discussion will be given in connection with our interpretation of the results in section 4 of this paper

Population and Conditions of Testing

As mentioned in the previous section, three groups altogether had to be tested—a normal group, a schizophrenic, and a manic-depressive group The normal group consisted of soldiers (mainly conscripts, but also included a few volunteers and professional soldiers), who had been selected on a random basis by the commanding officer and who had agreed voluntarily to take part in the experiment (It should be noted that this method is not identical with one calling for volunteers, it overcomes the difficulties inherent in personality differences possibly existing between volunteers and nonvolunteers)

The two psychotic groups were drawn, with the exception of a few cases tested at West Park Hospital, from the in-patient population at Maudsley and Bethlem Royal Hospitals, and were noncertified (voluntary) patients Great care was taken to include in the two groups (schizophrenic and manic-depressive) only cases about whom there could be little doubt as to their proper provenance, and even after they had been tested care was taken to follow them up for a period of several months to see if there had been any change in their condition which would lead to a change of diagnosis A number of such changes did in fact occur, sometimes as much as six or eight months after testing, and such cases were immediately discarded While this precaution probably served to purify the two groups in question, there can be no doubt that we were only partly successful in reaching 100 per cent reliable and valid diagnoses, if the patients had been followed up over a period of 10 years and rediagnosed after that lapse of time, it is highly likely that many more would have been diagnosed under some other category than that originally chosen All that can be claimed is that our schizo-

phrenic group probably contained more schizophrenics than our manic-depressive group, and conversely, that our manic-depressive group contained more depressives than our schizophrenic group For the purpose of our demonstration this is sufficient, and it will be noted, in support of this view, that there are significant differences on a variety of objective tests between these two clinical groups In other words, the null hypothesis is not tenable with respect to our final groups

The normal group was made up of 100 men, with an average age of 21 years The schizophrenic group was made up of 24 men and 26 women, with an average age of 28 The manic-depressive group was made up of 25 men and 25 women, with an average age of 46 Although the F test is not strictly speaking applicable because of the nonhomogeneity of variances, its use shows that the age differences are significant at the 1% level of significance [2] As regards intelligence, no single test was given to all the 200 subjects, but 80 of the normals were tested in conjunction with another project by Dr J Ingham with the Wechsler test and found to be slightly above average Most of the psychotics had been tested by various clinical psychologists or psychiatrists at the hospital, using a variety of different tests, and appeared on the whole to be slightly below average Both groups showed a good deal of variability, with the S D of the psychotic group considerably larger than the S D of the normal group

It will be seen that with respect to sex, age, and intelligence our three groups are far from homogeneous The question arises as to the influence of these factors on our criterion analysis This question cannot be answered conclusively In the first place, correlations of most of the tests used with age, sex, and I Q are known from our previous work (2) to be small or nonexistent, it seems doubtful if they could produce differences in scores as large as those observed In the second place, in so far as these factors (age, sex, intelligence) do give rise to differences, these would not be such as to produce the phenomena predicted, but rather such as to obscure them This point will be discussed further in the section dealing

[2] Precise figures

	Age	Variance ($\sigma 2$)
Control groups	21 10	10 81
Schizophrenics	27 80	62 20
Manic-depressives	46 44	144 42

with the explanation of our results In the third place, a separate statistical study, to be published, indicates that differentiation on the basis of test results is not influenced very significantly when age, sex, and intellectual differences are held constant as far as possible While from various points of view it would of course have been desirable to exclude variance due to these extraneous factors, it may be concluded that positive results of our criterion analysis would be independent of errors introduced through lack of homogeneity of age, sex, and intelligence In Table II are given correlations of all the tests used with age (for normals and psychotics separately), and with sex, for psychotics only

It was impossible for testing to be carried out at a fixed point during the stay of the patient, e g , when he came into the hospital, or at the termination of treatment, or when he left It is doubtful, in any case, if such dates have much significance in this connection The following rules were followed A patient was tested only after he had been in the hospital long enough for a definite diagnosis to be made, he was retained in the experimental group only if that diagnosis was not changed subsequently A patient under treatment by E C T was never tested on the day on which the shock was given A record was made of times of testing, as well as of times and types of treatment, for each patient, so that any direct influence on test scores could be traced This analysis is not reported here, as again such influences would obscure, but could not produce, the similarities in pattern of test scores which form the basis of criterion analysis

It will be clear that only patients who were in a sufficiently alert state to undergo a relatively large number of complex psychological tests were selected to form part of our experimental group No chronic cases are included, and no one was tested during acute psychotic attacks Manic-depressive patients were tested exclusively during their non-manic states, if a manic spell supervened between testing sessions the case was eliminated from the experimental group These limitations should increase the general interest of the data, as it is precisely with patients of this type that problems of differential diagnosis arise It is also with patients of this type that most of Kretschmer's experimental work was carried out, so that there is no reason to suspect that our selection of patients would

bias our results in a direction unfavorable to the hypothesis under investigation Indeed, an inspection of the case papers convinced the writer that the cases selected as representative of the two psychotic groups would have been classified in a similar manner by Kretschmer (This view is based on a careful reading of Kretschmer's textbook of psychiatry, as well as on his other work) Subdivision of cases in the two major classifications is given in Table I.

TABLE I

SUBDIVISION OF TWO GROUPS OF FIFTY SCHIZOPHRENICS AND FIFTY MANIC-DEPRESSIVES*

Recurrent schizophrenia	5	Manic-depressive insanity	24
Paranoid schizophrenia	10	Involutional melancholia	14
Hebephrenic schizophrenia	9	Agitated depression	9
Paraphrenic schizophrenia	1	Manic-depressive, mixed type	3
Catatonic schizophrenia	5		
Simple schizophrenia	5		
Schizophrenia, no subdivision	15		

*Cases were so selected as to conform to Kretschmer's definition of these two broad groups, other psychiatrists might prefer to keep involutional melancholia apart from manic-depressive insanity proper In view of the fact that it was Kretschmer's hypothesis that was under investigation, it was considered obligatory to use his own system of classification

Testing was carried out by one person, Miss S Rostal, who gave the battery of tests described in the next section in the same order in which they are put down there Testing occupied two one-hour sessions, in a few cases a third session was necessary, as it was decided that no one should be tested for more than one hour at one time A great effort was made to complete the total battery on every patient who had been selected, in order to keep biasing effects to a minimum, and as pointed out in footnote 1, this effort was largely successful One hundred and twenty patients were tested in all, of whom 20 had to be discarded because of alteration in diagnosis after completion of the testing

TESTS AND RESULTS

In this section are given brief descriptions of the tests used and of the method of administration and scoring, and the mean scores and variances (σ^2) of the control, schizophrenic, and depressive subjects [8] Also included is an estimate of the probability that the results for any given tests could have come from three groups selected by chance from one parent population, using Fisher's F test for the

[8] All variances listed are population estimates, i e $(n-1)$d f

purpose The level of significance is recorded as lying above one of the following three points 5% (corresponding to an r of +0 172), 1% (corresponding to an r of +0 214), and 1% (corresponding to an r of +0 260) These values should not be taken too seriously, as even a casual look at the variances will show that the assumption of homogeneity of variances which underlies the use of the F test is seldom justified However, even relatively marked deviations from such homogeneity are known not to invalidate the F test completely, and consequently the values given in the column headed "Significance" may perhaps be useful as a rough guide Also the F ratios for any two tests are not independent of one another In any case, no use is made of these values for any further computations, our main hypothesis being independent of the significance of these differences, and concerned only with the *intercorrelations* among the tests

Sufficient description is given with each test to enable the critical reader to repeat the experiment In certain cases reference is made to previous publications where various tests are discussed at greater length (cf for instance the suggestibility, social attitudes, persistence, and word-connection tests) In some cases, tests used have not yet been published, and full discussion would have taken too much space (concentration, work curve, color form, abstraction) Full details will be sent to anyone interested in this work The reasons for choosing particular tests, or particular forms of a given test, cannot be given here, they refer partly to hypotheses developed by others (e g , the use of the reversal of perspective test, first suggested by McDougall), partly to hypotheses and hunches developed by the writer and his associates

Most of the changes from the more usual methods of administration will be apparent, a special word may perhaps be called for in connection with the Level of Aspiration tests In the form in which we had used this test previously, performance was preceded by a statement of aspiration and followed by a judgment of the level of that performance, thereafter the experimenter would tell the subject his actual level of performance, and the cycle would begin again. In the present series of experiments it was thought that the suspected greater autism of psychotics could be brought out even better by omitting the reality reference implicit in telling the subject his actual level of performance This new procedure appears a promising one to us, but it should be noted that level-of-aspiration scores derived in this way are not comparable with level-of-aspiration scores arrived at in conformity with the older procedure.

