

PSYCHOLOGY REVIVALS

**Experiments in  
Personality:  
Volume II**

Psychodiagnostics and  
psychodynamics

*Edited by*  
**H.J. Eysenck**



## Experiments in Personality: Volume II

Originally published in 1960 these two volumes report a number of experiments in psychogenetics, psychopharmacology, psychodiagnostics, psychometrics and psychodynamics, all of which formed part of the programme of research which had been developing from the late 1940s at the Maudsley Hospital. Presenting the studies together in a book, rather than the more usual route of journal articles, was itself felt to be an experiment at the time, especially given the wide area covered. The decision was deliberate because all the studies reported formed part of a larger whole, which would have been lost if published separately.

Volume II looks at psychodiagnostics, psychodynamics and psychometrics.

This page intentionally left blank

# Experiments in Personality

## Volume II

Psychodiagnostics and psychodynamics

*Edited by*  
H.J. Eysenck

First published in 1960  
by Routledge & Kegan Paul Ltd

This edition first published in 2013 by Routledge  
27 Church Road, Hove, BN3 2FA

Simultaneously published in the USA and Canada  
by Routledge  
711 Third Avenue, New York, NY 10017

*Routledge is an imprint of the Taylor & Francis Group, an informa business*

© H.J. Eysenck 1960

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

#### **Publisher's Note**

The publisher has gone to great lengths to ensure the quality of this reprint but points out that some imperfections in the original copies may be apparent.

#### **Disclaimer**

The publisher has made every effort to trace copyright holders and welcomes correspondence from those they have been unable to contact.

A Library of Congress record exists under LC control no.: 61002085

ISBN: 978-0-415-84436-9 (hbk)

ISBN: 978-0-203-75347-7 (ebk)

EXPERIMENTS IN PERSONALITY

*Volume II*

PSYCHODIAGNOSTICS  
AND  
PSYCHODYNAMICS

## *Contributors*

**G. CLARIDGE**

*Research Associate, Institute of Psychiatry*

**H. J. EYSENCK**

*Professor of Psychology, Institute of Psychiatry*

**J. H. G. HEWLETT**

*Research Associate, Institute of Psychiatry*

**H. C. HOLLAND**

*Research Associate, Institute of Psychiatry*

**R. W. PAYNE**

*Lecturer in Psychology, Institute of Psychiatry*

*(Now Associate Professor of Psychology, Queens University, Ontario)*

**P. SLATER**

*Lecturer in Psychological Statistics, Institute of Psychiatry*

**R. A. WILLETT**

*Lecturer in Psychology, Institute of Psychiatry*

# EXPERIMENTS IN PERSONALITY

*Edited by*

H. J. EYSENCK, Ph.D.

*Professor of Psychology, University of London;  
Director, Psychological Laboratories, Institute  
of Psychiatry; Psychologist, Maudsley and  
Bethlem Royal Hospitals*

*Volume II*

PSYCHODIAGNOSTICS  
AND  
PSYCHODYNAMICS



*London*

ROUTLEDGE & KEGAN PAUL



*First published 1960  
by Routledge & Kegan Paul Ltd  
Broadway House, Carter Lane, E.C.4*

*Printed in Great Britain  
by Butler & Tanner Ltd  
Frome and London*

*© H. J. Eysenck 1960*

*No part of this book may be reproduced  
in any form without permission from  
the publisher, except for the quotation  
of brief passages in criticism*

**They reason theoretically, without demonstrating  
experimentally, and errors are the result.**

**MICHAEL FARADAY**

This page intentionally left blank

# CONTENTS

---

## PART ONE: EXPERIMENTS IN PSYCHODIAGNOSTICS

1. Thought Disorder in Psychotic Patients. *R. W. Payne and J. H. G. Hewlett* page 3

## PART TWO: EXPERIMENTS IN PSYCHODYNAMICS

2. The Excitation-Inhibition Balance in Neurotics. *Gordon Claridge* 107  
The Excitation-Inhibition Balance in Normals:—
3. Measures of Learning and Conditioning. *R. A. Willett* 157
4. Measures of Perceptual Functions. *H. C. Holland* 193
5. A Factor Analysis of Selected Tests. *H. J. Eysenck* 234

## PART THREE: EXPERIMENTS IN PSYCHOMETRICS

6. Factor Analysis and Some Allied Procedures. *P. Slater* 247
7. Canonical Analysis of Discriminance. *P. Slater* 256
8. Re-Examination of Some Data Collected by Hildebrand. *P. Slater* 271  
Epilogue: The Place of Theory in Psychology. *H. J. Eysenck* 303  
Bibliography and Author Index 316  
Subject Index 329

## PLATES

---

I. The Object-Sorting Test material	40
II. The Object Classification Test material	40
III. The Shaw Test material	41
IV. Brengelmann Picture Recognition Test material	41
V. Verbal conditioning apparatus	192
VI. Spatial conditioning apparatus: front	192
VII. Spatial conditioning apparatus: rear	192
VIII. Figural After-effect Apparatus	193
IX. Visual Tests	193

# PART ONE

## Experiments in Psychodiagnostics

This page intentionally left blank

# I

## THOUGHT DISORDER IN PSYCHOTIC PATIENTS

R. W. Payne and J. H. G. Hewlett

---

### I. INTRODUCTION<sup>1</sup>

IT is probable that different types of thought disorder are associated with different psychiatric illnesses. This study is concerned mainly with schizophrenic thought disorder which has been described in detail by a number of psychiatrists on the basis of material collected in interviews. However, relatively few of these writers have elaborated a theory about the nature of this type of thought disorder in sufficient detail to enable objective tests to be derived from it.

#### (a) *Kretschmer's Theory*

One of the earliest psychiatrists to develop a detailed theory of schizophrenic thought disorder was Ernst Kretschmer (1936, 1951). Kretschmer accepted Bleuler's (1950) theory that a generalized mental dissociation or disintegration was the main cause of schizophrenic thought disorder, and elaborated the idea considerably. Kretschmer believed that schizophrenia was an extreme position on a fundamental constitutional variable which he called 'schizothymia-cyclothymia'. This variable was regarded as being more or less normally distributed throughout the general population, most people having some intermediate position on it. A number of characteristics, both physical and psychological, were said to be associated with this constitutional factor. According to the theory, extremely 'schizothymic' people are of

<sup>1</sup> The research described here was made possible by a research grant from the governors of the Maudsley and Bethlem Royal Hospitals,



leptomorphic physique, and also share a number of psychological characteristics. Extremely cyclothymic people are of pyknic physique, and share other psychological characteristics. Individuals who are abnormally 'schizothymic' tend to develop schizophrenia, while individuals who are extremely 'cyclothymic' tend to develop manic-depressive psychosis. Presumably an individual's position on this constitutional variable is largely the result of inheritance, so that only minor changes can be effected by the environment.

