MENTAL TESTING.

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I. INTRODUCTION.

INCREASED use of mental tests for the study of psychoses and allied disorders is conspicuous in recent psychiatric practice. This increase is most prominent first in the use of Rorschach's ink-blots; second, in the investigation of conceptual thinking with methods originated by Goldstein; third, in the study of psychometric pattern; fourth, in the diagnosis and measurement of intellectual deterioration; fifth, in assessing prognosis and the effects of treatment. It is partially attributable to sharpening of interest, due to the war, in the prediction of break-down under stress, in the stability and social potentialities of border-line groups, and in estimating the effects of head injury. Another factor is that popular modern treatments such as shock therapy and prefrontal leucotomy appear to involve cerebral areas intimately associated with intelligence. The greatest advances, however, have been made by the followers of Rorschach and of Goldstein and their contributions began before these factors arose. Their methods are also much applied in investigations under the fourth and fifth headings. Their influence, too, is discernible in a change now developing in the way of using mental tests. Whereas in most early investigations tests were used quantitatively as instruments for studying how intelligence level affects and is affected by psychosis, the modern tendency is to use tests not as measuring instruments, but as standard interviews or situations in which the quality rather than the level of the subject's behaviour is studied. On the other hand, perhaps it was growing recognition of the unsuitability of most quantitative tests for application to adults, and of the additional difficulties of interpreting results in psychoses, that first induced search for other techniques.

II. TESTS AND SCALES.

Tests are currently used for investigating general intelligence, intellectual deterioration, conceptual thinking, and character and personality.

Tests of general intelligence.—Chief of these is the revised Stanford Binet scale. The new features are extension in range upwards and downwards, calculation of the I.Q. with a denominator of C.A. 15 instead of 16, and appearance in two equivalent forms, L and M. It still has many disadvantages. It is still, as Cattell (1940) scathingly says, a " hotch-potch." The ingredients are different at different levels of the same version, and at the same level of

different versions. Its administration to adults is a long and tedious business. The content of the items is often too childish or too gruesome (Krugman, 1939) to be suitable for adults and abnormal subjects. Its abbreviated vocabulary test appears to exaggerate mental age (Atwell, 1939; Brody, 1940). Nevertheless, its great prestige will ensure wide application.

Wechsler's Bellevue scale (1941) is rapidly gaining popularity. It consists of a battery of five verbal tests—comprehension, information, digit span forwards and reversed, arithmetical reasoning and similarities—and of five performance tests—picture arrangement, picture completion, object assembly, block design, and digit symbol. Intelligence quotients can be calculated for the total battery and for each half. Quotients are moreover calculated with a different denominator for different age-groups, thus allowing for normal decrement after adolescence. Such batteries are superior to scales of the Stanford Binet type for investigating psychometric pattern and for comparing persons of different ages.

Penrose and Raven's " Progressive Matrices " is a non-verbal intelligence test now widely used (Raven, 1942), and too familiar to need description. A disadvantage, common to all paper-and-pencil tests, is that the cause of failure in psychosis is not directly evident.

Among rapid tests of general intelligence those described by Brody (1940), Esher (1941), Hayman (1942), Kent (1942) and Trist (1941) may be recommended.

Measures of intellectual deterioration.—Babcock's test is the best known of these, and provided the pattern for others. The first part of the test, the 1916 Stanford Binet vocabulary test, is claimed to measure the patient's pre-morbid intelligence level. The second part tests the patient's effective ability in numerous traits. Norms for Part II are available for each vocabulary level. The index is calculated by subtracting the patient's average score in Part II from the norm for his vocabulary level. Part II of the 1930 version has 30 items, of which 20 are used in the 1933 version. Babcock and Levy again revised the scale in 1940. Brody's " Discrepancy Score " (1942b) is the percentage discrepancy between vocabulary norm and average score on five Babcock items. Discrepancy between score on vocabulary and on other tests, for example, a vocabulary-free Stanford Binet scale, has been similarly employed. Shipley's Hartford test (Pollock, 1942) employs the same principle in a paper-and-pencil form. Part I is a 40-item multiple choice vocabulary test. Part II contains 20 mixed items of the series-completion type claimed to test abstraction (e.g. mist is . . . wasp as . . . pint in . . . tone . . .). A limit of ten minutes is set for each half. The percentage of the score on Part I obtained in Part II is called the " Conceptual Quotient."

Hayman (1942) has adapted serial subtraction of 7 from 100 as a test of intellectual deterioration.

Tests of conceptual thinking.—Goldstein himself with Scheerer (1941) has described five of these. In two, a modified Kohs block-design and the " Stick Test," patterns are to be copied with coloured cubes and orange sticks. The task in the other three is sorting—of coloured wools, of cardboard discs which can be grouped as to colour or shape (the Weigl test), and of objects which can

be grouped as to shape, colour, mateiial or use. Another favourite is Hanf-mann and Kasanin's (1942) modificatiɔn of the Vigotsky test. The material consists of blocks of various shape, size and colour, but classifiable into four categories designated by nonsense names. The task is, by achieving the four-fold grouping, to arrive at the " meaning " of the nonsense names. Many verbal items, interpretation of fables for example, also test conceptual thinking.

Tests of character and personality.—These are considered in Section XII.

III. REVIEWS.

Blackburn (1938) and Brody (1942a) have published surveys of the litera-ture. The former reviews methods, the latter results. Brody includes a résumé of investigations on normal changes in mental test ability from adoles-cence to senility, to which the results in psychosis are referred. Kendig and Richmond (1940) and Roe and Shakow (1942) mention most of the important previous investigations. Excellent reference books have been published by Buros (1938, 1940) and Greene (1941).

IV. VALIDITY.

Has this individual failed because he is deficient in the specific function investigated by the test, or because he cannot react normally to the " piece of life " which the test session, so to speak, constitutes ? This doubt overhangs the validity of all conclusions, based on test results, about the " intelligence " of abnormal persons. Even though the subject has displayed during the tests his maximum co-operation, attention, effort, equanimity and so on, these may remain below levels necessary for validation. Wittman, realizing this, has devised the Elgin Test Reactions Scale (Wittman and Russell, 1942) whereby such factors can be rated. Significant here is Layman's report (1940) that increased rapport achieved by intravenous sodium amytal in schizophrenia is accompanied by improved test performance.

Roe and Shakow (1942) compared Stanford Binet records in " representa-tive " and " non-representative " patients. A patient was deemed " repre-sentative " if his performance was thought to be his best. In all diagnostic groups the former surpass the latter, " but the effect of attitude seems to be by far the greatest in the hebephrenic group, with the catatonic and paranoid groups following. It is least in the psychopathic personality, unclassified praecox and manic-depressive groups. These results may be interpreted to mean either that in some diagnostic groups attitude affects cognition less than it does in others, or that in these the quality of representativeness is more difficult to judge. Both factors seem to be involved but in different degrees." The differences between the groups were less than those between representative and normal groups. Thus, the effect of psychosis is greater than that of atti-tude ; but—an important point—the pattern of their effects is essentially similar.

V. PREMORBID INTELLIGENCE IN RELATION TO PSYCHOSIS.

Test results.—Whether psychoses in general or particular appear at certain mental levels rather than at others is a problem of perennial interest. Test results

XC.   9

in psychosis are rarely valid measures of intelligence. But the range of levels in Roe and Shakow's groups was so wide that it seemed "a potent argument against a belief-that original level of intelligence may determine in any substantial part the type of psychosis." In contrast, a graph prepared by Atwell (see Epstein and Solomon, 1939) of the I.Q. distribution of large numbers of recent patients shows the 50th percentile cutting I.Q. 78 as compared with I.Q. 87 for the American Army white draft. The results of Collins *et al.* (1938) suggested that epilepsy particularly attacks the feeble-minded. According to Trowbridge *et al.* (1939) alcoholism occurs in persons who, as a group, "may be classed as dull, but certainly not feeble-minded." Vocabulary level is the best, though not infallible, test indicator of pre-morbid intelligence, but has not been used in the present problem.

