A COMPARISON OF TERMAN MERRILL SCALE TEST RESPONSES AMONG LARGE SAMPLES OF NORMAL, MALADJUSTED AND BACKWARD CHILDREN.*

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INTRODUCTION.

There is a considerable body of literature concerning the diagnostic value of differences in pattern and scatter found in response to intelligence tests.

Irregularity of performance as a distinguishing characteristic of M.D. children was noted early in the history of mental tests (Binet and Simon, 1916), and the significance of pattern and scatter has continued to be of recurrent interest with reference to other groups of abnormal subjects.

With varying emphasis, the attention of investigators over the past 30 years has been directed mainly to two aspects of the problem :

(a) the extent of sub-test scatter,
(b) differences in pattern of response.

Although these two aspects cannot be entirely divorced from each other in any consideration of pattern abnormality, the former may be treated purely as a quantitative matter, while the latter is essentially a question of qualitative differences. In judging abnormality of pattern, it is of importance to know in what type of test any unusually early failure has occurred, and in what type of test isolated passes have continued at age levels beyond those at which all else has been failed.

Between 1920 and 1940 about 30 investigations into the responses of normal and abnormal subjects to various versions of the Binet mental tests were published. In the last decade a further 20 studies at least, based on similar inquiries into other scales, have been reported. Remarkably few of the earlier inquiries, using the Binet scales, dealt solely with children's records, while later inquiries, almost without exception, have referred to adult populations.

Methods of assessing characteristic differences have varied according to the type of test used, but much of the earlier work was concerned with the significance of quantitative scatter.

Despite a multiplicity of inquiries, however, the results were conflicting, with inconclusive and even apparently contradictory evidence. Though May-

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man (1946), reviewing the evidence, concluded that scatter analysis had been shown to have diagnostic value, a criticism commonly made was that the value, if any, was limited, since quantitative methods failed to stress the specific nature of the failures (Harris and Shakow, 1938 ; Lorr and Meister, 1941 *et al.*). There had been, however, some general agreement regarding qualitative differences and, of the inquiries made before 1940, some 20 had been directed to those qualitative differences which appeared to characterize different noso-logical groups. Several workers were in agreement that test failure among psychotic and maladjusted subjects occurred whenever sustained effort and attention were required, or when tests necessitated the facing of social realities. Among reasons advanced for disparities in the many conclusions was that which attributed discrepancies to the fact that few investigations had been undertaken into the records of sufficiently large and really comparable groups of subjects, and that certain variables, such as chronological and mental age, schooling, background and degree of co-operation of the subjects, had not been controlled. Other writers drew attention to the need for methods of assessing differences which would be based on the predictive capacity of the combined sub-tests in a battery, and which, at the same time, would differentiate the nature of failures. Klein (1948) remarked on the fact that the literature was " . . . notably deficient in statistical evaluations of a clinical test battery as a whole . . . " At least three reports,[*] however, have been published in which methods were employed which attempted to allow for the effects of quantitative scatter and, at the same time, to give due weight to differences in the response profiles. Myers and Gifford's analysis of the performances of psychotic and normal subjects is, however, the only one based on the Terman-Merrill (1937) Revision, Form L, of the Stanford Binet Scale. Their inquiry was intended to show—

(1) the extent to which schizophrenic subjects differed from normal subjects, of the same level of ability, with respect to the relative difficulty of test items within each year level ; and

(2) whether these differences could be used to re-score individual test records for abnormality of pattern.

They found that, within each test year, schizophrenic subjects consistently displayed a distinctive pattern of successes and failures which was quite different from that of normal subjects. Their scoring system was based upon the difference between the respective proportions of normal and abnormal groups passing each item within each test year.

A key was derived from these differences ; a plus sign indicated that a greater proportion of passes was found among subjects in the abnormal than among those in the normal group ; a minus sign showed the reverse to be the case.