This theory has a number of implications. One is that a person who is later to develop schizophrenia is from birth extremely 'schizothymic'. Even if he recovers from a schizophrenic illness, he is unlikely to have moved far along the continuum, and will always remain a 'schizothymic' personality, liable to a further illness. Another implication is that, since schizophrenia and manic-depressive psychosis are at opposite ends of the continuum, mixed psychotic states, with features of both, would be incompatible with the theory.

One of the main personality characteristics associated with 'schizothymia-cyclothymia' was held to be 'Spaltungsfähigkeit', or 'dissociation'. It too was held to be a continuous variable on which schizophrenics are extremely dissociated, and manic-depressives extremely non-dissociated. Kretschmer defined dissociation as the tendency for mental activity to occur in isolation, being uninfluenced by and isolated from other mental activity. Its opposite is a high degree of integration. An abnormal amount of dissociation could produce schizophrenic thought disorder, characterized by a 'fragmentation' of mental activity, and a lack of logical relationships between systems of ideas. Dissociation could also explain inappropriate affect, and the maintenance of delusional ideas at variance with everyday experience.

Following an early empirical study by Van der Horst (1924), Kretschmer (1928) listed a number of psychological tests which should be measures of the trait of 'dissociation'. All the measures were estimates of an individual's capacity for dissociating his attention, or performing more than one task at the same time. Some were motor, some perceptual, and some were mental tasks. If dissociation were the common factor underlying performance on these tests, they should intercorrelate significantly and yield a general factor. Payne (1955) assembled a group of typical tests of 'Spaltungsfähigkeit', including all the major tests that Kretschmer had reported on. The tests were given to 100 normal people. Seventeen 'dissociation' scores were obtained from each subject. It was found that none of these scores correlated significantly. That is to say, the matrix of correlations obtained showed only chance fluctuations from a mean value of zero. The implication is that the ability to dissociate one's attention is very specific and is entirely a function of the tasks involved. This result appears to be fatal to Kretschmer's theory. For one thing, if the 'Spaltungsfähigkeit' tests are uncorrelated, it is

### *Thought disorder in Psychotic Patients*

unlikely that they will differentiate abnormal groups in any consistent fashion. Indeed, they appear not to. Brengelmann (1954) in an extensive review of the German literature on these tests, reports that there is no consistent evidence that schizophrenics, normal 'leptosomes', normal 'pyknics' and manic-depressive psychotics obtain the mean scores on the tests demanded by the theory. In any event, Kretschmer laid great emphasis on the notion that this hypothetical factor accounts for large individual differences within the normal population. However, no such factor appears to exist.

Perhaps this result is not altogether surprising, since 'Spaltungsfähigkeit', as operationally defined by Kretschmer, is a positive ability. People who are good at dividing their attention will have an advantage in a number of cognitive situations. Even if there were evidence for a general ability of this sort, one is in the curious position of explaining a thinking deficit, schizophrenic thought disorder, as the result of an excess of some useful intellectual capacity.

#### *(b) Babcock's Theory*

Harriet Babcock (1930, 1933, 1941) advanced a different, and much simpler explanation of schizophrenic thought disorder. She suggested that in essence it is merely an extreme intellectual slowness. It is well known that people differ with respect to their speed of problem solving. Indeed Furneaux (1956) has recently demonstrated that individual differences in the speed of problem solving are an important determinant of the score obtained in a typical untimed test of general intelligence. Furthermore, intellectual speed is more or less uncorrelated with other intellectual functions. For example, fast thinkers do not necessarily make a larger number of errors. There is a very low correlation between speed and accuracy.

Babcock argued that schizophrenic thought disorder results mainly from a gross retardation of intellectual speed. Schizophrenic patients think so slowly that in a normal interview situation, they have not had time to think through the answer to one question before they have been given the next question. This makes them appear thought disordered, since one method of dealing with such a handicap is merely to answer at random. This could even explain their relative social isolation. They think too slowly to engage in normal conversation, so they tend to become socially withdrawn.

No attempt will be made to review the literature concerned with the experiments relevant to Babcock's theory, since this has been done at length elsewhere (Payne, 1960). By and large, previous investigations have tended to support Babcock's theory, in that schizophrenics have been found to be slow at problem solving. On the whole, acute or early schizophrenics are only moderately slow, while chronic or deteriorated schizophrenics are extremely slow. However, depressed patients have

usually been found to be just as slow as chronic schizophrenics. These and other findings suggest the possibility that abnormal slowness of thinking is not a unitary phenomenon. It may have several causes, some people being slow because their minds work slowly, some because they are unable to concentrate, being constantly distracted, and others because they are thinking about a different problem which they believe to be relevant.

(c) *The Theory of 'Concreteness'*

Two entirely different theories of schizophrenic thought disorder have one thing in common. Both suggest that it is essentially due to an abnormality of concept formation of some sort. However, they disagree about the nature of this abnormality.

Kurt Goldstein and several other writers (Bolles and Goldstein, 1938; Goldstein, 1939, 1946; Hanfmann and Kasanin, 1937, 1942; Kasanin, 1946; Kasanin and Hanfmann, 1938a, 1938b) have argued that schizophrenics are abnormally 'concrete'. That is to say, they are unable to perform inductive reasoning since they are unable to make an abstract generalization. A number of experiments have been carried out to investigate this hypothesis. These will not be reviewed in detail, as this has been done elsewhere (Payne, 1960; Payne, Matussek and George, 1959). Many of these experiments make use of either the Goldstein-Scheerer (1941) sorting tests, or the Vigotsky (1934) test to assess 'concreteness'. The main fault of the studies which report schizophrenics to be abnormally 'concrete', lies in the criteria of 'concreteness' used. For example, Goldstein and Scheerer (1941) label a large number of responses as 'concrete', including a failure to sort at all, a failure to 'shift' from one method of sorting to another, a failure to give an adequate verbal account of the sorting, and several unusual ways of sorting the material. Furthermore, if the test instructions are followed exactly, individuals who are initially 'concrete' are often not allowed to continue to sort the material spontaneously, in order to see whether later they will produce a more adequate method of sorting. Instead they are given a series of 'control experiments' aimed at assisting them with the task. Similarly an unusually slow performance on the Vigotsky tests would be labelled 'concrete' if the Hanfmann-Kasanin (1937) scoring method is used, as would an unusual generalization.