Altogether, 90 different sets of scores are reported, of which 30 are nonsignificant, 7 are significant at the 5% level, 15 are significant at the 1% level, and 38 are significant at the 1% level It should be noted, however, that these values are not all experimentally independent They do indicate, with a fair show of probability, that on the basis of objective tests the three populations tested are not chance samples from a single universe, but are significantly differentiated from each other This general finding will be elaborated further in the next section

(1) *Fluency* (2)

This test consists of four parts S is told "I want you to mention to me as many names of birds as you can think of Any birds at all" E writes down S's responses for one minute Test is repeated using names of flowers and names of animals Instructions for part four are "Now, I'd like you to say just any words at all that come to your mind Any words at all" E writes down S's responses for three minutes Any words at all are allowed, but not whole sentences Score for parts a, b, c, and d are the number of birds, animals, flowers, and words respectively, never counting repetitions

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	13 31	19 08	10 66	16 68	11 94	33 65	1%
b	10 29	10 39	10 46	14 62	10 06	17 85	—
c	14 59	12 51	12 74	15 26	11 24	15 62	1%
d	39 26	329 22	36 46	248 87	34 86	244 86	—

(2) *Word Connection*

Verbal Instructions as in (1), fifty stimulus words, each with two alternative responses, one normal, the other neurotic (1) "Now, you see these large words, with the two small ones against each one? Well, would you underline one of the two small ones, which seems to you to go best with the large one There are no right or wrong answers, it's just whichever one *YOU* prefer" Repeat instructions until subject fully understands, giving the example on the sheet (SINK, wash drown)

The test is untimed, but "go as fast as you can" was a suggestion made, but not insisted on Whenever possible, subjects were cajoled into underlining one small word for each line, and it was stressed that none "should be left out"

The words were never discussed, but when necessary, to give confidence, a word once decided upon and underlined was approved when subject asked E g SCISSORS, nurse *cut* *Observer* "Mm, carry on"

Scoring Number of neurotic answers underlined

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	10 77	23 78	12 18	42 60	12 86	40 45	–

(3) *Work-curve*

This test consists of continuous addition, using 15 30-second work periods in order to derive oscillation scores S is given a sheet containing 15 sets of two-rowed single digits, like this

8 1 6 8
etc
5 8 2 9

Verbal Instructions "Now, you don't mind adding up do you? Look, you have to do each row separately, and this test is timed" Demonstrate on separate sheet, while explaining the procedure

"You add these two numbers and put the answer in the middle—so, but I want you to put in *only the units*, i e, if the answer is 15, write only 5, if 17, write 7, and so on Then go on to the next two numbers, and so on to the end of the line If you finish the line before the time given for that row is up, come back to the beginning of the line and add up the top two numbers—so, always leaving the one out, and putting in only the second part of the number (i e, the top one and the one you have written yourself) If you still find you have some time to spare on that row, when you have reached the end of the line, come back and add the bottom two numbers, putting the answer on the side—so But, when I say change, stop WHEREVER you are on the line, and switch over to the next line doing exactly the same there, and so on"

Repeat these instructions at least once, even if subject says he positively understands, because it is undesirable to stop during the

test to repeat instructions *It is important to demonstrate the first line while giving instructions*

Mode of Testing After beginning test, every effort was made to keep subject going for the required 7½ minutes Timing 30 seconds for each of the 15 rows

All talking, smoking, etc were strongly discouraged during the "work curve" test, and when the patient was obviously on the wrong track, the instructions were *briefly* repeated, the stop watch being appropriately and very carefully adjusted so that not more or less than 30 seconds was spent for each row

No severe objection was raised, once patient had started, to putting whole numbers, i e , 15 or 17, etc , because after E C T some patients found the instructions lengthy and hard to remember all at once For the sake of continuity, then, this lapse was considered the most permissible

The basic technique in administering this test is to see that instructions are so clear to the subject that he will continue without confusion (and time loss) for 7½ minutes

The following scores were derived from this test (a) average of correct answers in fifteen rows, (b) lowest score on ony of fifteen rows, (c) number of inversions in work-curve, i e , number of times score on a row is lower than score on a preceding row, (d) number of scores lower than score in first row, (e) highest score of all

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	17 40	29 22	15 07	30 71	13 49	37 09	1%
b	12 95	23 08	10 08	29 14	8 70	27 89	1%
c	5.27	1 55	5 44	2 25	5 28	1 18	—
d	3 03	14 49	3 84	17 16	3 20	14 04	—
e	20.95	32 90	18 72	40 21	17 46	48 38	1%

(4) *Color-Form*

Test material consists of 36 cards, each containing one of six figures (triangle, circle, half-circle, cross, star, rectangle) in each of six colors (green, yellow, orange, red, purple, blue), so that each figure appears only once in each color Six cards are taken out by

E (each figure being represented only once, and consequently each color also being represented once), and placed in a row before S

"Now, I want you to take these cards [i e, the remaining 30 cards], and taking each one off the top, to place it under the one you think it ought to go below Place them so that you will be arranging them vertically downwards"

Instructions were repeated only if requested, but the answer to "Shall I arrange them in colour or form?" was "Just as you like"

Before starting, the patient was told, "The only thing to remember is that once you've placed a card in a column, you must not change its position You must leave it there"

As the subject started, the stop watch was put on as quietly as possible No allusions to time were made, but if the subject inquired, the answer was "It's not really a timed test, I only want to see how long you take over it"

Scoring Number of cards arranged in *color* order a=% of color answers, b=time in seconds

Special note was made of arrangements of a symbolic nature rather than color or form

N B Inquiries as to color-blindness were made after test.

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a.	3 48	89 30	5 62	130 48	6 70	143 44	—
b	52 91	369 38	86 88	12006	76 86	3272	1%

(5) *Mirror-drawing*

The apparatus was put in front of S, and the process demonstrated—not by E doing the drawing, but by showing the direction of required lines on paper The object to be traced was a diamond, the corners of which were indicated on the paper by dots:

C

B D

A

"What I'd like you to do now is to put this paper here and look at it through the mirror Then, join from here (A), to here (B), then to C, then D, and then back to A" (Subject sees this pointed out on the paper —but *not* through the mirror)

"You must remember to go from A to D in a clockwise way, and always

to keep looking in the mirror It doesn't matter how many apparently wrong lines there are, as long as you get from one point to another in some sort of way You can go any direction, as long as you finally reach ABCD consecutively If you find you are skidding past B, without touching it, you must come back and touch it before you can go on to the next one Now, the most important thing is that whatever happens, and however hopelessly wrong the lines seem, never, never lift your pencil off the paper Just try to remember to keep the pencil on the paper all the way round, until you get back to the starting point All right, let's start"

Repeat instructions if necessary

It was found important to watch the subject throughout very carefully, and constantly reassure and remind "not to lift pencil off paper," also to "keep looking into mirror," etc It really appeared necessary to keep reassuring E g, "You're doing all right, that's fine—you're *nearly* there," etc, because the task seems to be bafflingly more difficult than anticipated and it is important to keep subject "at it" throughout the first trial at least, so as to get the genuine first time round