In test year XII, for example, more abnormal than normal subjects passed item 1 (vocabulary), item 4 (reversed digits), and item 5 (abstract words) ; a greater proportion of the normal than of the abnormal group, however, passed

* Piotrowski, 1937 ; Malamud and Palmer, 1938 ; Myers and Gifford, 1943.

item 2 (verbal absurdities), item 3 (picture 2) and item 6 (Minkus completion). The abnormal pattern key for year XII was therefore as follows :

Item.					Key.
1	.	.	.	.	+
2	.	.	.	.	—
3	.	.	.	.	—
4	.	.	.	.	+
5	.	.	.	.	+
6	.	.	.	.	—

To each item was then assigned a numerical value, based on the extent of the difference between the respective percentage of subjects in each of the two groups who passed each item. Where, for instance, in year XII there was a large difference between proportions of normal and abnormal subjects passing item 1, a weight of 31 was given this test ; where, at item 5, the difference was considerably smaller, a weight of 16 was given ; the much smaller difference at item 6 was allotted a weight of 3.

The numerical values were such that the plus and minus weightings balanced, each adding up to 50 in each test year. The numerical values and key signs are given below as an illustration :

Item.			Key.			Weight.
1	.	.	+	.	.	31
2	.	.	—	.	.	20
3	.	.	—	.	.	27
4	.	.	+	.	.	3
5	.	.	+	.	.	16
6	.	.	—	.	.	3

In re-scoring an individual record for abnormal pattern, where there was agreement between the key and the subject's record, a plus sign was assigned to the appropriate numerical value for that item. Where the key and the individual record differed, a minus value was given to the weighting. The score for any test year was the algebraic sum of the plus and minus values, the maximum possible score for any test year being $\pm$ 100. Thus a subject who, in year XII, passed items 1 and 2, but failed the remainder, obtained a score for that year as follows : $+ 31, - 20, + 27, - 3, - 16, + 3 = + 22$. The final score was then obtained by summing algebraically the scores obtained for each test year and dividing this sum by the number of years in the range between the basal and total failure years, so that individual subjects' final scores would be comparable irrespective of the amount of scatter. In the present study these final scores are referred to as " deviation scores." As a further attempt at refinement Myers and Gifford later applied an age adjustment ; but, for reasons given below, this was not used in the present inquiry. Myers and Gifford based their study on a total of 961 subjects, of whom 498 were abnormal and 463 were normal.

Their inquiry was of particular interest for the following reasons :

1. It made use of the test battery as a whole.

2. It coped with the problem of lack of continuity in functions tested, which had given difficulty in earlier investigations in which versions of the Binet scale had been used.

3. It stressed the qualitative differences in the response patterns of individuals.

4. It provided a quantitative method of scoring qualitative differences, allowing also for the effects of scatter.

5. It appeared to be the only published record of an attempt at devising a method of scoring for use with the latest and now most widely used revision of the Binet scale.

It is surprising, therefore, that no more recent published study of patterning appears to have employed this method. A search of the literature showed neither follow-up nor extended application of the results of Myers' and Gifford's work.

PRESENT STUDY.

1. *Inquiry.*

The following inquiry was undertaken to see whether Myers and Gifford's system would have any diagnostic value when applied to the records of subjects within the age range 7–14 years whose behaviour was symptomatic of social maladjustment or personality disorder. Information was sought on the following questions :

(*a*) Do groups of children with specific types of difficulty show characteristic differences in the size of their scores ?

(*b*) Among children, are deviation scores as influenced by chronological age as Myers and Gifford's records suggested ?

(*c*) Is there any significant association between the deviation scores and either mental age or I.Q. ?

(*d*) Are scores with a " minus " value found to be generally associated with records of subjects presenting problems of a distinctly different type from those whose scores have " plus " values ?

(*e*) Is any sex difference to be found among children's scores ?

(*f*) Do different item profiles, made by the patterns of successive plus and minus weights, occur in the records of subjects who present different types of problem ?

(*g*) Are significant differences in extent of test scatter associated with different types of problem ?

(*h*) Does Myers and Gifford's system, when applied to test records of large samples of subjects aged 7–14 years, differentiate either groups, or individuals, presenting specific difficulties ?