More recent work (Fisher, 1950; Rashkis, Cushman and Landis, 1946; Rashkis, 1947; Rapaport *et al.*, 1945; McGaughran, 1954, 1957; McGaughran and Moran, 1956; Fey, 1951) has consistently suggested that, on sorting tests, schizophrenics tend to produce unusual generalizations when compared with normals. However, they can produce just as many generalizations as normal people, and it seems unreasonable to label this behaviour 'concrete', thus identifying it with the inability to generalize at all.

### *Thought disorder in Psychotic Patients*

The other main method of investigating 'concreteness' in schizophrenics, has been by the use of the 'proverbs' test. Studies by Wegrocki (1940), Benjamin (1946), Becker (1956) and Gorham (1956) have produced consistent results. Schizophrenics give more 'concrete' interpretations to proverbs than do normals, whether the usual method of administration is used, or whether a multiple choice form of the test is used. In view of the results obtained with sorting tests, these results cannot be regarded as unambiguous. There is no doubt that schizophrenics tend to define words and interpret proverbs peculiarly. However, this is not necessarily due to an inability to generalize. It is possible that unusual interpretations are often arbitrarily rated as 'concrete'. It is also possible that, just as they tend to use words peculiarly, schizophrenics tend to interpret test instructions peculiarly. They may interpret the instructions as allowing the use of apt 'concrete' illustrations of the meaning the proverb has for them, as well as allowing a general explanation of the principle illustrated. It is not certain that in these studies the schizophrenics were encouraged to go on talking. Some abstract generalization might ultimately have been given, even if this were preceded by apparently 'concrete' statements, or apparently irrelevant remarks.

Previous studies then, are at best ambiguous. There is no conclusive evidence that schizophrenics are more 'concrete' than normal, although there is considerable evidence that the generalizations they make tend to be unusual.

#### *(d) Cameron's Theory of 'Overinclusion'*

Norman Cameron (1938a, 1938b, 1939a, 1939b, 1944, 1947; Cameron and Magaret, 1949, 1950, 1951) has suggested that schizophrenic thought disorder is due to a quite different abnormality of concept formation. He believes that schizophrenics' concepts are over-generalized. Schizophrenics are unable to maintain the normal conceptual boundaries, and incorporate into their concepts elements, some of them personal, which are merely associated with the concept, but are not an essential part of it. Cameron used the term 'overinclusion' to describe this abnormality. Cameron reported that in working on the Vigotsky test, and a sentence completion test, schizophrenics were unable to preserve the 'conceptual boundaries' of the task. In solving a problem, the schizophrenics '... included such a variety of categories at one time, that the specific problems became too extensive and too complex for a solution to be reached' (Cameron, 1939a).

A surprising number of experiments have been carried out to investigate this theory. These have been reviewed elsewhere (Payne, 1960; Payne, Matussek and George, 1959). The results obtained have consistently supported the theory. For example, Moran (1953) and Epstein (1953) developed very similar tests, consisting of a list of words printed

on a sheet of paper. Following each stimulus word was a number of response words, including neologisms, and the word 'none'. The subjects were asked to underline each response word which they regarded as an essential part of the concept denoted by the stimulus word. Individuals whose concepts were abnormally overinclusive were expected to underline more words. Both investigators found that schizophrenics underlined significantly more words than normals.

White (1949), testing a matched schizophrenic and normal group, asked his subjects to group fifteen cards with a word printed on each in any way they liked. The schizophrenics tended to form very large, vague categories, forming concepts such as 'suspicion' or 'having to do with God'.

Chapman (1956) and Chapman and Taylor (1957) report a series of interesting experiments which have also confirmed the theory of over-inclusion. They made use of card sorting tests of different types, and found that, when asked to sort according to a specific concept (e.g. 'fruit'), schizophrenics tended to include in this category similar cards (e.g. cards depicting vegetables) but not completely dissimilar cards. Normals did not do this. In another experiment, the subjects were presented with cards containing four pictures, some of which illustrated a concept. The subjects were asked to sort the cards according to a concept, but to disregard all the pictures on the cards except the picture in the lower right-hand corner. As predicted, the schizophrenics were influenced by these irrelevant 'distractor' items, whereas the normals were not. There was no evidence of 'concreteness' or inability to sort at all, since the number of errors made varied directly with the number of distractor items relevant to the sorting categories, there being no significant difference between normals and schizophrenics when distractor items of this sort were not present.

It must be concluded that Cameron's theory of overinclusion has received strong support from the experiments so far carried out.

*(e) A Reformulation of the Theory of Overinclusion*

Payne, Matussek and George (1959) have suggested that it is possible to reformulate Cameron's theory of overinclusion in a slightly more general way so that a number of predictions follow from it. Concept formation can be regarded as largely the result of discrimination learning. When a child first hears a word in a certain context, the word is associated with the entire situation (stimulus compound). As the word is heard again and again, only certain aspects of the stimulus compound are reinforced. Gradually the extraneous elements cease to evoke the response (the word) having become 'inhibited' through lack of 'reinforcement'. This 'inhibition' is in some sense an active process, as it suppresses a response which was formerly evoked by the stimulus. 'Overinclusive thinking' may be the result of a disorder of the process

### *Thought disorder in Psychotic Patients*

whereby 'inhibition' is built up to circumscribe and define the learned response (the word or 'concept'). In short, it could be an extreme degree of 'stimulus generalization'.

The same theory can be expressed in different terms. All purposeful behaviour depends for its success on the fact that some stimuli are 'attended to' and some other stimuli are ignored. It is a well-known fact that when concentrating on one task, normal people are quite unaware of most stimuli irrelevant to the task. It is as if some 'filter mechanism' cuts out or inhibits the stimuli, both internal and external, which are irrelevant to the task in hand, to allow the most efficient 'processing' of incoming information. Overinclusive thinking might be only one aspect of a general breakdown of this 'filter' mechanism.