For level of aspiration After the first trial had been completed, the subject was told his score, i e, told how long the performance had taken Then he was asked to give an estimate of the time he thought he would need to complete the same again After trial number 2, he was asked how long he thought he had taken over that mirror drawing

After the *first* time the subject was never told his true time performance

Each aspiration and judgment was accepted and not queried

Throughout the patient was reassured, and practically everything was tried to sustain his interest throughout the 10 trials required

Answer to the query "Was my guess right?" was "I'll tell you at the end" But by the end trial, the query was never made again, and the matter was dropped Subject was unable to read scoring across table during test

Scoring. All scores are in terms of seconds taken or estimated by S There are 10 P (performance) scores, 9 A (aspiration) scores, and 9 J (judgment) scores. The following scores were derived· (a) average time over ten trials (P score), (b) number of inversions over ten trials, (c) total of 9 J scores, (d) Average

of 9 A scores, (e) time taken over first trial (P score), (f) time taken over longest trial, (g) time taken over shortest trial, (h) A-P for trial giving highest aspiration score, (i) P-J for trial giving lowest judgment score, (j) P-J for trial giving highest judgment score, (k) A-P for trial giving lowest aspiration score

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	18 63	69 31	24 46	283 93	43 48	908 70	1%
b	2 42	1 12	2 58	1 27	2 34	1 17	—
c	21.61	209.26	31 98	805 05	57 80	5402 34	1%
d	2 28	214 90	33 44	992 70	62 53	6011 34	.1%
e	47 65	880 25	66 08	3289 18	122 02	12461 65	.1%
f	48 53	857 93	72 18	3545 54	138 60	13926 49	1%
g	9 21	13 54	10 62	55 79	16 42	172 98	1%
h	− 2 72	297 28	34 74	2180 20	68 20	8656 45	1%
i	−13 68	195 13	−27 48	1944 01	−41 96	3394 45	1%
j	0 90	77 95	0 26	377 75	− 1.34	2546 47	—
k	− 4.07	110 31	− 4 36	655 99	−14 48	5608.34	—

(6) *Social Attitudes*

Verbal instructions Subject was given a 40-item questionnaire (5), and it was demonstrated that his opinion was wanted on the various topics raised, by putting:

√ = for agreement
X = for disagreement
O = for neutral (i e don't know, don't care, rather not give opinion, unsure, etc)
√√ = for *strongly* agree
XX = for *strongly* disagree

The system of response by √, X, O, etc., was made quite clear, as well as the fact that there was no question of "snooping," but rather a genuine interest in subject's all round outlook Occasional refusals were dealt with by pointing out the possibility of O response, and the subjects soon became interested enough to agree and disagree with some questions It was pointed out that the test was not on a time basis, and that they could think about it, taking their time

Mode of testing The tester was actually engaged in marking the work curve during this period but it was made clear that the sub-

ject could discuss the questions at issue if he should be puzzled or need assistance

One-sided discussions frequently took place, in which patient stated views, and tester *always* agreed

Foreign patients had words and meanings explained or translated, always keeping within neutral bounds in answering

No patient was ever rushed into completing the form hurriedly

Question wording was never defended when criticized, but an answer was pressed for in the light of the question "as it stands"

Scoring

E=Emphasis (i e , *strongly* approve or *strongly* disapprove) (a)
Z=Number of 0 (zeros) (b)
R=Radicalism (c)
T=Tendermindedness (d)

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a.	7.33	54 87	4 78	50 54	3 88	59 62	5%
b	3 58	12 77	5 96	29 39	5.24	24 76	1%
c	5 31	5 47	4 22	5 16	4 48	6 46	5%
d	6 16	4 08	7 08	6 08	6 70	4 58	5%

(7) *Concentration*

Verbal instructions

"Now, I'm going to read you some numbers, and I want you to try to remember the last six, in the right order, i e if I read, say 1, 2, 3, 4, 5, 6, 7, 8, then I want you to repeat 3, 4, 5, 6, 7, 8 In the right order, you notice, not backwards The trouble will be that I shall jumble the numbers and that I shan't tell you how many numbers in all I'll read. You'll just have to listen carefully, and try to pick out the last six in the correct order in which I read them If you find you can't remember all six, give me the last four or three," etc (Same instructions for letters, *mutatis mutandis*)

These instructions were repeated if necessary.

Mode of testing While 1, 2, 3, 4, 5, 6, 7, 8 was read, and 3, 4, 5, 6, 7, 8, explained as the answer, no further examples were given No set of numbers was repeated The numbers were read at the rate of one per second, and as far as possible all grouping was avoided.

Instructions were brief for letters, except that the same principle was repeated, and it was explained that the only difference was the fact that now there were letters instead of numbers

Scoring

Eg	M C W X A Q
M C W X A Q	= 6 marks
M W X A Q	= 5 marks
M C A Q W	= 4 marks
M X Q	= 3 marks
A Q	= 2 marks
W	= 1 mark

As long as letters in correct order (irrespective of wrong ones in between) they are scored as correct

Scoring E interrupts reading of list of numbers (and of letters) 8 times, at prearranged place, to get S to repeat last 6 numbers (or letters), thus there are 8 scores for numbers and 8 scores for letters The following were used

(a) total score, numbers, (b) lowest score, numbers, (c) highest score, numbers; (d) total score, letters, (e) lowest score, letters, (f) highest score, letters

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	35 94	29 21	32 12	58 80	32 62	33 18	.1%
b	2 63	1 63	2 34	1 78	2 50	1.52	—
c	5 72	0 26	5 42	0 82	5 52	0 66	5%
d.	33 80	30 40	29 92	68 12	30.06	49.98	1%
e.	2 45	1 20	2 10	1.52	2 04	1 51	—
f	5 62	0.44	5 12	1 13	5 26	0.85	1%

END OF FIRST SESSION

After the concentration test (i e, one-hour session) the session was closed and the subject asked whether he had minded coming, and whether he would consent to come the following day An appointment was made for the second session

When the patient took over one hour, the session was generally drawn to a close earlier on, the criterion being tested for not over *one hour,* rather than the number of tests covered However, the break between sessions was predominantly after the concentration test

When the session was ended before the concentration test, this was given at the beginning of the second session, and if further delay was caused by this and it was impossible to draw the second session to a close after an hour without leaving out some tests, these were continued in a third session

(8) *Expressive Movements*

(a) *Copying prose* A newspaper containing a letter to be copied was placed before the subject, who was asked to copy it He was not told that it was timed, but if queried, the answer was "I don't want you to go as fast as you can, I just want to see how long it takes you" No directions were given as to how and where to write it

Text to be copied

I have just returned from a three weeks' holiday in Eire, the first for 23 years One thing struck me about the attitude of my fellow countrymen, their obvious goodwill towards England! Everywhere in Eire I found that the prestige of this country was sky-high The old bitter feeling against England seems to have gone completely

Scoring

Two scores were used (a) area of writing in cm^2, (b) time in seconds

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	179 43	2573 08	176 70	2686 70	197 34	3056 02	–
b	250 03	5950 74	233 32	7135 53	251 72	9849 84	–

(b) *Three circles* The subject was handed a clean piece of paper and asked to draw three circles No directions given as to size or whereabouts No questions answered "Just as you like" to all queries

(c) *Three squares* The paper with the circles on was reversed and the subject was asked for three squares on other side Similarly no queries answered

Scoring. "Three circles" was scored for (a) time in seconds, (b) largest diameter, (c) smallest diameter, (d) average diameter

of all circles "Three squares" was scored for (e) time in seconds, (f) largest diagonal, (g) smallest diagonal, (h) average diagonal