Educational levels.—Educational levels have been investigated by Roe and Shakow (1942) and by Kendig and Richmond (1940). Of the former's groups only the catatonics significantly differed from normal, having had almost two years more schooling. The latter, however, report that 76 per cent. of their 500 schizophrenics were retarded at school. The quality of school work was "poor" in 41 per cent. of cases, the catatonic and paranoid types having had the best records. The hebephrenics had the highest percentage (20 per cent.) to reach college level. Either schizophrenia, they conclude, or the factors precipitating it occur early enough to encroach on the school period, or the malady chiefly affects persons of poor endowment.

Psychosis and mental defect.—Rosanoff (1938) quotes figures showing that psychoses are common in oligophrenia. Mental defectives with psychosis constitute 3·5 per cent. of the total population in New York State Hospitals, and about 2·2 per cent. of first admissions. Kallman *et al.* (1941), however, after studying the taint conditions in the kinships and twin partners of schizophrenics and mental defectives, find no correlation between the two conditions.

A new method.—Sufficient time has now elapsed for obtaining relevant information by following up children and adolescents tested in the early days of standardized scales. This method offers the best chance of solving this problem. Gardner (1940) has made a promising start. The 22 psychotic patients he discovered in a follow-up of 3,500 children had been normal in intelligence. Terman (1940), more interested in the fate of his group than the present problem, reports, incidentally, that highly gifted children, examined after an interval of 16 years, had a lower insanity rate than others of their age.

VI. Intelligence Level in Psychosis.

Few researches are now undertaken simply to measure "intelligence level" in psychosis. Test results are rarely valid indicators of premorbid capacity; and other methods have now been evolved for investigating intellectual deterioration.

Mental ages, or their equivalents, in various syndromes are included in papers by Babcock (1941), and Roe and Shakow (1942); in schizophrenia, by Kendig and Richmond (1940), and Chase (1941); in drug addiction by Hall (1938), Pescor (1938), and Brown and Partington (1942*a* and *b*); and in

epilepsy by Collins *et al.* (1938). On the whole the results are in agreement, and support other evidence of the important effects of faulty test reaction. Groups such as psychoneurotics, drug addicts, manic-depressives in remission and paraphrenics consistently approach normal. Paretics and epileptics score poorly, with mental ages usually about 11. Results in schizophrenia vary between these levels, paranoid excelling hebephrenic types.

VII. PSYCHOMETRIC PATTERN.

The disposition of an individual's relative success in different kinds of tests or in the items of a composite scale is termed his psychometric pattern. Many attempts are now being made to discover specific psychometric patterns in psychosis as a whole and in the various diagnostic groups.

Vocabulary preservation.—An early observation was that vocabulary ability is usually well preserved in psychosis. Many modern researches confirm this. Good testimony is the popularity of Babcock's technique for measuring dementia, since its validity depends on vocabulary preservation. Davidson (1939) and Roe and Shakow (1942) found vocabulary superior to Stanford Binet scores. Jastak (1939) and Bijou (1939, 1942*a* and *b*) regard vocabulary supremacy as a hallmark of mental abnormality. Wechsler (1941*a*) and Magaret (1942) report vocabulary supremacy in psychotic performance of the Bellevue scale. Penrose and Myers' patients (1941) achieved their best performance in vocabulary (see Graph II). The frequency of better performance in psychosis on verbal than on non-verbal tests is partially attributable to the prominence of vocabulary and similar items in verbal scales.

Nevertheless evidence is now accumulating which throws doubt on both the specificity and universality of this vocabulary superiority. By listing the vocabulary-Stanford Binet discrepancy according to age, Roe and Shakow convincingly demonstrate that vocabulary superiority increases with increasing age, irrespective of psychosis or normality. Brody's survey (1942*a*) led to a similar conclusion. Capps (1939) and Gottschalk (1942) both report almost zero Babcock indices in their most deteriorated epileptics, proving that vocabulary had declined to the general level. The schizophrenics studied by Kendig and Richmond and by Chase scored on vocabulary little better than on the whole Stanford Binet scale. Shakow *et al.* (1941) found in senile and arterio sclerotic patients a vocabulary failure absent in normal persons of the same age. The hebephrenic and paretic subjects of Roe and Shakow scored 28 and 16 M.A. months below the levels expected from their educational histories. Brody (1942*c*) found that vocabulary score itself decreased with increasing dementia, partially explicable, he believes, by *earlier* as well as greater vocabulary deterioration than has hitherto been supposed.

Verbal-non-verbal pattern.—Jastak's pattern, vocabulary highest, verbal scale next, non-verbal scale lowest, is believed by Bijou to be so characteristic of abnormality that he suggests (1942*b*) its use by medical boards for the prediction of breakdown. Earl (1940) also attaches importance to verbal over nonverbal superiority. He found that the prognosis for morons was good in those who scored better on Kohs blocks and a modified Dearborn formboard than on

vocabulary and verbal absurdities, and poor in those with the reverse pattern. Wechsler found better performance on the verbal than on the non-verbal half of his scale in " organic brain disease, psychosis and psychoneurosis." In the same scale, verbal preponderance is displayed in schizophrenia (Rabin, 1942a, Mitchell, 1942) and depression. Epileptics investigated by Somerfeld-Ziskind and Ziskind (1940) scored below their Stanford Binet mental age on the Goodenough drawing and Knox cube tests. In two investigations of children inadequacy on non-verbal tests accompanied abnormality. According to Bender (1940), children with post-encephalitic behaviour disorders exhibited specific disability in the Goodenough drawing test. Lord and Wood (1942) invariably discovered evidence of cerebral damage in children who, in comparison with their performance in verbal tests, scored poorly in a designs from memory test, the Ellis Visual Designs test. It should be noted that the designs from memory and ball-and-field items usually included in verbal scales and regularly found to be difficult for psychotic subjects are essentially non-verbal in type.

Some investigations, however, have failed to reveal this pattern of verbal over non-verbal test superiority. Gilliland (1941) discovered no significant differences in this respect between the Wechsler patterns of psychotic and normal subjects. Brown and Partington (1942a and b) made a similar comparison, with negative results, between narcotic drug addicts and normals. Sixty patients tested by Benton et al. (1941) had mean I.Q.'s of 105 and 99 for the verbal and non-verbal of the same scale, the difference being statistically insignificant. Rabin (1941, 1942a and b) and Wechsler himself (1941a) found no verbal supremacy in manic-depressive and psychoneurotic patients, and in psychopathic personalities and mental defectives. Arluck's (1941) 16 epileptics showed insignificant differences between performance on verbal tests and Porteous mazes. Brody (1942c) found that verbal superiority, though present in slight, was absent in more severe dementia, wherein there is a general levelling down of abilities.