## II. THE PRELIMINARY INVESTIGATION OF THOUGHT DISORDER IN SCHIZOPHRENICS

While many studies had been carried out to assess separately the various abnormalities described, no large-scale study had been conducted to compare measures of slowness, concreteness and overinclusion on the same schizophrenic and normal populations in order to determine which type of dysfunction is most characteristic of schizophrenia.

Payne, Matussek and George (1959) administered a large battery of tests, including measures of slowness, concreteness and overinclusion to eighteen schizophrenic and sixteen neurotic in-patients. The groups were carefully matched for age, Mill Hill Vocabulary score (Raven, 1948), Progressive Matrices score (Raven, 1948) and Nufferno 'Level' score (Furieux, 1956), both groups being almost exactly of average mean intelligence on all three tests.

Most of the tests given have been used in the present study and will be described in detail later. In order to test Babcock's theory that abnormal intellectual slowness is the basis of schizophrenic thought disorder, three tests of intellectual speed were given, Nufferno speed tests A1 (individual, unstressed), A2 (individual stressed) and B1 (individual, stressed) (Furieux, 1956).

The schizophrenics were slower than the neurotics, but on only one test did the mean difference achieve the 5% level of statistical significance (on a 'one tail' test). A Nufferno 'speed-level discrepancy' score also failed to differentiate the groups significantly. It was predicted that if schizophrenics were abnormally slow, they would tend to compensate for this by working at their maximum speed all the time. Thus, when their normal working rate (as measured by the 'unstressed' speed test—A1) was compared with their maximum rate (as measured by 'stressed' speed test A2) they should show little improvement in speed as compared with the neurotics. While this measure of 'stress gain' differentiated the groups as expected (i.e. schizophrenics improved less when asked to

work as fast as possible), the difference was only statistically significant at the 5% level by a 'one tail' test. It was also predicted that, if schizophrenics were abnormally slow thinkers, they would tend to compensate for this by being more persistent. However, a measure of persistence consisting of the two longest times spent during the Nufferno Level test on items which were later abandoned or solved incorrectly, failed to differentiate the groups significantly. It was concluded that intellectual slowness is not an important abnormality, fundamental to thought disorder in schizophrenia, as Babcock's theory suggests. It was suggested that intellectual slowness in schizophrenia might be a secondary by-product of 'overinclusion'. Because they perceive 'irrelevant' aspects of the test as being necessary for a solution (e.g. their personal associations to the letters in the Nufferno letter-series items), schizophrenics have more data to think about. They must consider a larger number of possible solutions, and this would result in a longer average solution time per item, with a greater variability of solution times. This would not necessarily lead to an increase in errors, as solutions based on irrelevant aspects of the material might still be rejected if they did not 'fit'.

Babcock believed that abnormal slowness in schizophrenia is fundamental, and affects simple motor speed tests as well as more complex intellectual tests. To test this theory, four of Babcock and Levy's (1940) simple motor speed tests were administered. These were the speed of writing 'the United States of America', the speed of writing one's own name, the speed of writing a sentence from dictation, and the speed of performing the Babcock-Levy (1940) 'substitution' test. While the schizophrenics were slightly slower on all four measures, none of the differences reached statistical significance. Again, Babcock's theory that slowness is of fundamental importance, was not supported.

Five measures of 'concreteness' were obtained from the two groups. These were ratings obtained in the traditional way from the Goldstein-Scheerer (1941) Colour-Form and Object-Sorting tests, and Benjamin's (1946) Proverbs test, and two scores derived from a modified form of Feldman and Drasgow's (1951) test for concept formation. Only one of these scores differentiated the groups significantly. This was the rating of 'concreteness' obtained from the Goldstein-Scheerer Object-Sorting test. The schizophrenics were significantly more 'concrete'. It was concluded that the heterogeneous nature of the test material of the object-sorting test favoured the production of unusual responses in the schizophrenic group, and that for this reason they were labelled more 'concrete' when the Goldstein-Scheerer test administration and scoring criteria were followed. Goldstein and Scheerer (1941) have identified 'concreteness' with 'rigidity'. Two measures of 'rigidity' were obtained from the modified Feldman-Drasgow test. These were based on the number of times the two alternative methods of classifying the objects on each card were perceived. Only when a one-minute time limit per

### *Thought disorder in Psychotic Patients*

card was enforced did the rigidity score differentiate the groups significantly, and it was pointed out that this result was almost certainly due to the tendency among the schizophrenics to produce unusual groupings, which were not scored as correct. It was concluded that there was no evidence of abnormal concreteness in the schizophrenic group.

Thirteen different measures of 'overinclusion' were obtained from the Benjamin Proverbs test, the Goldstein-Scheerer Object-Sorting test, an 'Object Classification Test', the Epstein (1953) test for 'overinclusion', and the Leiter Partington (1950) 'Pathways' test. All these scores will be described in detail later. Seven of these scores differentiated the groups as predicted, at well beyond the 1% level of significance. Only four scores failed to produce significant differences, although the mean differences were in the expected direction.

The Klein and Krech (1952) tactile 'figural after effect' test was given to the two groups. There was evidence that the schizophrenics developed weaker figural after effects, and might be regarded as developing less 'reactive inhibition'. While this result was not regarded as unambiguous, it was consistent with the hypothesis that 'overinclusion', which was thought to be due to a defect of some central 'filtering' mechanism which inhibits irrelevant stimuli, is associated with a general inability to develop cortical 'inhibition'.

This study suggested that 'overinclusion' may be a fundamental cause of schizophrenic thought disorder. The present study was designed to follow up these results.

### III. THE PURPOSE OF THE PRESENT STUDY

The studies previously mentioned, and the initial study (Payne, Matussek and George, 1959) are all consistent with the hypothesis that 'overinclusion' is an abnormality fundamental to schizophrenic thought disorder. However, all these studies have one weakness. It has not been demonstrated that abnormal 'overinclusion' is specific to schizophrenia. It might be equally frequent in depressive patients, and thus might better be regarded as a general characteristic of psychosis.