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	6 92	33 10	10 92	91 50	14 88	306 27	1%
b	19 75	181 72	29 48	553 60	41 82	1229 13	1%
c.	16 32	144 46	20 34	217 70	30 90	542 38	1%
d	18 14	180 12	24 92	308 77	36 22	796 62	1%
e	9 52	46 05	17 04	161 67	19 16	205 20	1%
f	26 89	324 83	40 92	1026 48	52 10	1660 42	.1%
g	22 86	243 48	30 42	600 25	37 36	476 44	1%
h.	24.91	281 30	35 46	690 29	44 02	798 35	.1%

(d) *Size estimation—pound note* On a clean sheet of paper, the subject was instructed to "draw the size of a pound note—just draw what you remember approximately to be the size of the pound note" No questions answered No timing (No ruler)

(e) *Size estimation—half crown* On the same sheet, the size of half a crown was requested Same as (d) No questions answered, etc

Scoring For pound note (a) largest diagonal For half-crown. (b) largest diameter All measures in mm

	Controls		Schizophrenics		Depression		Significance
	M	V	M	V	M	V	
a	149 07	433 84	156 76	1050 10	152 96	613 67	—
b	32 28	26 38	36 92	64 69	35 38	42.24	1%

(f) *Fewness of lines.* Subject was given a clean sheet of paper, with two parallel lines drawn on it, five inches apart "I want you to draw lines across, between these two lines" Answer to "How many?" was "Just as you like" No questions answered, and no ruler allowed

Scoring (a) Number of lines, (b) time taken

	Controls		Schizophrenics		Depression		Significance
	M	V	M	V	M	V	
a	14 51	159 59	14 10	78 13	10 60	18 78	–
b	39 94	1094 76	48 12	1519 94	35 74	370 36	–

(g) *Slowness of writing* Two lines were drawn (on back of sheet with £1 and 2/6 drawn), approximately ¾ inch apart, and subject was instructed to WRITE the word YEAR somewhere in between the two lines "Do not print it—write it out, and try to go as SLOWLY as possible" This latter remark was repeated several times until the true meaning penetrated The tail of the "Y" was allowed to dip below the lower line

Scoring (a) Length of word measured in mm, (b) time in seconds

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	29 01	204 52	39 34	914 60	44 98	805 37	1%
b	41 16	1792 66	33 86	1254 90	35 92	2453 79	–

(h) *Reading prose* The subject was asked to read aloud a piece of prose, i e, the letter he had previously copied from the paper

Scoring

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	19 95	10 82	23 24	37 66	23 62	38 04	1%

(i) *Measuring distances* The subject was asked to indicate what he considered a two-foot distance by placing two matches two feet apart on the table. Then one foot, then eight inches, so that there were four matches on the table, and no distance had yet been measured.

Where distance ab=2 feet
bc=1 foot
bd=8 inches

Then the distances were measured and recorded *N B* The subject *was* allowed to *change* his mind *before* the measuring

Scoring (a) Overestimation, on all 3 tests together, in ¼ inch units; (b) underestimation as above [Scores underestimated are counted zero in (a), scores overestimated are counted zero in (b)], (c) error in 8 inch estimate, regardless of direction, (d) error in one-foot estimate, (e) error in two-foot estimate, (f) total error

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a.	5 94	88 56	17 54	597 27	10 52	366 26	1%
b	10 21	170 83	8 66	240 15	10 00	145 31	–
c	31 13	16 82	34 66	41 17	31 76	33 04	1%
d	47 34	32 77	51 10	101 89	49 06	55 73	5%
e.	43 36	110 58	49 00	358 78	45 70	228 05	–
f	16 15	140 45	26 30	573 03	20 52	307 28	1%

(j) *Numbers* On a separate sheet the subject was asked to write the numbers from one to twenty To the query "Do I write them vertically or horizontally?" the reply was "Whichever way you like"

Scoring (a) Total length of writing, from first stroke of *1* to last stroke of *20,* in minutes, (b) total time, in seconds, (c) shape —horizontal scored 1, vertical scored 0

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	182 43	2801 14	188 04	2454 00	213 90	4488 26	1%
b	18 02	16 97	20 62	166 69	20 66	41.86	–
c	0 77	0 18	0 78	0 18	0 88	0 11	–

(k) *Waves* Squared paper, with V's marked at the precise places, a, b, c, and d respectively, was given to the subject

The procedure was explained to him and simultaneously demonstrated on rough paper I e, "You see this V here; well, I want you

to trace over it so (demonstrate), and then to close your eyes and draw *six*, the same, along the line But you must remember to keep your arm up all the while, so that *only* your pencil touches the paper" Repeating this constantly, the test was started

When "a" was done, paper was put over the first set of waves before subject opened eyes, so that he would not see which course his effort was taking until all four were completed

When "b" was started, the direction of the waves was pointed out again, and the request to "keep your arm up" was repeated

Then "b" was covered, and "c" was started Similarly for all four It was found necessary to cover the waves as they were drawn, sliding the paper along, so that if the subject unexpectedly opened his eyes, the waves were covered If he went off the paper, he was guided back on

Constant reminders were given to "keep your arm up—off the paper—and your hand—and your fingers too," etc No time scores taken

Scoring. All measures are in terms of wave amplitudes To measure amplitude, draw line across top of V, and connect midpoint to bottom of V This last line is the amplitude of the wave (a) Average of first and last amplitudes of four sets of waves (i e of eight measures altogether), (b) first amplitude, first set, (c) last amplitude, first set, (d) first amplitude, second set, (e) last amplitude, second set; (f) first amplitude, third set, (g) last amplitude, third set, (h) first amplitude, fourth set, (i) last amplitude, fourth set, (j) average wave lengths of all four sets, measured parallel to edge of paper

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	22 38	14 58	24 72	30 61	28 68	30 96	1%
b	22 27	14 20	23 46	21 48	27 62	25 22	1%
c	20 71	32 41	22.52	48 42	29 30	104 50	1%
d	22 90	16 17	23 90	21 07	27 20	17 43	1%
e	22 25	33 00	23 98	49 53	29 48	63 07	1%
f	23 30	19 02	24.34	29 74	27 82	22 93	1%
g	23.06	35 88	26 16	86 75	31 62	57 63	1%
h	27 73	14 20	23 34	21 70	27 28	25 72	1%
i	21 96	39 59	24 42	68 37	29 56	112 54	1%
j.	89.29	440 90	100 00	744 20	117 84	1182 14	1%

(9) *Perseveration* (2)

(a) Demonstrating on rough paper while instructing "Now I want you to write a series of S's so—SSSSSSSS, etc., then, when I say change, you go on to the next line and write a series of *S*'s reversed, so— ƨ ƨ ƨ ƨ ƨ ƨ ƨ ƨ etc Then, when I say change again, you go on to the next line, and write one of each—you alternate one *S* and one ƨ , etc , so— SƨSƨ , continuing until I stop you" Instructions repeated only if necessary Paper given to subject horizontally placed, in order that there should be more room for the sets of *S* and ƨ etc

Scoring Call 15 seconds writing of SSSS Period A Call 15 seconds writing of ƨ ƨ ƨ ƨ ƨ ƨ Period B Call 30 seconds of writing SƨSƨS Period C Then score=$\frac{A+B}{C}$

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a.	144 72	2179 54	146 96	2592.61	152 88	2352 43	–

(b) *Ready* On the same sheet of paper (or if no room, on the other side), subject was instructed to write the word "Ready" until stopped "Just continue writing: Ready, Ready, Ready, etc , until I say change, then go to the next line writing it backwards, so—starting with *y* and writing from right to left, finishing with *r* Demonstrate on rough paper.