Stanford Binet pattern.—Many attempts have been made to discover Stanford Binet patterns typical of diagnostic groups. Malamud and Palmer (1938) evolved schizophrenic and organic patterns from the analyses of the performance of 100 patients of each type. The organic pattern is composed of successes on years X, XII and XIV vocabulary and on year XIV "differences between president and king"; and of failures on " counting backwards from 20 to 1," " weights," " 4 and 5 digits reversed," " three words in a sentence," year X " absurdities," " free association for three minutes," and " date." The schizophrenic pattern is composed of successes as in the organic pattern with additional success on year XIV " arithmetic "; and of failures in years VIII and X " comprehension," " date," " weights," " three words in a sentence," year X " absurdities," " free association for three minutes," year XII " picture interpretation " and " problems of fact." As can be seen, the patterns are similar, especially in the successes, which are mainly in vocabulary. Collins et al. (1938) applied the Stanford Binet scale to 229 epileptics whose M.A. range was 2–6 to 18–0 with the median at 10–5. Notably common failures below average adult level were on " ball-and-field "

both plans, "weights," "4 digits reversed," "6 digits forward," "rhymes," "immediate memory for paragraph," and especially "designs from memory." At the upper levels, tests often passed above M.A. were "induction," "problems of fact," and "enclosed boxes." On comparing these patients with 249 paretics and 210 schizophrenics, Collins (1939) concluded that the pattern was " of deterioration and memory failure in the paretic, of apathy and thinking disturbance in the schizophrenic, and non-psychotic in the epileptic." In 1941 she again failed to find a specific pattern in epilepsy. Somerfeld-Ziskind and Ziskind (1940) and Arluck (1941) had similar results in epilepsy. Whereas Kendig and Richmond found little to differentiate the patterns in the four types of schizophrenia, Roe and Shakow discovered differences on almost every item. In schizophrenia as a whole, however, their results agree. Kendig and Richmond divide the items notably failed by schizophrenics into two groups, as follows :

Mainly Eductive.

Fables : XII–5 and XVI–2. Abstract words : XII–2 and XVI–3. Vocabulary : XIV–1. Induction : XIV–2. Problems of fact : XIV–4. Ball-and-field : VIII–1 and XII–3. Dissected sentences : XII–4. Pictures : VII–2 and XII–7. Absurdities : X–2. Comprehension : X–5. Differences : VII–5. Similarities : XII–8.	This includes all items classed by Roe and Shakow as conceptual and associative thinking, except XVI–4, XVI–6 and XIV–6, and also all vocabulary and definition items.

Mainly Non-eductive.

Digits forward : VII–3, X–Alt. and XIV–Alt.
　　„　reversed : IX–4.
Designs : X–3.
Reading and report : X–4.
60 words : X–6.
Date : IX–1.
Weights : IX–2.
Syllables : VI–6.

Roe and Shakow group the Stanford Binet items into four classes (Table I). Their summary of the pattern in many syndromes appears in Table II. Apart from the vocabulary preservation already mentioned, they were impressed by the " consistency with which repetition of digits forward was affected. . . . In general, the severer the clinical manifestations of the disorder, the more marked the impairment of this test " ; but whether due to disturbance of memory or of the span of attention, they were unable to decide. Analysis showed that items " primarily affected are of the conceptual thinking and immediate memory group, and . . . those least affected are old learning items."

Roe and Shakow also compared similar disorders. In chronic alcoholism with and without psychosis and in acute alcoholic psychosis, the pattern was similar although general level was superior in the last group. Psychopaths with and without psychosis were very close, with, however, more variability in the latter. This group closely resembled the psychoneurotic but was significantly inferior at interpreting pictures and the clock test. Paraphrenics were

TABLE I.—Classification of Stanford-Binet Items (Roe and Shakow, 1942).

Year level.	Remotely learned—vocabulary (LRV).	Remotely learned—other types (LRO).	Immediately learned (LI).	Associative thinking—immediate (TAI).	Associative thinking—sustained (TAS).	Conceptual thinking (TC).
VI	..	1. R. and L. 3. 13 Pennies 5. Coins	6. Syll. (16)	2. Mut. Pic. 4. Compr.	..	..
VII	..	1. Fingers 4. Bow knot 7. Days week	3. 5DF 8. 3DB	2. Pic. des.	..	5. Diff.
VIII	5. Defn. 6. Vocab. (20)	2. 20—0 7. Coins	..	3. Compr.	1. B. and F.	4. Simil.
IX	..	1. Date 7. Months	4. 4DB	3. Change	5. Sen. cons. 6. Rhymes	..
X	1. Vocab. (30)	..	3. Designs 4. Rd. and rep. 7. 6DF 8. Syll. (20)	5. Compr.	..	2. Absurd.
XII	1. Vocab. (40) 2. Abst. words	..	6. 5DB	7. Pic. intp.	3. B. and F. 4. Diss. sent.	5. Fables. 8. Simil.
XIV	1. Vocab. (50)	..	7. 7DF	..	5. Ar. reas. 6. Clock	2. Induct. 3. Pres. and king. 4. Prob. fact.
XVI	1. Vocab. (65)	..	5. 6DB 7. Syll. (28)	..	4. Encl. box 6. Code	2. Fables. 3. Abs. words.
XVIII	1. Vocab. (75)	..	3. 8DF 4. Thought 5. 7DB	..	2. Paper cut 6. Ingenuity	..

TABLE II.—*Types of Items Affected in Representative Groups* (*Roe and Shakow*, 1942).

	LRO.	VOC.	TAI.	TAS.	LI.	TC.	No. +.
General paresis	+	+	+	+	++	++	8
Chronic alcoholism c̄ psychosis	o•	+	o	+	+	+	4
„ „ s psychosis	o	o	o	o	o	+	1
Acute alcoholic psychosis	o	o	o	o	o	o	0
Paranoid DP	o	+	+	o	+	++	5
Hebephrenic DP	+	++	++	++	++	++	11
Catatonic DP	o	o	o	o	o	+	1
Simple DP	o	o	+	o	+	+	3
Unclassified DP	+	+	+	+	+	++	7
Manic-depressive	o	o	o	o	o	o	0
Psychopathic personality c̄ psychosis	o	o	o	+	o	+	2
„ „ s psychosis	o	o	o	o	o	o	0
Paranoid condition	o	o	o	o	+	o	1
Psychoneurosis	o	o	o	o	o	o	0
Without psychosis	o	+	+	+	+	+	5
Number of groups with + or ++	3	6	6	6	8	10	..
Total number +	3	7	7	7	10	14	48

o = None ; + = 1-40 per cent. ; ++ = 41 per cent. above.

consistently superior to paranoid schizophrenics, though statistically, only the difference in absurdities at X–2 approached significance. Catatonic and manic-depressive patients were indistinguishable in both total performance and item analysis. Chronic psychotic alcoholics surpassed paretics in total performance and in similarities, induction, 4 digits backwards and 6 digits forward. Paretics surpassed both psychotic and non-psychotic simpletons in mean score and in many items. They were, however, differentiated from the hebephrenics (Graph I) by only one sign—superiority in XII–2 differences between abstract words. This important result is confirmed by the similarity in Wechsler pattern between Magaret's (1942) schizophrenic and paretic patients.

Brody (1942c) investigated psychometric pattern in dementia with form L of the revised Stanford Binet scale. He summarized his chief findings as follows :

Item.	Significance.
Below year VII Similarities and differences (year VIII)	Failure uncommon but always indicative of serious dementia if vocabulary is within normal range.
Memory for designs (year IX) Reading and report (year X) Copying bead chain (year XIII) Picture absurdities (year XIV) Orientation (year XIV) Codes (A.A.) Ingenuity (A.A.) Essential similarities (S.A. 1) Enclosed boxes (S.A. 1)	Failure below vocabulary age almost always present in serious dementia, but not necessarily proof thereof, since many normal persons also fail here. Success strongly argues against the presence of serious dementia.
Verbal absurdities (year VIII) Memory for stories (year VIII) Memory for sentences (year VIII) Paper cutting (year IX) Rhymes (year IX) Dissected sentences (year XIII)	Failure below vocabulary age present in at least 50 per cent. of seriously demented patients, and usually indicative of serious dementia.
Finding reasons (year X)	Failure below vocabulary age as above, and almost always indicative of serious dementia.

TABLE III.—"Pattern" of Psychotic Test Performance (Penrose and Myers, 1941).