A study by Eysenck (1952a, 1952b) suggests that this is a strong possibility. Eysenck (1952a), in attempting to find evidence for Kretschmer's typology 'schizothymia-cyclothymia', tested a group of a hundred normal soldiers, fifty schizophrenic patients, and fifty manic-depressive patients. They were given a large battery of tests, most of which were selected because it was thought that they would differentiate between the two psychotic groups. Twenty of the tests which differentiated best were factor analysed separately for the normal and the psychotic groups. It was demonstrated that only one factor was necessary to account for the differences observed between the three groups. This factor was labelled 'psychoticism'. On the tests of 'psychoticism', normals had the



lowest scores, schizophrenics tended to have intermediate scores, while manic-depressives tended to have the most extreme scores. It had been expected that a second factor, independent of 'psychoticism', but differentiating the two psychotic groups would be obtained. However, no such factor could be demonstrated, and the results were consistent with the theory that in the population investigated, the depressives differed from the schizophrenics only in that they were more 'psychotic'.

Two later studies (Eysenck, Granger and Brengelmann, 1957; Eysenck, S.B.G., 1955) investigated further tests of 'psychoticism'. However, in these studies, the two psychotic groups were not analysed separately, schizophrenics and manic-depressives being combined. In both researches, a number of tests successfully differentiated between a combined psychotic group, and a normal and a neurotic group.

The aims of the present investigation can be summarized as follows:

(1) To determine whether 'overinclusion' is an abnormality specific to schizophrenia, or whether it is a general characteristic of psychotic patients.

(2) To determine whether or not neurotic patients suffer from any degree of thought disorder. It is generally believed that neurosis does not produce thought disorder of the kinds described, hence the use of neurotic patients as a control group in the preliminary investigation.

(3) To determine whether or not tests of 'overinclusion' intercorrelate significantly, and thus measure some factor in common. While the preliminary study suggested that they differentiate schizophrenics from neurotics as predicted, it is necessary to demonstrate that they have something in common before we can conclude that they all measure the same basic abnormality. It is further necessary to demonstrate that the common factor shared by these tests (as measured by a factor score) also differentiates schizophrenics from the other groups.

(4) To determine whether general psycho-motor slowness is more characteristic of depressed patients than of schizophrenics. It has been mentioned that although Babcock thought psycho-motor slowness to be fundamental to schizophrenia, several studies suggest that depressed patients as a group are considerably slower than acute schizophrenic patients. The evidence so far available suggests that there might be two unrelated causes of slowness in psychotic patients. It is possible that depressives are extremely slow at all types of task, motor, perceptual and mental, possibly because they are so distracted by their depressive ideas that they are generally retarded. Slowness in acute schizophrenics on the other hand, might be confined to intellectual tasks. It is possible that they are slow at problem solving, merely because their overinclusive thinking forces them to consider an unduly large number of possibilities. If this general formulation were correct, we would expect to find in a combined population of normals, neurotics and psychotics, that tests of 'overinclusion' would be unrelated to tests of simple motor and per-

### *Thought disorder in Psychotic Patients*

ceptual speed. Tests of reasoning speed on the other hand, would be related to both tests of overinclusion, and tests of motor and perceptual slowness, since slowness of reasoning can be caused either by general retardation or by 'overinclusion'.

(5) To investigate the relationship between the tests of 'psychoticism' used by Eysenck and his co-workers, and measures of 'overinclusive' thinking and slowness.

(6) To replicate the previous finding that schizophrenics are not abnormally 'concrete'.

#### IV. THE GROUPS TESTED

The subjects tested consisted of twenty normal people, twenty neurotic patients, twenty depressive patients and twenty schizophrenics. These groups were matched for age, pre-illness intellectual level (as assessed by a vocabulary test), socio-economic status, and educational attainment.

The twenty normal subjects were selected carefully to match the abnormal groups as closely as possible. They were approached individually, and were drawn from a very wide range of sources. Their backgrounds were very varied, and their occupations ranged from 'home help' to physician. Some of the occupations sampled were counter hand, carpenter, plumber, garage hand, engineering student, typist, secretary, motor mechanic, house-painter, shop assistant supervisor and general clerk. This wide range of occupation was necessary in order to match them with the patients, who were equally heterogeneous. It had initially been intended to match the groups for sex as well as the other variables. However, it proved so difficult to match the groups on five independent variables, that sex was allowed to go uncontrolled, as it was thought to be the least important factor. In the normal group, there were nine males and eleven females.

The twenty schizophrenic patients consisted of ten males and ten females. The group was composed mainly of 'acute' or 'early' schizophrenics. Only one was regarded as chronic, and the remaining patients were not judged to have deteriorated markedly by the psychiatrists in charge. On the other hand, only typical, clear cut cases were selected. A number of these patients had been admitted previously with a similar illness. All were inpatients of the Maudsley Hospital, except for two cases who were inpatients of Cane Hill Hospital. Most were tested within two weeks to one month after admission and all were judged still to be psychotic at the time of testing. These subjects were, on average, considerably more co-operative than a random sample of acute schizophrenic patients. This was because the lengthy testing programme (two days) required a considerable degree of co-operation. A number of subjects were excluded because they were unable to co-operate sufficiently. However, several quite disturbed patients were persuaded to

take the entire battery. On average, the testing required four two-hour sessions, although some slower patients required longer than this. So far as possible, all the subjects were tested before they had begun treatment, and before they had been given any drugs (apart from mild night sedation). This proved a difficult condition to fulfil, as a large proportion of the psychotic inpatient population in the hospitals involved, were receiving drugs soon after admission. Only two of the schizophrenics tested were having drugs at the time of testing (apart from mild night sedation). Both were having 'Largactil' (50 mg. three times a day). No attempt was made to select any particular sub-type of schizophrenia. A number of the patients selected were clinically judged to be suffering from 'schizophrenic thought disorder' at the time of testing. However, this was not the case for a little over half the subjects. The psychiatric diagnoses which had been given at the time of testing were as follows:

'Schizophrenia', 2; 'Paranoid Schizophrenia', 3; 'Paranoid Schizophrenia with affective features', 1; 'Paranoid Schizophrenia' (later re-diagnosed merely as 'Paranoid State'), 1; 'Simple Schizophrenia', 4; 'Catatonic Schizophrenia', 3; 'Hebephrenic Schizophrenia', 2; 'Acute Relapse in chronic, hebephrenic schizophrenia', 1; 'Acute Schizophrenia following operation', 1; 'Schizophrenia with depressive features', 2 (one of these was later re-diagnosed as 'depressive disorder in a person with a marked schizoid personality').