After repeating this, and stressing that it is not "ydaer" that is wanted and explaining the correct way, the test was started. Timing 30 seconds for writing forward (Period X), 30 seconds for writing backward (Period Y)

Scoring

Score is *X* (each letter completed=0 2)
Y (each letter half-completed=0 1)

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
Score	63 58	559 68	70 46	862 17	79.08	1789 79	5%

(10) *Abstractions*

"I'm going to show you a card, and on it there are a number of different letters Some of these letters will be straight, some upside down, and others skewed What I want you to do is to try to fix them in your memory so that later, when I take the card away, you can draw the letters you remember, where they were, and exactly which way up they stood" No demonstration, but repetition of these instructions until subject fully understood

Showing card for 15 seconds, the tester briefly repeated the orders· "The letters, what they were, where they were, and which way up!" The subjects were asked to draw the letters as soon as the 15 seconds were up and the card had been removed

Original Card

Then, when subject insisted that he had remembered all that he could and coaxing evidently no longer added any letters, he was told, "Right, That's very good Now can you remember that these letters were colored?" Just write down the color of each letter as it was on the card, putting the appropriate color next to each letter"

Subjects were encouraged to put a color in for each letter, even if it was evidently a pure guess They were told, "It doesn't matter if you are not quite sure, just take a guess at them if you can't remember," etc

No time limits Card shown to subject after test *only* if specially requested

Scoring	Letter Score.
Correct letter, correct place, correct orientation	1 mark
Correct letter, correct place, wrong orientation	½ mark
Correct letter, wrong place, wrong orientation	¼ mark
Wrong letter, correct place, correct orientation	0 mark
	Color Score
Correct color	1 mark
Wrong color	0 mark
Correct color, right place (but no letter)	1 mark

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a Letters	16 66	17.06	14 88	19 98	13 04	18 73	1%
b Color	1 52	1 48	1 28	1 72	1 14	1 06	——

(11) *Tapping*

Tapping with a pencil on a sheet of paper for 15 seconds The score was the number of taps made The instructions were *not* to tap as fast as possible, the score therefore represented natural tempo rather than maximum rate

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a.	75 67	184 28	66 76	260 84	69 42	285 68	1 0%

(12) *Reversal of Perspective*

Plain card—with Necker cube drawn—such that all lines are thick and even

The card was shown to the subject, and it was patiently explained that there are two ways of looking at it The ways were traced out on the card with the reverse end of a pencil and it was explained that the phenomenon is quite commonplace and well-known The instructions, or explanations, were continued until patient exclaimed that he had "got it" The discovery is evidently always sudden, so that a gradual "Mm—I see!" indicates precisely that he does not yet see, whereas a sudden "Ah! I saw it then" is more like it All other "shapes," "patterns" etc, were repudiated, saying that these were quite irrelevant, and the two required ways were again described Then—"Now, I want you to hold the card straight on the table before you and to tell me every time you see the cube change from one position to the other, and then again when it changes back again That is, just say 'change' every time there is a reversal"

The number of reversals during 30 seconds was counted Score (a)

"Next, I want you to try to make it change as often as possible Again say 'change' for every reversal"

Count number of reversals for 30 seconds Score (b)

"Next, I want you to try to *stop* the cube from reversing try to keep it fixed in one way, and don't let it reverse If it reverses, however, let me know, say 'Change' again, and then try to keep it in the new position without changing"

Count number of reversals for 30 seconds Score (c)

"Now, lastly, I want you to do as you did the first time—just watch the cube, and tell me the number of times it changes, i e, don't try to hurry it or try to stop it from changing, just watch it as you did the first time"

Count number of reversals for 30 seconds Score (d)

Stop watch was stopped if subject evidently gazed into space, at tester, out of window, or elsewhere He was reminded of the test and the instructions, and the watch was again started

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	7 56	41 82	6 24	35 82	5 16	24 14	—
b	16 90	212 21	11 26	119 22	10 74	104 48	1%
c	2 93	6 21	2 44	7 31	1 46	3 52	1%
d	7 41	44 67	4 56	14 01	4 72	36 78	1%

(13) *Tracing Test*

The apparatus (2) was placed in front of the subject, and the process demonstrated while explaining The task consists in tracing with a metal stylus between rows of holes marking out a path

"This pointer is connected by a battery to a bell which rings whenever the pointer goes into one of these holes What I want you to do is to trace in between the holes, along this line, as quickly as you can, but not going into any of the holes When the bell rings, it means you have gone into some hole, and this counts as a mistake The aim is to go as quickly as you can and to make as few mistakes as possible"

The subject was told to hold the pointer in the right hand (unless left handed), the wire of the pointer in the left hand (unless left handed), and to keep the right arm up, as in the "Waves" test (unless left handed)

No practicing was permitted

Level of aspiration After the first trial, subject was told how long this had taken and how many errors had been incurred (Only actual bell rings were counted as errors) The subject was told this last piece of information and asked how long he thought the next trial, doing the same thing, would take, and how many errors he thought he might make After the second effort he was asked

how long he thought he had taken and how many errors he thought he had made This procedure was repeated five times, so that there were six trials in all Much encouragement was given, and great care was taken that no subject gave up, either during a trial or before the six were completed

Scoring There are 6 scores for each of the following P_e (actual number of errors made per trial), P_t (actual time taken during trial) There are 5 scores for each of the following· A_t (aspiration regarding time), A_e (aspiration regarding error), J_t (judgment regarding time), J_e (judgment regarding error) The following scores were computed from these.

(a) Total of 5 A_t scores, (b) highest A_t score, (c) total of 5 A_e scores, (d) highest P_t score, (e) total P_t score, (f) total J_t scores, (g) lowest J_t score

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a.	182 13	4566 78	236 86	10361 55	240 66	15753.54	1%
b	403 80	63 07	411 58	321 47	410 64	314 11	1%
c	17 18	287 22	19 74	333 22	15 38	180 73	–
d	49.66	251 88	66 54	2918 38	59 64	588 36	1%
e	242 48	5876 29	291 06	23644 20	281 78	10943 07	5%
f	188 79	4727 12	247 24	21246 27	242 90	15051.24	1%
g	95 49	70 31	89 26	207 34	89 06	243.00	1%

(14) *Suggestibility*

Verbal instructions (2) "Now if you will come over here, I should like to see how straight you can stand"

The apparatus was merely a length of thin string, with a weight and a pointer on one end, and a safety pin on the other, running over two ring screws to give a pulley effect

Pre-test· when the patient had his back to the scale (and wall) and had the pin (and string) attached to the back of the shoulder he was told "Now just close your eyes, and see how still you can stand" The amount of sway was read off on the scale, any upward motion of the pointer denoting a forward sway, and the downward movement of the pointer showing a backward sway. This pre-test takes 30 seconds.

Scoring Both forward and backward sway were recorded as separate scores

Forward sway +

Backward sway —

The patient was encouraged to relax during this test, but was told to keep his arms by his side

Next the subject was told to stay where he was, and to listen to a gramophone record to be played "Just stand quite still, as you did just now, be quite relaxed, and listen carefully to the record, close your eyes, please"

The record was then played and the amount of sway noted down, +'s for forward and —'s for backward sway

The record was played out to the end, even in spite of protests If the patient opened his eyes, he was told to close them again, but if any real sign of fear or hysteria was observed, the record was stopped and a note made of the circumstances

If a patient fell, 9 units was scored, and the record immediately stopped All scores are in ½ inch units I e , 4½ inches was scored as 9 Two patients refused the test and were scored zero

Scoring (a) Pre-test sway forward, (b) pre-test sway backward, (c) sway forward, (d) sway backward Each score is *maximum* sway in given direction.