"General Examination M."
Relative Difficulty of Sub-tests for Psychotic Subjects.

Revised Stanford-Binet (Form L).
Relative Difficulty of Items for Schizophrenic Subjects.

Sub-test.*	Relatively easy.	Non-psychotic. N. 293.	Psychotic N. 40.	Number of year levels at which item appeared.	Relatively easy.	Average weighted score value.†
v.	Vocabulary	10	9·3	9	Vocabulary	+ 35
No. 2	Picture assembly	10	8·8	4	Abstract words	+ 12
No. 9	Same—opposite	10	8·1	3	Memory for sentences	+ 10
No. 7	Arithmetic problems	10	8·0	7	Repeating digits	+ 10
	Relatively hard.				**Relatively hard.**	
No. 6	Mechanical information	10	5·7	4	Absurdities (verbal)	− 16
No. 8	Absurdities (verbal)	10	5·5	3	Memory for stories	− 21
No. 1	Picture completion	10	4·9	3	Absurdities (picture)	− 28
No. 3	Absurdities (picture)	10	4·7	4	Memory for designs	− 29

(Mean standard score.)

* Sub-tests Nos. 4, 5 and 11 are omitted because they were found to be of neutral difficulty, i.e. neither relatively "easy" nor relatively "hard" for psychotic subjects.

† Weight based on comparison of 100 schizophrenic and 100 non-psychotic subjects (matched for M.A.). Each item was compared to other items in the same year level in respect to per cent. passing.

TABLE IV.—*Test Characteristics of Various Clinical Groups (Wechsler, 1941).*

A. Organic brain disease.

    1. Verbal higher than performance.
    2. Information : Relatively good.
    3. Comprehension : Relatively good.
    4. Arithmetic : Poor.
    5. Similarities : Poor.
    6. Memory span : Very poor, particularly digits backwards.
    7. Block design : Very poor.
    8. Object assembly : Poor.
    9. Digit symbol : Very poor.
    10. Small variability when verbal and performance test scores are considered separately.

B. Schizophrenia.

    1. Verbal higher than performance.
    2. Information : Good.
    3. Vocabulary : High.
    4. Comprehension : Generally good but occasionally poor.
    5. Arithmetic : Poor.
    6. Memory span : Unpredictable ; usually high on digits forwards, often poor on digits backwards and generally poor when taken together.
    7. Similarities : Low (paranoid).
    8. Picture arrangement : Low in certain types of paranoids.
    9. Picture completion : Low in hebephrenics and relatively high in simple schizophrenics.
    10. Digit symbol : Low.
    11. Block design : Better than object assembly.
    12. Large intertest discrepancies.

C. Psychopathic personality (adolescents).

    1. Performance higher than verbal.
    2. Object assembly : High.
    3. Information : High.
    4. Comprehension : Unpredictable.
    5. Arithmetic : Poor.
    6. Similarities : Poor.
    7. Picture arrangement : Relatively good.
    8. Picture completion : Frequently poor.
    9. Sum of block design and picture completion test scores nearly always less than sum of object assembly and picture arrangement test scores.
    10. Intertest variability : Moderate.

D. Neurotics.

    1. Verbal higher than performance.
    2. Vocabulary : High.
    3. Information : Good.
    4. Arithmetic : Unpredictable, but generally poor.
    5. Digit span : Generally poor, frequently showing no difference between number of digits repeated correctly forwards and number repeated correctly backwards ; sometimes better on digits backwards than on digits forwards.
    6. Similarities : Relatively good.
    7. Object assembly : Low.
    8. Digit symbol : Generally low, but with some exceptions.
    9. Interest variability : Unpredictable but generally less than schizophrenics.

Attempts, however, to categorize these items failed. No distinctive types of mental test differentiated non-demented, slightly, moderately and seriously demented subjects. Font (1940) also used the revised version. Although the published summary of his paper gives no details, he claimed that certain responses were typical of schizophrenia. Penrose and Myers (1941) compared the psychometric patterns of psychotic and neurotic subjects in General Examination—M of the Canadian Psychological Association and in the Stanford Binet scale with that of recruits. In both tests, the easy and difficult items were of the same kind (Table III). They claimed that 75 per cent. of abnormal cases could be recognized by the pattern in General Examination M.

Wechsler pattern.—Wechsler's own large experience led him to beliefs summarized in Table IV. Elsewhere (1941*b*) he noted specific failure amongst heavy drinkers without psychosis or signs of cerebral involvement, in the similarities and digit-symbol items of his scale, suggesting that capacity for logical analysis and organization is affected more than memory. The pattern discovered by Rabin (1941, 1942*a*) in manic-depressive psychosis and schizophrenia is shown in Table V. Rabin believes that the index $\dfrac{\text{Inf.} + \text{Comp.} + \text{Block design}}{\text{Dig.-Symb.} + \text{Obj. Ass.} + \text{Sim.}}$ is useful for diagnosing schizophrenia. Indices in various groups were nurses, 0·98 ; manic-depressive psychosis, 1·08 ; psychopathic personality, 1·08 ; psychoneurosis, 1·09 ; schizophrenia, 1·27. On comparing senile and arterio-

TABLE V.—*Rank Order of Wechsler Subtests in Psychosis* (*Rabin*, 1941, 1942*a*).

| Item.	28 Manic-depressives.	76 Schizophrenics.	92 Normals.
Information	1	1	7
Comprehension	2	2	2
Arithmetic	8	3·5	10
Digits	9	7·5	9
Similarities	4·5	5	5·5
Picture completion	6·5	7·5	8
Picture arrangement	6·5	9	5·5
Object assembly	4·5	6	3
Block design	3	3·5	4
Digit symbol	10	10	1

sclerotic dements (1942*b*), he found that age particularly affects performance in object assembly and picture completion, and arteriosclerosis in digits and arithmetic, while leaving conceptual approach to the similarities and block design items relatively unimpaired. The schizophrenic pattern described by Magaret (1942) differed not only from the normal pattern, but also from the schizophrenic patterns described by both Rabin and Wechsler.

In contrast, Gilliland (1941) and Brown and Partington (1942*a* and *b*) could find no distinctive patterns in various groups. Where deterioration occurred, if was general rather than specific.

Babcock test.—Hall (1938) applied the 1930 Babcock test to 27 female drug addicts aged 22 to 57. Their scores were above their average for the total battery on tests of motor control and previous knowledge, but below that level on tests of memory, learning, and, especially, tests requiring close attention. Partington's (1940) 156 male addicts aged 18 to 68 displayed deficient learning and motor control but normal repetition. In epilepsy (Gottschalk, 1942) " there seems to be no impairment in formation of new associations, remote memory, orientation, mental clarity, recognition or meaning comprehension. Lack of retention for recent data, small memory span, slow comprehension of new ideas, less inability to concentrate and difficulty in special mental effort, are all characteristic . . . in this group." According to Brody (1942*c*) Babcock performance in dementia is quite good on rote repetitions and items of practical and familiar information ; less good on memory tests, especially retention, and in motor control ; worst on tests requiring new learning—the ability to profit from experience—and on items of information not directly

connected with practical life. But the same pattern is present in dementia of all degrees and in non-demented subjects of the same age (50–69).