The twenty patients in the depressive group consisted of seven males and thirteen females. It was originally hoped to make this a group of 'manic-depressive' psychotics. This aim had to be abandoned because of the shortage of such patients in the two hospitals. Very few manic patients were available, and those that were, were usually too disturbed to co-operate in such a long testing programme. Manic-depressive patients were even scarcer. Patients who had been hospitalized with both a manic and a depressive episode were too infrequently admitted to allow a group to be collected within a reasonable length of time. (The present groups took over a year to collect.) This group includes only two 'manic-depressive' cases. One patient was tested during a depressive episode, although she had had previous admissions with a manic illness. The other patient was actually tested during a hypomanic phase, although she had had episodes of depression. The remainder of the cases could be regarded as psychotic. All were selected as being reasonably typical of 'endogenous depression'. However, many of the doctors who assisted in this selection did not themselves believe that 'endogenous' and 'exogenous' depressions can be regarded as separate categories. Rather, they believed that there is a continuum from the purely endogenous to the purely exogenous, most cases falling in between. The cases selected were therefore regarded as falling distinctly towards the 'endogenous' end of the continuum. As a group

### *Thought disorder in Psychotic Patients*

they were characterized by ideas of guilt and unworthiness, retardation, depressive delusions, a history of previous depressive attacks, and the absence of any clear precipitating causes. The sample selected was not a random sample of the inpatient 'endogenous depressive' population. On average, the depressive inpatient population was considerably older than the other groups. Thus, in order to match the groups for age, the depressed patients tested were selected from the younger age range of this population. Like the schizophrenic patients, most were tested within two weeks to a month of admission. Three were inpatients at Cane Hill Hospital, and the remainder inpatients of the Maudsley Hospital. Nearly all these patients were tested prior to the onset of treatment. Unfortunately, this was not always possible. One patient had received three E.C.T. treatments prior to testing, while two others had received one E.C.T. treatment each. However, all were tested while still depressed. In spite of efforts to avoid it, six patients were being given drugs at the time of testing. In all but two cases, the dose was regarded as not large enough to affect test performance, although this judgment is subjective. Two were having 50 mg. of 'Largactil' three times daily, one was having 25 mg. of 'Drinamyl' twice daily and one was having 50 mg. of 'Pacatal' three times daily. The other two were having 150 mg. per day of 'Pacatal' when testing was commenced, but this was being increased at the rate of 50 mg. a day, so that on the final day of testing, they were having about 250 mg. daily.

The twenty neurotic patients were subdivided into a group of eight 'hysterics' and twelve 'dysthymics'. The hysteric group consisted of six females and two males. The dysthymic group consisted of seven females and five males. Of the entire neurotic group, three were inpatients of Cane Hill Hospital, the remainder inpatients of the Maudsley Hospital. Nearly all the patients in this group were having fairly long-term psychotherapy. Most were tested between two weeks and a month after admission, although a few had been in hospital considerably longer. Most were free of drugs, apart from mild night sedation, at the time of testing. However, one case of 'anxiety state' was receiving 50 mg. of 'Largactil' three times a day. One case of 'reactive depression' was receiving small doses of 'Equanil' during the day, and a second similar case, small doses of Sodium Amytal during the day. The psychiatric diagnoses given to those classified as 'dysthymic' were as follows: 'Reactive Depression', 6; 'Obsessional Neurosis', 1; 'Obsessional neurosis with anxiety', 1; 'Anxiety with depressive features', 2; 'Anxiety State', 1; 'Phobic Anxiety', 1. The patients included in the 'hysteric' group were diagnosed as follows: 'Hysteria', 1; 'Hysterical reaction with multiple somatic symptoms', 1; 'Hysterical illness in hysterical personality', 1; 'Hysterical aphonia', 1; 'Fugue state', 2; 'Hysterical multiple personality', 1; 'Hysterical personality with psychopathic tendencies', 1.

The data concerning the variables on which the groups were matched are presented in Table 1.1.

TABLE 1.1

*Control data*

Variable		Normals (N = 20)	Neurotics (N = 20)	Depressives (N = 20)	Schizo- phrenics (N = 20)
Age	Mean	32.10	32.65	37.60	32.10
	Variance	89.47	104.68	165.74	69.26
	range	18-51	19-55	19-65	18-48
	significance	F = not significant			
Mill Hill Vocabulary IQ	Mean	102.70	103.74	101.35	101.26
	Variance	158.42	200.33	225.73	157.22
	range	78-126 +	80-123	80-126 +	80-126 + $\frac{2}{5}$
	significance	F = not significant			
Occupational status rating scale	Mean	4.20	4.60	4.35	4.40
	Variance	2.06	1.94	2.98	2.46
	range	1-7	1-7	1-7	1-7
	significance	F = not significant			
Years of schooling and training	Mean	10.95	10.85	10.45	10.80
	Variance	10.47	3.32	4.89	3.37
	range	8-22	9-16	8-17	9-14
	significance	F = not significant			

In spite of the attempt to match the groups exactly for age, the mean age of the depressive group is still slightly higher. However, an 'F' test suggests that overall mean differences in age are not significant.

The main aim of the matching was to ensure that the groups were similar in pre-illness general intellectual and educational levels. It is clearly not desirable to match the groups on a measure of general intelligence obtained during their illness, since thought disorder can reasonably be expected to reduce efficiency on many cognitive tests, and this

### *Thought disorder in Psychotic Patients*

would be controlling a variable which we wish to examine. There is considerable evidence (Payne, 1960) that vocabulary tests scored in the conventional way are least affected by mental illness. Thus, while this is not a perfect estimate of pre-illness 'general intelligence', it is probably the best available. As can be seen the groups are almost exactly matched on the Mill Hill Vocabulary test (Raven, 1948). The 'IQ' scores quoted are based on a simple transformation from Raven's published percentile norms. The 'IQ' units in this case are made to have a mean of 100 and a standard deviation of 16 for each age-group. The Mill Hill Vocabulary test was chosen as it provides a reliable score, being based on both a 'definitions' and a 'multiple choice' vocabulary test and is standardized on an English population.

The occupational status was assessed on Belson's (1955) seven-point rating scale. The mean occupational status for each group is very close to the British average. The range in the present group is a trifle restricted, in that there are no representatives of either of the extremes of income level. This is inevitable with such small groups, as it is clearly not possible in a representative sample of twenty cases to include individuals who occur only once in 1000 of the general population. In terms of the range of occupations sampled, and the variance on this rating scale, the groups can be regarded as reasonably representative of the British population in terms of occupational status.

The groups are well matched in terms of years of formal education. This measure includes years of university, teachers' training college, technical, or other full-time education in addition to years spent at school.