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
a	1 03	1 22	1 18	1 38	1 46	2 99	—
b	0 56	0 69	0 82	1 05	0 72	1 18	—
c	1 42	3 76	1 54	4 66	1 44	3 76	—
d	1 00	1 37	1.28	2 45	1 22	1 93	—

(15) *Persistence* (2)

The subject was *reseated* in his own chair, and another chair was placed in front of him He was asked to put one leg over the chair and raise it so that it did not touch the chair "Now just keep your leg up there; see how long you can manage it" The subject was told he could move the leg about, i e , he need not keep it rigid as long as it never once touched the chair even slightly

Scoring The time was recorded to the nearest second *N B* The subject was constantly encouraged and told how well he was doing, and in answer to "Can I put it down now?" he was told, "You're doing fine—just carry on a bit longer" Permission to end was never given, but when the leg touched the chair, or the patient definitely decided and the leg dropped, touching the chair, the stop watch was stopped, and he was told how well he had done

	Controls		Schizophrenics		Depressives		Significance
	M	V	M	V	M	V	
Score	112 74	4557 65	104 72	7266 37	138 72	23821 14	–

Certain general statements appear warranted by the results given so far In the first place, the large number of significant differences shows that the three groups tested are very unlikely to have come from a single universe, there is good reason to believe that the selection procedures have been successful in giving us subjects showing much greater heterogeneity than would have been expected by chance

In the second place, it appears that on the majority of tests, the schizophrenic group scores somewhere between the normal and the manic-depressive group Out of 38 test results significant at the 1% level, only six show exceptions to this general tendency In other words, it would appear as if we were dealing with one continuum, ranging from normal through schizophrenic to manic-depressive This point will be taken up again later, when further data are being adduced to throw some light on this point

In the third place, it is clear even from a casual inspection of the data that the variances in the psychotic groups are considerably larger than those in the normal groups, there is also a tendency, although less strongly marked, for variances in the manic-depressive group to be larger than in the schizophrenic group

In the fourth place, it is interesting to note that those tests which had in past work been shown to have high correlations with neuroticism, or to discriminate well between normals and neurotics, do not show even a tendency to discriminate between normals and psychotics We might mention here such tests as persistence, body

TABLE II

Test	Controls	Psychotics	
	Age	Age	Sex
1a	085	124	133
1b	191	.114	− 224
1c	118	− 102	245
1d	015	− 016	084
2a	042	053	077
3a	147	− 188	179
3b	139	− 162	180
3c	− 158	− 042	− 210
3d	−.200	− 119	− 089
3e	133	− 150	132
4a	062	105	− 134
4b	033	065	− 048
5a	029	502	− 117
5b	020	− 014	− 046
5c	046	328	− 154
5d	049	.341	− 160
5e	149	425	− 123
5f	140	451	− 122
5g	−.093	.384	−.077
5h	152	324	− 120
5i	− 159	−.199	146
5j	− 013	− 055	120
5k	001	− 075	− 132
6a	− 089	061	.152
6b	025	− 072	002
6c	− 016	− 057	.082
6d	− 012	054	− 154
7a	112	− 019	056
7b	.091	031	038
7c	167	− 025	070
7d	124	− 038	.046
7e	− 075	− 048	075
7f	139	− 050	055
8a,a	051	121	052
8a,b	− 117	158	110
8b,a	022	338	− 126
8b,b	030	278	066
8b,c	.044	286	−.028
8b,d	020	292	025
8c,e	119	309	− 061
8c,f	.040	292	144
8c,g	069	235	056
8c,h	053	.281	109
8b,a	.156	.042	197
8e,b	.196	177	.079
8f,a	− 017	− 158	084
8f,b	066	091	−.035
8g,a	163	111	− 165
8g,b	055	027	033
8h,a	053	281	109
8i,a	− 087	− 106	− 118
8i,b	098	006	040
8i,c	− 118	− 170	− 124
8i,d	− 111	− 075	− 145
8i,e	− 094	− 041	− 068
8i,f	040	− 106	− 095
8j,a	130	230	063
8j,b	002	118	− 082
8j,c	196	087	018
8k,a	172	394	139
8k,b	181	446	010
8k,c	116	391	093
8k,d	071	368	026
8k,e	080	375	134
8k,f	112	351	064
8k,g	150	373	039
8k,h	192	453	115
8k,i	136	302	065
8k,j	− 038	313	− 054
9a	121	087	000
9b	− 109	088	129
10a	− 130	− 074	− 056
10b	− 037	− 191	036
11a	036	− 061	137
12a	− 062	− 242	094
12b	003	− 216	094
12c	021	− 256	− 022
12d	− 051	− 096	135
13a	− 106	112	− 187
13b	− 030	− 028	− 179
13c	069	− 162	001
13d	002	046	− 087
13e	− 050	124	− 061
13f	− 108	071	− 175
13g	061	455	165
14a	− 068	137	− 227
14b	− 099	− 055	− 014
14c	− 085	− 073	079
14d	− 090	−.076	− 099
15a	070	188	− 103

Correlations between tests, and age and sex, for normals and psychotics respectively

sway (with and without suggestibility), perseveration, work-curve inversions, and the word-connection test The implications of this finding are too obvious to require elaborate discussion, they suggest that neurotic and psychotic states lie along different continua, and that objective tests of the kind described could with advantage be used in differential diagnosis where the question of neurosis or psychosis arises

In the fifth place, is is clear that neither the color-form test (4a) nor the dissociation test (10b) gives results which support Kretschmer's hypotheses There are no significant differences with respect to these tests, and the actual figures are not even suggestive of any such differences as he predicted It is possible that the tests used by us were unsuitable for a relatively high-grade group of subjects and that with tests better suited to their level more significant results might have been obtained While such an argument cannot be gainsaid, there is no evidence to favor such speculation in our results

In the sixth place, it is apparent that there are a number of personality traits which distinguish the normal from the psychotic group at or below the 1% level We may perhaps briefly summarize these, emphasizing of course that the terms used here should be understood to bear the operational connotation imposed upon them by the actual tests used We find then that psychotics are less fluent (tests 1a, 1c), perform poorly in continuous addition (3), perform poorly in mirror drawing (5), show slower oscillation on the reversal of perspective test (12), are slower in tracing with a stylus (3), are more undecided with respect to social attitudes (6), show poorer concentration (7), have a poorer memory (10), tend to make larger movements (8b, 8c, 8g, 8k) and to overestimate distances and scores (8e, 8i), tend to read more slowly (8h), and to tap more slowly (11) and to show levels of aspiration much less reality-adapted (5) [4] Those who would argue that of course psychotics are poorer in all tasks than are normals, and that con-

[4] This can be seen most clearly by taking the differences, for each of the three groups, between performance and aspiration, and between performance and judgment These are 3 65, 8 98, and 19 05 (A - P), and 2 98, 7 52, and 14 32 (J - A) Adding these figures gives total difference between performance on the one hand, and aspiration and judgment on the other 6 63, 16 50, and 33.37 It will be clear how very much more psychotics are influenced by autistic factors in their aspirations and judgments than are normals

sequently these results are hardly surprising, will have to explain why on those tests set out in the next paragraph no significant differences occurred, and also why no such differences were observed with respect to the tests enumerated under point four above

In the seventh place, no differences were observed with respect to a number of tests other than those mentioned under number four These are time of writing (8a, 8g, 8j), number of lines drawn (8f) Occasionally, tests under the same general classification gave conflicting results, thus, under the heading of Fluency, tests Flowers and Words showed no significant differences, while tests Birds and Animals did Similarly, when both the best and the worst of a series of scores on a test were scored separately, different results were sometimes obtained As an example, we may select test 7, Concentration, where two subtests are used, Letters and Numbers, each consisting of eight separate scores which are added to give total scores It will be seen that for both Letters and Numbers, the lowest scores (7b and 7e) do not give significant differences, while the highest scores (7c and 7f) give significant differences This phenomenon could with advantage be studied separately, its implications are, presumably, that while normals often do as poorly as psychotics on a single trial, psychotics hardly ever do as well as normals even on a single trial

This completes our brief summary of the isolated results of the experiment, and we must turn now to the study of the patterns of intercorrelations by means of criterion analysis