Babcock (1941a) analyses pattern on the Babcock-Levy test in many syndromes. Although she much stresses the importance of analysing an individual's pattern of abilities, and although each diagnostic group has special features, " the likeness in the mental capacities of patients at equivalent degrees of impairment is striking. In all groups, ability to do something
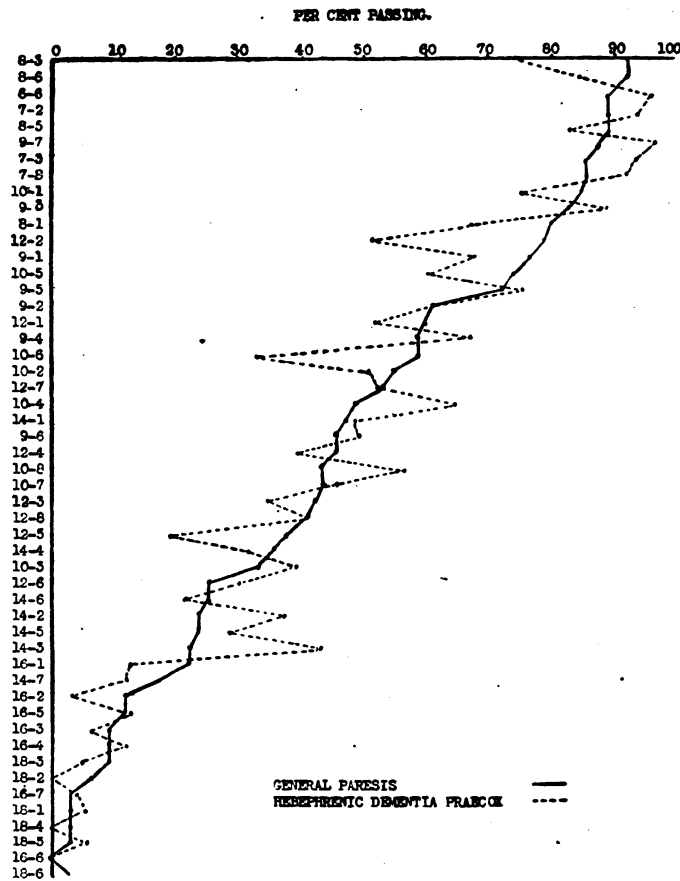
GRAPH I.

which requires concentration and which cannot be done by dependence on old habits, scores the lowest. The next lowest is Warming Up. . . . Next are the first trials in learning tests but not the learning. After these are tests of fixation and recall. . . ."

Scholastic tests.—According to Jastak (1941), " . . . high reading and low arithmetic scores tend to occur in mental states of a developmental nature and of long standing as in neuroses and schizophrenia, while high arithmetic and low reading abilities are more frequent in acquired psychoses due to alcoholism and syphilitic infection."

Discussion.—Although these researches have conflicting results, their

number and quality reflect the increasing importance attached to psycho-metric pattern. It is a pity that so much work has been done with " hotch-potch "-scales, which make comparisons difficult. Wechsler's scale is to be recommended.

Perhaps the most frequent and striking conclusion is the similarity in organic and non-organic syndromes (Malamud and Palmer, Roe and Shakow, Babcock, Gilliland, etc.). On the whole Jastak's pattern—vocabulary highest, verbal scale next, non-verbal scale lowest—is confirmed, but with reservations. Vocabulary is now known to deteriorate earlier and more than was thought; and, in serious disorganization, there is a general levelling down of abilities. Further, more results comply with a principle of classification not according

Sub-Tests – "General Examination- M"

GRAPH II.
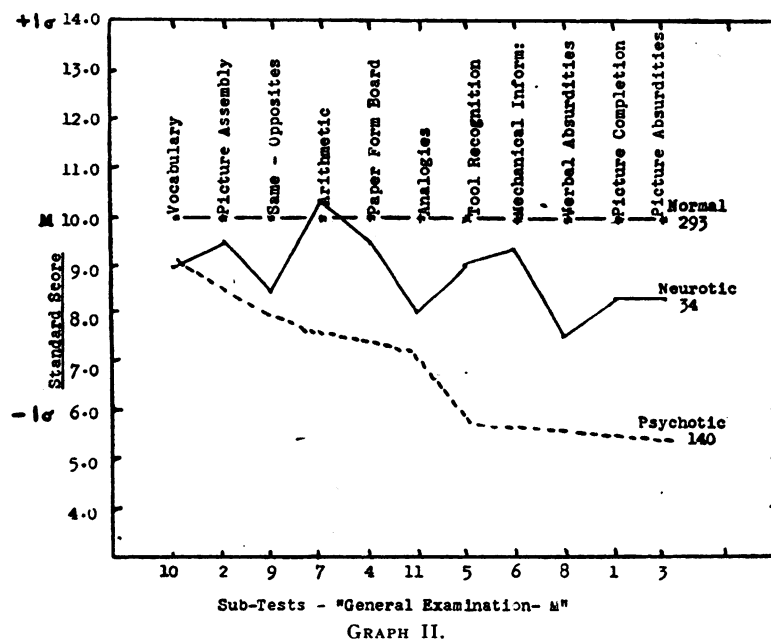
to the material of the test, but on the extent to which the answer is ready made or has to be actively sought. Vocabulary, old school knowledge, and familiar information are of the first type. Non-verbal tests are usually of the second type. Mixed verbal scales, like the Stanford Binet, have items of both types.

Some, notably Babcock, regard patterns as reflections of native endow-ment, or of the effect of psychosis on true " intelligence." Such assump-tions fail to consider two points. First, so-called psychotic pattern is displayed by normal persons at just the age when organic dementia is commonest (Magaret, 1942). Thus a dilemma arises. In early and slight dementia, the pattern is the same as in normal senility, and in more serious dementia, only a patternless low level is achieved. Even the classical memory defects of senile and arteriosclerotic dementia are thought by Shakow et al. (1941) to be due more to age than psychosis. Second, the demands made by tests as " pieces of life " are clearly in the reverse order

to the ease with which answers can be given ready made. Thus, irrespective of any other factor, the faultier the " attitude," the greater the tendency to the pattern. Thus, as results show, the pattern appears less in young co-operative patients such as drug addicts and manic-depressives in remission than in schizophrenics, in whom it is less evident in paranoid than in hebe-phrenic types. In paraphrenia, better attitude is counterbalanced by usually greater age. It seems therefore that the above assumptions are not warranted. In young persons an uneven pattern may indicate abnormality—Bijou's suggested use of Jastak's pattern by service recruiting boards may be justified —or may help to confirm a suspicion of abnormality. But abnormality may be present in its absence. In persons over 50 it is probably without significance. A separate interpretation must be made for each individual. Despite much good work and more promise, knowledge of psychometric pattern is not yet enough for safe generalization.

VIII. SCATTER AND IRREGULARITY.

Subjects only rarely pass every item on a composite scale at or below a certain level and fail every item thereafter. The dispersion between the level of complete success (basal age) and complete failure (upper limit) is termed " scatter." Scatter is also sometimes used to denote variability in different kinds of tests. " Irregularity " is a good term for this, since " variability," the obvious term, is also sometimes used as a synonym for scatter in composite scales.

Stanford Binet scatter.—Harris and Shakow, who demonstrated the high correlation of numerical measures of scatter with M.A., compared (1938) schizo-phrenic, delinquent and normal groups. The schizophrenics rated higher than the normals in Pressey and age-level scatter, but lower in Woodworth and Wallin scatter. On equating mental age, significant differences disappeared. They believe that scores of and above 8 in age-level scatter and 40 in Pressey scatter may be accepted as probable, but not invariable evidence of abnormality. Malamud and Palmer (1938), using four different measures of it, found scatter about equal in organic and schizophrenic groups, but considerably higher in both than in morons of the same mental age. Collins (1939) found increased and about equal scatter in G.P.I., schizophrenia and epilepsy. Kendig and Richmond (1940) found Pressey scatter low at the upper and lower, and high at the medium M.A. levels. On the average their schizophrenics were insignificantly more irregular than normals. But the greater range in schizo-phrenia suggested that exceptionally high scatter might indicate " functional disorder impairing the reliability of the examination, or organic involvement resulting in selective deterioration." The greatest range and highest median scatter occurred in the catatonic type ; otherwise inter-group differences were slight.