#### V. THE TESTS USED AND THE MEAN DIFFERENCES OBTAINED

A complete list of the measures derived from the battery of tests administered is given in Table 1.2, along with the code number used to denote each variable. These code numbers will be used in subsequent tables and diagrams. (The code numbers were used to tabulate the control data as well. Thus the first test code number is 9.)

TABLE 1.2

*List of variables with code numbers*

Code Number	Variable
9	Mill Hill Vocabulary IQ.
10	Brengelmann Picture Recognition test score.
11	Object Classification test number of 'A' responses.
12	Object Classification test number of 'non A' responses.
13	Total time on Object Classification test.
14	Average response time for Object Classification Test.

TABLE 1.2

*List of variables with code numbers (continued)*

Code Number	Variable
15	Average time per 'A' response for Object Classification Test.
16	Luchins test: Number of simple solutions after set.
17	Luchins test: Number of difficult solutions after set.
18	Luchins test: difficult solution to 'control problem' before set = 1, simple = 0.
19	Epstein test, total time taken.
20	Epstein test, Overinclusion score.
21	Epstein test, Neologism score.
22	Goldstein-Scheerer Colour-Form test 'concreteness' rating.
23	Goldstein-Scheerer Object-Sorting test 'concreteness' rating.
24	Goldstein-Scheerer Object-Sorting test 'Overinclusion' score.
25	Goldstein-Scheerer Object-Sorting test. Number of unusual sortings.
26	Waves test: Average amplitude.
27	Waves test: Average wavelength.
28	Dynamometer test: maximum grip.
29	Static ataxia: number of reversals.
30	Static ataxia: total movement.
31	Shaw test: Number of 'A' responses.
32	Shaw test: Number of 'B' responses.
33	Shaw test: Number of 'C' responses.
34	Shaw test: Number of 'D' responses.
35	Shaw test: total time.
36	Shaw test: Average response time.
37	Nufferno Level test score.
38	Sum of two longest 'incorrect' or 'abandoned' item times on Level test.
39	Nufferno Speed test A1, unstressed.
40	Nufferno Speed test B1 unstressed.
41	Nufferno Speed test A2 stressed.
42	Word Association test: number of synonyms.
43	Word Association test: repetition of stimulus word.
44	Word Association test: number of multiple responses.
45	Word Association test: number of aside remarks.
46	Word association test: repetition of previous stimulus or response words.
47	Babcock test: speed of writing 'U.S.A.'
48	Babcock test: speed of writing sentence.
49	Babcock test: speed of writing name.
	(Note: scores 47, 48 and 49 were combined, and are referred to as variable 47 in the factor analysis plots).
50	Babcock 'Substitution' test average time per line.
51	Time to draw three squares.
52	Wechsler Arithmetic sub test.
53	Wechsler Picture Arrangement sub test.

## *Thought disorder in Psychotic Patients*

TABLE 1.2

*List of variables with code numbers (continued)*

Code Number	Variable
54	Disproportionality score, drawing design test.
55	Average time: drawing design test.
56	USES combined manual and finger dexterity score.
57	Proverbs test 'A' score.
58	Average number of words per proverb.
59	Average reaction time per proverb.
60	Average total time per proverb.
61	Pathway I: time required.
62	Pathway I: number of errors.
63	Pathway II: time required.
64	Pathway II: number of errors.
65	Shaw test: Average 'A + B' response time.
66	Shaw test: Total number of responses.
67	Shaw test: Average time per 'A' response.
68	Static ataxia: maximum backwards sway.

### *(a) Tests of Intellectual Speed*

It was pointed out in the introduction that Babcock (1930, 1933, 1941) regarded intellectual slowness as a primary cause of schizophrenic thought disorder. However, previous studies have suggested that depressed patients are even slower than acute or early schizophrenics. It is possible that these two groups are slow for different reasons. Depressives may be abnormally slow at all tasks, perhaps because they are constantly distracted by their depressive thoughts, whatever they are doing. Schizophrenic slowness on the other hand might be confined to intellectual tasks, because it is a by-product of overinclusive thinking. In the present study, intellectual speed was measured by the Nufferno Speed tests (Furneaux, 1956). These tests consist of Thurstone-type letter series items, the subject being required to write down the next letter of the series. Normal people, when solving a letter series problem, consider only a limited range of possible solutions. Indeed they regard only the sequence of the letters as being relevant to the task. It is possible that schizophrenics do not exclude other aspects of the letter series items in considering possible solutions. For example, they might also take into account their associations to the letters. This in itself would not necessarily produce an incorrect answer, since solutions incorporating irrelevant aspects of the material might nevertheless be rejected if they did not fit. It would, however, produce on the average a slower solution time per item, since more information would have to be considered for each item. It should also lead to an increased variability of solution times.



In the present investigation, both the Nufferno 'Level' test, and the Nufferno speed tests were used. The Level test makes use of precisely the same type of items as do the speed tests, namely Thurstone-type letter series items. In this test, each item is presented individually on a card. The subject is encouraged to take all the time he needs. The test items do not get progressively more difficult, but are arranged in cycles of seven items each, starting with easy, and ending with difficult items. The test is arranged so that each individual is given only items around the 'threshold' of his level of failure. Items he would always solve correctly or would always fail (as determined by performance on the first cycle) are not given. Thus the experience of failure (and presumably the accompanying discouragement) is controlled for all subjects. Normally the test is untimed, although in the present study the solution time for each level item was timed secretly (by the use of a wall clock with sweep second hand behind the subject). Only the first three cycles of the Level test were used.

The raw scores obtained from this test were transformed linearly for ease of computation, as shown in Table 1.3.

TABLE 1.3

*Level Test raw score transformations*

Raw Score	Coded Score
0-64	0
65-129	1
130-194	2
195-259	3
260-324	4
325-389	5
390-454	6
455-519	7
520-584	8
585-649	9

The results for the five groups are presented in Table 1.4.

TABLE 1.4

*Nufferno Level Test coded scores (Variable 37)*

	Normals	Dysthymics	Hysterics	Depressives	Schizophrenics
Number of cases	20	12	8	20	20
Mean	6.05	5.08	5.13	4.15	5.05
Variance	5.42	1.72	1.55	6.34	5.94
Significance	F = 1.85, not significant				

It is interesting that, although the groups were deliberately not matched on a test of general intelligence, on the grounds that thought

### *Thought disorder in Psychotic Patients*

disorder might well reduce the scores, the Nufferno Level test does not differentiate the groups significantly.