Criterion Analysis

In view of the fact that not all the tests used gave highly significant results, and as many of the scores used were not experimentally independent of each other, 20 tests in all were selected for the factorial study These tests are given in Table III, fuller descriptions can be found in each case in the previous section Also given in this Table are the point biserial correlations of each test with the following dichotomies (1) controls vs depressives, (2) controls vs schizophrenics, (3) schizophrenics vs depressives ($C_{s,d}$), (4) controls vs psychotics ($C_{n,p}$) The product-moment intercorrelations for these 20 tests are given in Table IV for the normal (control) group, and in Table V for the psychotic group

TABLE III

	I	II	III	IV	V	VI
	Test	Score	$r_{c,d}$	$r_{c,s}$	$r_{s,d}$	$r_{c,p}$
1 Overestimation in distance judgment	8,1	a	− 160	− 325	159	− 233
2 Fluency—animals	1	c	397	233	189	328
3 Social attitudes—zero responses	6	b	− 189	− 255	070	− 222
4 Reading prose—time in secs	8,h	a	− 364	− 332	− 031	− 335
5 Three circles—time in secs	8,b	a	− 322	− 254	− 140	− 268
6 Concentration—numbers	7	a	274	279	− 037	281
7 Tapping—15 secs	11	a	197	280	− 081	244
8 Mirror drawing—J scores, average	5	c	− 364	− 237	− 228	− 271
9 Perspective reversal—slow	12	c	290	090	208	199
10 Perspective reversal—last normal	12	d	193	224	− 016	229
11 Abstractions—letters remembered	10	a	379	195	207	301
12. Three squares—largest diagonal	8,c	f	− .397	− 272	− 152	− 322
13 Track tracer test—J scores, total	13	f	− 274	− 265	016	− 257
14 Work curve—lowest score	3	b	376	262	129	332
15 Largest diameter size estimation—half-crown	8,e	b	− 253	− 332	106	− 294
16 Numbers 1-20, length of writing	8,j	a	− 250	− 051	− 216	− 162
17 Expressive movements—average length of waves	8,k	j	− 459	− 213	− 279	− 341
18 Expressive movements—average amplitude	8,k	a	− 556	− 242	− 339	− 402
19. YEAR—length of writing	8,g	a	− 353	− 228	− 097	− 275
20 Suggestibility—body sway forward	14	c	− 005	− 028	025	− 018

Columns I and II give reference to tests in section three of this paper Columns III to VI give point biserial correlations of 20 tests with dichotomies Control-Depressive (col III), Control-Schizophrenic (col IV), Schizophrenic-Depressive (col V) and Control-Psychotic (col VI) Columns V and VI are the two-criterion columns mentioned in section one $C_{s,d}$ and $C_{n\,p}$

These two tables were factor analyzed by means of Thurstone's centroid method Thurstone's method of sign reversal was used until all the column sums were positive, this was followed by reflection of pairs of columns in accordance with Holley's criterion (6) Two factors were extracted from each of the tables, this number was decided by means of the following method (1) A one-factor solution was assumed and iterations made until the communalities from the last two iterations were all within ± 005, when the first factor residuals were calculated Twenty-eight and 22 of these were above the 05 level of significance in the two tables, where 19 would have been expected, 12 and 8 respectively were above the 01 level, where 4 would have been expected It was therefore decided to extract a second factor (2) A two-factor solution was assumed and iterations carried out until the last two agreed within ± 001 The second-factor residuals were then cal-

TABLE IV

Correlations Control Group

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1		+ 112	036	− 082	− 011	109	− 128	024	− 089	− 073	065	089	− 117	062	− 080	036	179	081	− 015	004
2			− 084	− 190	− 199	432	156	− 107	065	− 026	252	− 043	− 121	300	106	239	080	045	255	− 070
3				− 008	018	061	056	222	− 228	− 153	− 007	083	− 109	− 081	− 070	005	− 103	097	− 073	039
4					192	− 307	− 155	156	006	005	− 153	284	180	− 337	070	− 059	055	100	210	− 041
5						− 038	− 043	098	− 136	011	− 077	491	037	− 054	063	106	065	− 089	116	− 168
6							214	− 139	000	− 003	298	113	− 177	276	106	281	033	− 022	120	− 071
7								− 076	− 015	045	107	− 149	− 206	028	124	079	− 013	− 041	072	045
8									− 161	− 180	− 115	041	010	− 233	067	− 003	− 023	017	− 056	068
9										340	− 163	− 161	− 141	011	− 110	054	017	− 113	115	033
10											003	− 021	− 072	− 022	− 052	− 033	058	− 050	044	121
11												− 045	− 121	252	227	136	− 057	− 132	022	− 015
12													191	004	140	404	232	047	183	040
13														− 154	008	102	187	239	− 080	− 049
14															− 097	085	− 085	− 136	− 156	− 028
15																249	055	064	166	− 056
16																	068	− 016	187	− 150
17																		328	091	− 034
18																			095	042
19																				− 015

TABLE V

Correlations Psychotic Group

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1		− 106	− 138	020	023	− 011	083	005	− 129	− 163	− 098	− 183	054	− 087	165	007	139	089	069	− 004
2			113	− 163	026	269	250	− 189	101	255	337	155	− 077	280	144	032	− 304	− 170	173	032
3				004	052	042	− 061	− 147	− 099	− 103	145	− 027	− 129	031	− 140	162	− 007	− 022	129	012
4					086	− 173	− 252	053	002	− 090	− 094	103	303	− 290	252	061	113	214	− 034	094
5						048	− 206	135	− 133	− 088	− 141	406	133	− 240	018	083	122	240	342	− 033
6							173	− 293	091	134	298	− 070	− 242	272	− 117	090	− 172	− 230	269	+ 140
7								− 163	112	139	139	− 066	− 196	138	− 022	− 001	004	− 032	060	014
8									− 025	005	− 215	− 014	122	− 198	− 109	− 022	085	148	− 125	− 055
9										295	270	− 094	018	195	− 089	− 100	− 140	− 224	− 102	183
10											119	− 090	− 193	203	− 101	− 031	− 214	− 129	− 045	029
11												− 069	− 124	176	− 005	027	− 295	− 326	072	− 157
12													− 069	− 080	288	049	012	144	107	144
13														− 200	258	− 060	127	143	238	− 096
14															039	− 141	− 153	− 132	− 018	077
15																084	023	146	065	014
16																	280	145	332	− 074
17																		535	199	+ 011
18																			064	046
19																				− 180

culated, and in both tables 8 and 2 respectively were found to be significant at the 05 and 01 levels, where 19 and 4 would have been expected by chance The analysis was terminated at this point Factor saturations are given in Table VI together with the communalities

TABLE VI

TWO-FACTOR SOLUTION, UNROTATED, FOR NORMAL AND PSYCHOTIC GROUPS

	NORMAL GROUP			PSYCHOTIC GROUP		
	F_n	F'_n	h^2_n	F_p	F'_p	h^2_p
1	025	200	041	170	044	031
2	− 295	502	339	− 379	361	274
3	117	052	016	− 060	183	037
4	.487	− 163	264	363	− 165	159
5	386	064	153	396	196	195
6	− 343	679	579	− 375	432	327
7	− 207	177	074	− 290	226	135
8	348	− 034	122	276	− 330	185
9.	− 251	− 228	115	− 373	− 228	191
10	− 155	− 128	040	− 373	− 064	143
11	− 242	370	195	− 448	170	230
12.	613	434	564	174	171	060
13	339	− 049	117	425	− 124	196
14	− 465	273	291	− 497	142	267
15	.090	.271	082	244	121	074
16.	065	481	236	183	357	161
17	228	172	082	509	156	283
18	308	068	099	537	120	303
19	076	201	046	202	579	376
20	001	− 051	003	− 034	− 099	011