Scatter in the revised Stanford Binet scale was studied by Brody (*1942c*) in demented and non-demented cases. He found that Harris and Shakow's critical limits do not apply in the revised version. Both Stanford Binet scatter and inter-test irregularity inadequately differentiated his subjects.

Other tests.—Gilliland (1940) reported 35 per cent. more Wechsler scatter in 100 psychotic patients than in 100 controls. Magaret (1942) also found increased Bellevue scale scatter in schizophrenic and paretic subjects. According to Chase (1941), increased scatter characterizes hebephrenic performance of the Goodenough drawing a man test.

Discussion.—High scatter and uneven psychometric pattern obviously go together. The conclusions of the previous section therefore apply here. A further limitation on the usefulness of scatter is its relation to mental age. Where this is low, scatter is restricted by the poverty of the subject's powers ; and where M.A. is high, scatter is restricted by the test "ceiling." Thus, comparisons are valid only between groups of about equal and about medium intelligence. Unfortunately, selection of such groups is beset with difficulty, for, as has been previously shown, to measure "intelligence" reliably in psychosis is almost impossible except in subjects who deviate so little from normal that their scatter is also likely to be normal, or in those sunk so low that their scatter is limited by their uniformly poor performance.

IX. The Diagnosis and Measurement of Intellectual Deterioration.

Re-test method.—One method of studying intellectual deterioration is to apply tests at intervals. This technique was first, and has so far been mainly, used in epilepsy. Barnes and Fetterman (1938) analyzed the Stanford Binet records of 35 epileptics over ten years. On the whole, deterioration was absent. This, too, was the conclusion of Rubisoff (1940), whose 66 epileptics dropped an average of only four Stanford Binet I.Q. points in from one to eleven years. Both luminal-treated and untreated epileptics sustain their performance according to Somerfeld-Ziskind and Ziskind (1940). Arieff and Yacorzynski (1942) reported an average drop in from one to ten years of only six Stanford Binet I.Q. points in 27 patients with "organic" epilepsy. Even this significantly exceeded the drop in 63 non-organic epileptics (Yacorzynski and Arieff, 1942). Thirty-seven per cent. of the first group and only 4·8 per cent. of the second consistently deteriorated. Collins (1941) however, after examining the Stanford Binet records over 12 years of 106 epileptics, reported deterioration in 65 cases, no change in 36, and improvement in only 5. All agree that the number and severity of the fits is not related to deterioration, which is, however, greater the greater the duration of the illness (Fetterman and Barnes, Collins, Harrower-Erickson).

Kendig and Richmond (1940) intensively studied Stanford Binet retests after several years in 72 schizophrenics. Thirty-one (43 per cent.) were too inaccessible to test, 31 (43 per cent.) advanced or maintained their level, only 10 (14 per cent.) deteriorated. Items wherein deterioration was most conspicuous were about equally of the eductive and non-eductive type. "Most of them however require close and frequently very sustained attention and the expenditure of considerable effort to solve them." They conclude that true intellectual deterioration is uncommon in schizophrenia.

Babcock and similar techniques.—The most popular current technique for

measuring intellectual deterioration is, as in Babcock's test, to calculate the discrepancy between scores in vocabulary and in other tests. With Babcock's test, Hall (1938) and Partington (1940) and Barnes and Fetterman (1938) found only slight doubtful deterioration in drug addicts and non-institutional epileptics. According to Capps (1939) and Gottschalk (1942), Babcock indices usually correlate well with clinical estimates of epileptic dementia, but mis-leadingly tend to zero, because of vocabulary deterioration, in the worst patients. Capps found a moderate correlation between deterioration and hospitalization, but none between deterioration and age, education, original I.Q. and duration of illness.

Babcock (1941a), having matched subjects in vocabulary level, reports indices with her latest revision as normal, 0·0 ; normal Q. —1·0 ; psycho-neurotic, —1·2 ; psychopathic personality, —1·9 ; simple praecox, —2·7 ; catatonic, —3·0 ; paranoid, —3·3 ; hebephrenic, —3·6 ; organic, —4·1. She also found (1940, 1941b) that normal subjects who scored at the extremes of Bernreuter intro- and extra-version and submission-dominance had interestingly large negative indices.

Vocabulary—Stanford Binet discrepancy.—The discrepancy between score in vocabulary and in the Stanford Binet scale deprived of vocabulary items and appropriately adjusted has been used like Babcock's scale. Malamud and Palmer (1938) found average discrepancies of 42·42 M.A. months in organic cases, 38.44 M.A. months in schizophrenics, and 0.84 M.A. months in morons of the same mental age. Davidson (1939) compared the discrepancies of manic-depressive and schizophrenic patients, mental defectives and normal children. Discrepancy was greatest in schizophrenia. Kendig and Richmond (1940) obtained results (Table VI) agreeing with their other evidence of the rarity of

TABLE VI.—*Vocabulary-Stanford-Binet Discrepancies (Kendig and Richmond, 1940)*.

Diagnosis.	Number.	Discrepancy in M.A. years.
Nurses	217	+ 0·3
Employees	128	+ 0·1
Paranoid-state	41	— 1·0
Total dementia praecox	477	— 0·2
Simple dementia praecox	14	+ 0·7
Hebephrenic dementia praecox	32	+ 0·1
Catatonic dementia praecox	51	— 0·1
Paranoid dementia praecox	41	— 0·9
With mental deficiency	22	+ 0·2

true dementia in schizophrenia. The comparatively high discrepancy in the paranoid patients probably arose from their relatively better preserved vocabulary.

Brody (1942b) calculated both the Babcock indices and the vocabulary-Stanford Binet discrepancy in three groups of patients with increasingly severe dementia. All the patients were fully co-operative and aged 50 to 69. He compared their performances with that of an equal non-demented group. He stressed the overlapping of groups at this age. "A critical level below which dementia is probable, if fixed low enough to exclude most non-demented patients, inevitably excludes some demented patients." He believed that the

sensitivity of these measures could be increased by expressing discrepancies as percentages of the vocabulary score. He suggested the following interpretations :

Interpretation.	1930 Babcock.		1933 Babcock.		V-St. B. discrep.	
	Index.	Per cent.	Index.	Per cent.	M.A. years.	Per cent.
Absent or doubtful dementia	0 to −2·50	0 to 15	0 to −3·00	0 to 20	0 to 3	0 to 20
Mild or moderate dementia	−2·50 to −4·50	15 to 27	−3·00 to −5·00	20 to 35	3 to 5	20 to 30
Serious dementia	−4·50 +	27 +	−5·00 +	35 +	5 +	30 +

Shipley-Hartford test.—The Shipley-Hartford test (Shipley, 1940*a* and *b*) employs the same principle. The significance of the " C.Q." is " above 90— probably normal ; 85–90, slightly suspicious ; 80–85, moderately suspicious ; 75–80, more than moderately suspicious ; 70–75, very suspicious ; below 70, probably pathological." Shipley and Burlingame's (1941) results are displayed in Table VII. Pollock (1942) discovered close correspondence between the scores and clinical condition of 50 patients, thus confirming the test's validity.

TABLE VII.—*Median Shipley-Hartford C.Qs. (Shipley and Burlingame,* 1941).