Three forms of the Nufferno speed tests (Furieux, 1956) were used in the present study. Test A1 consists of a group of easy items of homogeneous difficulty level. It was given individually under 'unstressed' conditions. That is, the subjects were told to work at their own rate, and they were unaware that they were being timed. This was followed by test B1, which is similar to A1, but consists of a homogeneous set of more difficult items. It was also given individually under 'unstressed' conditions. The third test given, test A2, is of the same level of difficulty as test A1. However, it was given individually under 'stressed' conditions. That is to say, the subjects were told to work as quickly as possible, and were aware that they were being timed.

The scores obtained from all three speed tests are 'mean log time' scores (i.e. the average of the logarithm of the solution time for each item solved correctly, excluding the average time required merely to write down the answer). The mean log time scores obtained from these tests were transformed linearly for ease of computation as shown in Table 1.5.

TABLE 1.5  
*Nufferno Speed Tests, transformations used*

Test A1		Test B1		Test A2	
Mean log time	Coded Score	Mean log time	Coded Score	Mean log time	Coded Score
0.8000-0.9230	0	0.9900-1.1280	0	0.7630-0.8730	0
0.9231-1.0460	1	1.1281-1.2660	1	0.8731-0.9830	1
1.0461-1.1690	2	1.2661-1.4040	2	0.9831-1.0930	2
1.1691-1.2920	3	1.4041-1.5420	3	1.0931-1.2030	3
1.2921-1.4150	4	1.5421-1.6800	4	1.2031-1.3130	4
1.4151-1.5380	5	1.6801-1.8180	5	1.3131-1.4230	5
1.5381-1.6610	6	1.8181-1.9560	6	1.4231-1.5330	6
1.6611-1.7840	7	1.9561-2.0940	7	1.5331-1.6430	7
1.7841-1.9070	8	2.0941-2.2320	8	1.6431-1.7530	8
1.9071-2.0300	9	2.2321-2.3700	9	1.7531-1.8630	9

The results obtained are presented in Tables 1.6, 1.7 and 1.8.

TABLE 1.6  
*Nufferno Speed Test A1 (individual, unstressed) coded scores (Variable 39)*

	Normals	Dysthymics	Hysterics	Depressives	Schizophrenics
Number of cases	20	12	8	19	18
Mean	2.30	2.25	2.38	4.21	3.89
Variance	3.06	2.02	3.12	4.51	4.93
Significance	F = 4.05, $p < 0.01$				

TABLE 1.7

*Nufferno Speed Test B1 (individual, unstressed) coded scores (Variable 40)*

	Normals	Dysthymics	Hysterics	Depressives	Schizophrenics
Number of cases	20	12	8	19	18
Mean	1.95	2.67	2.00	3.68	3.33
Variance	1.94	1.88	4.00	3.34	1.88
Significance	F = 4.02, $p < 0.01$				

TABLE 1.8

*Nufferno Speed Test A2 (individual, stressed) coded scores (Variable 41)*

	Normals	Dysthymics	Hysterics	Depressives	Schizophrenics
Number of cases	20	12	8	19	18
Mean	1.80	2.50	2.25	3.84	3.50
Variance	2.17	2.27	3.36	4.92	5.09
Significance	F = 3.58, $p < 0.05$				

These results are as expected. As in previous studies (Payne, 1960) it is the depressives who are slowest on all three tests, although the schizophrenics are slower than the neurotics and normals. (The various group comparisons which might have been made using 't' tests have not been attempted, as this is not strictly permissible statistically.)

Generally speaking, we might expect individuals who are unusually slow at problem-solving to tend to compensate for this by becoming

TABLE 1.9

*Level Test, transformation applied to persistence scores*

Score in Seconds	Transformed Score
51-79	0
80-123	1
124-191	2
192-297	3
298-462	4
463-717	5
718-1114	6
1115-1729	7
1730-2685	8
2686-4168	9

more persistent. This might reasonably be expected of the schizophrenic group, if their slowness is the result of overinclusive thinking. With so many more data to consider in order to solve a problem, the over-inclusive thinker would have to become more persistent than average, if he were to reach any solution at all. However, this need not be the

### *Thought disorder in Psychotic Patients*

case with the depressives. If they are slow because their worries distract them, they are likely also to become distracted from the task altogether, and thus give up if they cannot get an answer in a reasonable length of time. In order to examine these expectations, a measure of persistence was obtained from the Level test. This was the sum of the two longest times (in seconds) spent during the Level test on items which were subsequently abandoned or solved incorrectly. The distributions on this measure were markedly skewed for all the groups, as is generally the case with untransformed time scores. In order to keep the variances for the groups equal as nearly as possible, and because it was intended to intercorrelate all the measures, a log transformation was applied to normalize these distributions. The transformation is shown in Table 1.9.

The results for this score are given in Table 1.10.

TABLE 1.10

*Nufferno Level Test persistence scores (transformed) (Variable 38)*

	Normals	Dysthymics	Hysterics	Depressives	Schizophrenics
Number of cases	20	12	8	20	20
Mean	3.90	3.92	3.25	3.50	4.30
Variance	3.46	4.63	2.50	4.05	5.38
Significance	$F = 0.57$ , not significant				

As expected, the schizophrenics have the highest mean persistence scores. However, the differences are not statistically significant.

#### *(b) Tests of Motor Speed*

It has been suggested that acute schizophrenics are slow only at intellectual tasks, because they are overinclusive. This was the case in the preliminary study (Payne, Matussek and George, 1959). On the other hand, depressives were expected to be slow at all types of activity. A number of simple motor speed tests were given to test this hypothesis. The tests used, all sub-tests from the Babcock-Levy (1940) test, were as follows:

- (1) The speed of writing 'the United States of America'. The score was merely the number of seconds required (Variable 47).
- (2) The speed of writing one's own name. The score was the number of seconds required (Variable 49).
- (3) The speed of writing a simple sentence from dictation. The sentence used, from Babcock's battery (item 12 MC) was 'I hope to leave here very soon'.
- (4) The Babcock-Levy 'substitution' test (test 7 in Babcock's battery). This test merely requires the subject to write the appropriate number (from 1 to 5) in a symbol, using a key provided. The test would appear to be a function of simple perceptual and motor