We now have available the data with which to test our hypothesis As shown in section one, Kretschmer's hypothesis requires that the two sets of factor saturations should be proportional to each other We must therefore correlate F_n with F_p, and F_n' with F_p', the hypothesis requires that these two correlations should be significantly positive. In actual fact they are +0 871 and +0 768, it appears therefore that this deduction is borne out by the facts Both factor patterns are remarkably alike

The next deduction to be tested relates to our Hypothesis I, and states that F_n and F_p should both be proportional to $C_{n,p}$ The respective correlations are +0 899 and + 954 Again we find our deduction verified, and it would appear that psychotic states do in fact form a continuum with normal mental states Our last deduc-

tion relates to Hypothesis II, and requires that F_n' and F_p' should both be proportional to $C_{s,d}$ The correlations in question are 014 and — 089, and it will be clear that in this case the deduction is not verified It would appear to follow that schizothymia-cyclothymia does not exist as a separate dimension of personality [5]

Before accepting this negative conclusion, however, it would appear desirable to study the possible effects which rotation might have on the emergence of a factor of the kind we are looking for As has been pointed out in the original paper on criterion analysis (3), one feature of this method is the rotation of factors, not into simple structure as in Thurstone's system, but into maximum correlation with the criterion column As we have two criterion columns in the present study, two separate and different rotations are possible for each of the two matrices (1) rotation such that a vector is found which, in the two-factor space, coincides as nearly as possible with the projection of the $C_{n,p}$ column on that space, and (2) rotation such that a vector is found which, in the two-factor space, coincides as nearly as possible with the projection of the $C_{s,d}$ column on that space In either case, the second factor is calculated by keeping it orthogonal to the factor first extracted Table VII gives the rotation of the two factors in both matrices such that maximum correlation with $C_{n,p}$ is found, while Table VIII gives the rotation of the two factors in both matrices such that maximum correlation with $C_{s,d}$ is found

Rotation as given in Table VII does not appear to alter conditions to any great degree Correlations between F_n and F_p and F_n' and F_p', are now 860 and 793 respectively Correlations of F_n and F_p with $C_{s,d}$ are still quite insignificant Rotations given in Table VIII are rather more interesting Correlations between (F_n) and (F_p) and (F_n') and (F_p'), are now 825 and 833 respectively Correlations of (F_n) and (F_p) with $C_{s,d}$ are now 615 and 684, which seemingly indicates that here we do have some justification for speaking of a schizothymia-cyclothymia factor But this putative factor can be shown to have no real meaning when we compute

[5] No attempt is made here to interpret F_n' and F_p' Such interpretation could be speculative at best and could serve little useful purpose The possibility that this second factor may be related to the personality dimension extraversion-introversion (2) has been considered, but until the tests most highly saturated with factor two have been included in the same battery with other tests known to measure E-1, no such view could be put forward with any confidence

TABLE VII

FACTOR SOLUTION ROTATED TO MAXIMIZE CORRELATION WITH $C_{n,p}$

	NORMAL GROUP		PSYCHOTIC GROUP	
	F_n	F'_n	F_p	F'_p
1	− 040	198	− 174	024
2	256	523	335	402
3	− 121	043	039	189
4.	−.473	− 199	− 342	− 205
5	− 390	035	− 416	149
6	291	703	323	472
7	193	.192	.262	257
8	− 344	− 060	− 236	− 359
9	267	− 208	396	− 183
10	162	− 116	378	− 021
11	214	387	425	220
12.	−.644	387	−.192	.149
13	− 334	− 074	− 408	− 172
14.	443	.307	477	198
15.	− 110	263	− 256	.092
16.	− 101	475	− 222	334
17	− 240	154	− 523	.097
18	−.312	044	− 547	058
19	− 091	195	− 267	552
20	003	− 050	045	−.094

TABLE VIII

FACTOR SOLUTION ROTATED TO MAXIMIZE CORRELATION WITH $C_{s,d}$

	NORMAL GROUP		PSYCHOTIC GROUP	
	(F_n)	(F'_n)	(F_p)	(F'_p)
1	− 076	187	−.174	− 025
2	.156	.561	212	.479
3	−.126	.020	− 015	.192
4	−.429	− 283	− 272	− 292
5	−.389	− 037	− 441	029
6	157	744	181	543
7.	154	.224	181	.320
8.	−.327	−.122	−.128	−.411
9	.301	−.156	432	−.067
10	.181	− 084	369	084
11	139	420	.349	.329
12	− 704	262	− 226	.091
13	−.315	− 134	− 345	− 278
14	379	.383	405	322
15	−.157	239	− 272	018
16	−.186	448	− 306	260
17	−.264	.108	−.530	− 051
18	− 315	− 013	− 542	−.095
19	− 125	.175	−.409	457
20	012	− 050	069	−.078

the correlation between $C_{n,p}$ and $C_{s,d}$, which turns out to be 581 This is simply a confirmation of a point made before, viz., that differences between schizophrenics and manic-depressives tend to be in the same direction as differences between normals and schizophrenics, and that therefore the schizophrenic group tends to be intermediate between the others In other words, the correlations of (F_n) and (F_p) with $C_{s,d}$ appear due entirely to the correlation of $C_{s,d}$ with $C_{n,p}$, and again we find no evidence whatever for the existence of a schizothymia-cyclothymia factor

This conclusion, like others in this paper, should not be taken as in any way definitive It is possible that a selection of tests which gave more scope to schizophrenic-depressive differences might produce results more in line with Kretschmer's hypothesis, although the fact that tests of his which were included did not succeed in making this discrimination makes it somewhat unlikely that very different results would be reached with a different selection of tests It is perhaps significant that wherever results in this experiment are positive, they are very decidedly so, and where they are negative, they are equally decidedly negative; the support for the first hypothesis investigated, and the failure to find any support for the second hypothesis, are equally impressive in their finality

Summary and Conclusions

Two hypotheses were investigated in this paper (I) The functional psychoses (schizophrenia and manic-depressive insanity) are not qualitatively different from normal mental states, but form one extreme of a continuum which goes all the way from the perfectly normal, rational to the completely insane, psychotic individual (II) The two main functional psychoses show patterns of traits which are observable in nonpsychotic persons also, although in a less extreme degree, and which give rise to a continuum running from the extreme schizothyme to the extreme cyclothyme

One hundred normal subjects, 50 schizophrenes, and 50 manic-depressive patients were tested with a large battery of objective tests, and the significance of differences established by means of analysis of variance Then factor analyses were performed on the intercorrelations of tests for the normal and the psychotic groups separately, and the method of criterion analysis used in order to

verify deductions made from the original hypotheses Hypothesis I was verified, Hypothesis II was not verified

Certain general findings seemed of interest (1) Scores of schizophrenes tended to be intermediate between scores of normals and scores of depressives (2) Variances for psychotics are considerably higher than for normals (3) Tests on which neurotics and normals had been shown to differ very significantly showed no differences between psychotics and normals (4) Tests using expressive movements were particularly significant in differentiating between normals and psychotics

References

1 Crown, S A controlled association test as a measure of neuroticism *J Personal*, 1948, **16**, 198-208

2 Eysenck, H J *Dimensions of personality* London Kegan Paul, 1947

3 Eysenck, H J Criterion analysis an application of the hypothetico-deductive method to factor analysis *Psychol Rev*, 1950

4 Eysenck, H J Cyclothymia-schizothymia as a dimension of personality I Historical *J Personal*, 1950, **19**, 123-152

5 Eysenck, H J Primary social attitudes *Internat J Opin Attit Res*, 1947, **1**, 49-84

6 Holley, J W A note on the reflection of signs in the extraction of centroid factors *Psychometrika*, 1947, **12**, 263-268

7 Kretschmer, E *Körperbau und Charakter* Berlin Springer, 1948

8 Kretschmer, E *Medizinische Psychologie* Leipzig Thieme, 1946