Diagnosis.	Number.	Median C.Q.
Normals	1,046	100
Private hospital patients	203	85
State hospital patients	171	65
Psychoneurotics	31	93
Manic-depressive depression	27	85
Manic-depressive mania	15	76
Schizophrenia	155	75·5
Involutional	17	75·5
C.N.S. syphilis	15	58

Other discrepancy tests.—Lidz *et al.* (1942) studied the vocabulary-Kohs' block discrepancy in definitely and doubtfully demented patients, schizophrenics and aphasics. In deciding that a discrepancy of over 2 M.A. years suggests deterioration, they failed to note the greater age of their demented patients. Brody (1942*b*), after investigating the discrepancy between scores on vocabulary and on Kohs', Passalong and Porteous tests, concludes that normal decline is so great in the second half of life that only a discrepancy of 50 per cent. of the vocabulary score constitutes indisputable evidence of dementia. Wesley (1942), without giving details, claims that 95 per cent. of organically demented patients can be differentiated by the discrepancy between vocabulary score and score on a varied battery of memory tests. Shaskan *et al.* (1942) found in 27 chronic encephalitics an average discrepancy of 30 I.Q. points between scores on the vocabulary, information and comprehension items and on the remaining items of Wechsler's scale. Hayman (1941, 1942) uses the simply and rapidly applied " serial sevens " test. Diagnosis is based on the number and pattern of errors or on a comparison with pre-morbid level as assessed by " the factors in the past history including school record and grade attained . . . or any standardized vocabulary test. . . ." In organic dementia, results correlated with clinical estimates. Failure of " conceptual attitude," especially in the presence of good vocabulary and verbal ability, helps to confirm

the diagnosis of intellectual deterioration in doubtful cases (Nadel, 1938 ; Benton and Howell, 1941 ; Anderson, 1942, etc.), and is proportional to " deterioration " in schizophrenia (Adler, 1942).

Rationale of discrepancy tests.—Babcock believed that discrepancy occurs because the two parts of her scale test long acquired—therefore well maintained—and recently acquired—therefore easily lost, functions. Yacorzynski (1941) believes it arises because success in vocabulary can be achieved by a " number of separate and qualitatively different acts of unequal difficulty," whereas other problems can be solved only by specific methods.

Scatter.—Still another method of measuring dementia is by numerical measures of scatter. These are now little used, having been found unsatisfactory.

Premorbid level and dementia.—Brody's (1942c) groups of patients showed, as already stated, decline in vocabulary score with increasing dementia. This implies, he believes, not only an early clinically unsuspected vocabulary deterioration, but also that dementia occurs in inverse proportion to the premorbid intelligence. The latter belief is supported by results in normal senility (Brody, 1942a), epilepsy (Collins *et al.*, 1941), and senile and arteriosclerotic dementia (Shakow *et al.*, 1941).

Discussion.—Much confusion has resulted in the past from failure to distinguish true intellectual deterioration from dilapidation and disinterestedness. As has been shown, it is now recognized that the effect of both on mental test performance is very similar. Hence, intellectual deterioration cannot be diagnosed purely by mental test scores. The manner of obtaining the score must be considered. Where, however, this justifies the method, tests are useful for recording the progress of an individual, and for assessing relative severity in comparable cases.

Serial tests appear to be preferable for the first task, and discrepancy tests for the second. Each, however, has disadvantages. High test-to-test variability may impair the significance of serial tests. This is indeed the case, according to Harrower-Erickson, in epilepsy, in which the method has been most used. Discrepancy indices have two defects ; they tend to zero in the most demented cases in whom vocabulary has severely deteriorated ; and, after the middle years, they tend normally to be so high that their significance is hard to assess. Both the Babcock test and the Stanford Binet are also too long—and tedious—for routine use. Nevertheless, discreetly used, Babcock's test is of indisputable value. Further progress seems to be promised more by refinement and abbreviation of this scale than by search for new scales, or by brief paper-and-pencil scales, such as Shipley's, in which the manner of obtaining the score is not directly apparent.

X. Psychopathology Revealed in Mental Tests.

Both the quality of mental test performance and item-analysis provide interesting pointers to underlying psychopathology. Rorschach's inkblots and tests of conceptual thinking have been especially fruitful. It should be noted that evidence of impaired categorization has often been reported in tests other than those specially designed to reveal it—for example, in items of the Stanford Binet scale.

XC.   ·   10

Non-cognitive aspects of intelligence.—Not surprisingly, many comments reflect faulty reaction to the test as "pieces of life." Both Kendig and Richmond (1940) and Capps (1939), for example, refer to failure of effort and attention. Of rather different meaning is "loss of directional control of thought," described by Malamud and Palmer in schizophrenia and organic psychosis, and by Collins in epilepsy. This appears to refer to the non-cognitive, affective-conative aspects of "intelligence" itself. These are the aspects of intelligence which Brody believes are particularly affected in dementia. In normal senility, he says, cognitive deterioration may be as great as in dementia, but the affective-conative deterioration is proportionately much less. In dementia, all aspects of the psyche, and, in most cases, the physical condition too, are affected. Diethelm (1942), on analysing thinking in dementia as revealed by the application of special tests, stressed the importance of non-cognitive factors. Jastak (1939) also differentiates cognitive and other elements in intelligence. He distinguishes intellectual "altitude" and "relevance," and coins the words " encracy " to denote test evidence of disparity between them.

Psychotic thinking.—Cameron (1938*a* and *b*, 1939*a* and *b*), opposing a popular theory, denies that either senile or schizophrenic thought can be understood as a simple regression to a child-like mode of thinking. In schizophrenia, he distinguishes (1) asyndesis—"the appearance of loose clusters of terms in place of organically integrated concepts "; (2) metonymic distortion—"the use of terms or phrases that approximate the meaning striking somewhere on the periphery of the target instead of at the bull's eye "; and (3) interpenetration—"the concomitant appearance of co-ordinate themes interweaving with each other, and, through mutual interference, producing what at first glance looks like a mere jumble of words." These signs were not exhibited by senile dements who " apparently suffered from a dearth of (mental) material ; and their organization, far from being too loose and too inclusive, was rather too simple and restricted." Capps supports Cameron's theories on the basis of tests applied to demented epileptics. Collins (1941), in contrast, found that the items failed by institutionalized epileptics suggested the influence of extrinsic factors such as social segregation and loss of normal environment rather than of epilepsy alone.

Korsakoff's psychosis.—Lidz (1942) asked patients to draw time after time a design somewhat resembling a face, but each drawing was removed after completion. The resultant distortions led to a theory that the fundamental disability is in constructing a continuum in time. This leads, first, to apathy about the present because there is no continuity of stimuli, next to confabulation with respect to gaps in the past, eventually to total disorientation. A peculiarity described by Zangwill (1941) in recognizing previously exhibited pictures, objects, and so on, may arise from this defect.

Efficiency in functioning.—Babcock (1940, 1941*a* and *b*) regards " efficiency of functioning," that is the tempo and control of perceptive, apprehensive and associative mechanisms, as the all-important factor in psychology. Where associations are too fast or too slow or without control, social difficulty ensues. The type of mental breakdown depends partly on the nature of the deficiency in functioning and partly on the individual's level of endowment in reasoning

ability, memory span and so on. She believes that explanation of test failure by disturbance of mood or motivation is unscientific when all can be explained in terms of what she calls the " instinct of intelligence." Babcock traces the implications of her theory with ingenuity, but, it must be admitted, with some disregard of clinical evidence. This is a criticism that can be levelled against many theories in which interpretation of test results is attempted in purely cognitive terms.

XI. MENTAL TESTS IN PROGNOSIS AND TREATMENT.

The use of mental tests in assessing prognosis and the effects of treatment is an interesting recent development.

Shock therapy.—Here tests of the Goldstein type have been much used. For both spontaneous recovery and shock therapy the prognosis is good where conceptual attitude is preserved, and poor in its absence (Goldstein, 1939 ; Bolles *et al.*, 1938 ; Zubin and Thompson, 1941 ; Adler, 1942). Jastak (1939) reported that uneven psychometric pattern disappeared after successful insulin therapy. Wechsler *et al.* (1940) described a battery of five short tests, the results of which not only corresponded well with physician's estimates of the effects of treatment made soon after its completion, but when rechecked 6 to 18 months later, gave a more accurate " long-distance prognosis " than the clinical estimates. According to Graham (1940) patients who improve after insulin therapy display improved total score, diminished scatter, and a less typically schizophrenic Malamud-Palmer scatter pattern in the Stanford Binet scale, and give fewer individual responses in the Kent-Rosanoff association test. Initially good performance in absurdities augurs a favourable outcome. Statistically reliable improvement in test performance follows shock therapy (Wittman, 1939 ; Wittman and Russell, 1942). Correlation between improvement in mental tests, in tests of co-operation, and physician's estimates of the results of treatment was high between the first and second and between the second and third, but low between the first and third.

Effect of convulsive therapy on memory.—Tooth and Blackburn (1939) demonstrated impaired Babcock performance in patients treated with cardiazol in contrast to those who spontaneously recovered. Ziskind (1941) believes that after each treatment memory function is immediately greatly depressed, thereafter recovering in the next few hours. After a few treatments, however, recovery more and more falls short of the initial level, so that loss increases as the course continues. Wittman and Russell, on the other hand, failed to substantiate such findings.

Zubin (1941, 1942) and Zubin and Barrera (1941) studied learning of word associates before and after electro-shock therapy. Learning acquired immediately before treatment is affected more than learning which precedes shock by a longer interval. Memory traces are disorganized rather than destroyed. Levy *et al.* (1942) found, on testing " by the customary psychiatric methods," impaired memory in 2 of 11 metrazol-treated patients, and in 8 out of 13 patients treated with electro-shock. Impairment in the latter lasted from one to several weeks and in one patient was present after several months. Grinker, discussing this paper, compares these with punch-drunk patients in

whom he asserted careful testing reveals permanent damage. Sherman *et al.* (1941), however, discovered no impairment in the memory of 10 patients treated with both metrazol and electro-shock.

Psychosurgery.—Hunt (1940, 1942) applied to patients before and after prefrontal leucotomy a variety of tests, many of which were specially designed to investigate the presence of signs commonly displayed by monkeys with lesions of the prefrontal areas. Very few significant defects followed the operation, and these, mainly revealed by the Rorschach test, indicated poor intellectual spontaneity rather than incapacity to reach pre-operative level. One or two patients tested by Mixter *et al.* (1941) showed similar changes, the others showed no significant change. Very little change was also discovered by Lidz (1939), Lyerly (1939), and Worchell and Lyerly (1941), although the last-named believe that the operation may decrease associative spontaneity (Stanford Binet, 60 words in three minutes). Division of the corpus callosum for the treatment of epilepsy also, according to Parsons (1940, 1942), appears to affect test performance surprisingly little. Kohs' block test is sometimes performed after operation as by subjects with "known cerebral lesions"; but the response is not uniform and often rises later to the previous level.

Anti-convulsant and sedative drugs.—Somerfeld-Ziskind and Ziskind (1940) compared changes in the records of 48 epileptics treated for one year with phenobarbital gr. $1\frac{1}{2}$ twice or thrice daily with those of 42 untreated epileptics. The tests included the Stanford Binet scale, Goodenough drawing, a construction puzzle, Knox cube, a directions and an association test. Only slight changes were discovered and these were in the direction of normality. Collins (1941) and Yacorzynski and Arieff (1942), whose patients were treated over longer periods, confirmed this finding. The latter found that bromides also had no deteriorating effect, although the level in the blood reached 250 mgm. per 100 c.c. in some cases. Investigations of volunteers who took large doses of bromides for several weeks led to the same conclusion (Moore *et al.*, 1942; Jellinek and Bolles, 1942). It may be commented that the subjects were on the whole younger than those in whom clinical bromide intoxication usually occurs. Epanutin is also without effect on test performance (Ross and Jackson, 1940). According to Slater *et al.* (1942), small sedative doses of sodium amytal do not impair performance in the matrices test.*

Other investigations.—Women drug addicts tested by Hall (1938) insignificantly improved their average Babcock indices after treatment from —1·20 to —0·75. Epstein and Solomon (1939) applied the Stanford Binet scale before and after treatment of 78 paretics. They conclude that a final I.Q. of at least 70 is necessary to offer a chance of social survival; but that the extent of the pre-treatment fall and post-treatment rise as compared with presumed initial level is a better guide to prognosis than I.Q. itself.

Discussion.—Here, as always, it must be remembered that changed attitude may simulate changed power. The surprisingly slight effect of psychosurgery suggests perhaps that methods used with such interesting results by Conkey (1938), Nadel (1938) and Halstead (1940) in other types of frontal lobe disease

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* Psychometric investigation of stimulants such as benzedrine have been mainly on normal children.

should be widely adopted.*   Otherwise the work summarized in this section needs little comment.   Its practical value and its promise can hardly be exaggerated.

XII. Personality.

This chapter would be obviously incomplete without reference to character and personality tests.   This section, however, will be short for several reasons. Although 68 tests are mentioned in Buros's 1940 *Mental Measurements Year-book*, few have been applied in psychosis, and many that have been thus employed are as yet invalidated.   Since the Rorschach test is a favourite tool in this work, many relevant investigations are considered elsewhere.   Finally, although general studies have been attempted as by Arluck (1941) and Gottschalk (1942) in epilepsy, the object of these tests is usually to reveal individual peculiarities, so that results defy generalization..   Only a survey of the most important techniques is therefore attempted here.

Observation.—The most direct method of studying personality is by direct observation, as, for example, of children's play.   Every mental test session provides opportunities.   Hanfmann (1941) and Brown and Rapaport (1941) find concept formation tests particularly valuable.   The latter also study reaction to frustrated and impossible tasks.   Cattell (1941) has designed a special test called the " Cursive Miniature Situations " test.   In this a roll of paper is unwound past a window, providing the subject with varying situations to which he reacts, as well as he can, in accordance with previously given instructions.

Projective techniques.—Projective techniques are becoming increasingly popular.   In these, the subject reveals himself by what he reads into meaning-less data, or by his " organization " of amorphous material.   Word association tests are the oldest of such procedures, Rorschach's the most used.   The tautophone (Rosenzweig, 1942) is a device which presents for interpretation auditory stimuli in a manner analogous to inkblots in the visual field.   In the " Thematic Apperception Test " (see Rosenzweig) the subject is asked for the interpretation, the origin and outcome of a number of scenes.   In the Szondi test (Rapaport, 1941) the subject picks those he most likes and dislikes from six series of photographs of abnormal and criminal types.   " Organization " of plastic materials, of Lowenfeld's coloured shapes, of strip cartoons, even of the dots made in a tapping test, have also been profitably analysed.

Questionnaires.—Questionnaires contain a large number of questions usually to be answered " Yes " or " No," so selected that the answers reveal dominant frames of mind.   The best known of these, the Bernreuter Personality Schedule (Super, 1942) measures neurotic tendency, self-sufficiency, intro-extra-version, domination, need for and type of sociability.   A new scale, the Minnesota Multiphasic Personality Schedule, contains no fewer than 550 questions and claims even wider powers.   Rating and attitude scales are some-what similar.   In these, the subject may be rated by the examiner ; or may rate himself in, for example, his level of aspiration ; or may rate, for example, moral statements or facial beauty.   As may be expected, few psychotic patients

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* The work of Rylander and of Hebb and others who have collaborated with neuro-surgeons is pertinent here.

are able to collaborate sufficiently with such scales. Indeed, Super cites only seven investigations of psychotic patients with the Bernreuter Schedule, and the results of these are conflicting.

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