2. *Subjects.*

Among Myers and Gifford's normal subjects whose records were used to compute an age adjustment for the final score there were 162 children, of whom 50 were aged from 5 to 9 years and 112 aged between 10 and 14 years. In the study now reported, the records of 1,955 subjects aged 7–14 years were analysed and re-scored according to Myers and Gifford's system. Of these records, 1,297 had been collected, over a period of about three years, from subjects seen during the ordinary course of work at child guidance clinics, a

children's hospital, a juvenile court and in schools. Apart from the fact, therefore, that they all, at the time of examination, had presented problems of one or another sort, they were not otherwise specially selected for the present inquiry, since all cases seen during a certain period were included. The remaining 658 were, however, selected particularly ; some were chosen for their very good social and educational adjustment, some as showing difficulties common among high grade mentally subnormal patients in an institution, and others, drawn from a variety of sources, were deliberately selected in such a way as to form a randomized sample of school age population with an I.Q. distribution fitting as closely as possible to the normal curve. The actual numbers of subjects from each of these sources were as follows :

562 referred to clinics and hospitals for behaviour and personality difficulties and for psychosomatic symptoms.

502 charged at a juvenile court, or summoned before a court as '' in need of care and protection.''

233 referred by teachers and others for general or specific learning difficulties, or on account of associated problems.

108 patients in an institution for mental defectives. Since only one of this number had an I.Q. below 55, that of the majority falling between 55 and 85, with 8 scattering above this level as far as I.Q. 99, this group tended to present behaviour problems which, in some respects, were different from those commonly associated with mentally lower grade patients.

100 children considered by their teachers to be particularly well adjusted, though not necessarily the most intelligent, and, as far as could be ascertained, to have presented no problem either in or out of school.

450 children, from a variety of sources, forming a randomized sample control group with a normal I.Q. distribution. This group included—

> (a) children seen originally, not as presenting any intellectual or behaviour problem, but for such purposes as vocational guidance, or because they had been chosen as normal control subjects in another inquiry, or simply because they happened to sit next to a child who had been a subject in some other investigation :
>
> (b) The sibs of children selected for a previous inquiry into birth weight differences ;
>
> (c) the sibs of a group of spastic children ;
>
> (d) a group of children from primary, secondary, grammar and special schools, some of whom were chosen because they were sibs of children who had obtained free places at grammar schools, and some because they were the sibs of children ascertained as educationally retarded or mentally backward ;
>
> (e) children who were sibs of ascertained defectives ;
>
> (f) children who were cousins of defectives.

Among the subjects available in groups (a) to (d) above there were found to be too few within the I.Q. range 85–120. In order, therefore, to supplement these so as to obtain the required proportional incidence in each I.Q. range without decreasing the control group numbers, the subjects in (e) and (f) were

added. The mean I.Q. for the resulting control group of 450 subjects was then 102·78, with a standard deviation of 16·86, which seemed to compare favourably with the mean of approximately 103 and a standard deviation of approximately 17 given in the standardization data of the test used.

For the records of subjects in (e), (f) and a few of those in (a) I am indebted to Dr. M. A. Mellone and Mrs. E. H. Scarr, of the Royal Eastern Counties Institution Research Department, whose help in building up the required control group was much appreciated.

3. Method.

Myers and Gifford's method of scoring was applied to the Terman Merrill (1937) Revision Form L (full scale) records of all the above subjects. The age adjustment suggested for subjects aged 14 years and under was not used, since it was based on such small samples that it was deemed advisable to see whether data from larger samples would confirm the suggestion that age adjustments were needed and whether, if this were so, a more finely graded scale than that given by the authors of the system could be constructed. The 1,405 subjects who presented special difficulties were grouped into the following classes:

Clinical Groups.

(1) Stealing, larceny, breaking and entering, etc.

(2) Aggressive behaviour, absconding, truancy, wandering, lying, etc.

(3) Psychosomatic disorders, hysteria, fears and phobias, solitariness, apathy, poor concentration, etc.

(4) General and specific learning problems, poor work record, general social inefficiency.

4. Results.

(1) General Distribution of Scores.

Deviation scores from all sources were symmetrically distributed. Except for that between the control and institution groups, the differences between mean scores were small and without significance (Table I).

TABLE I.—*Deviation Score Means. All Groups* (1,955 *cases*).

Group.	N.	Mean score.	S.E.	S.D.
(1) Control	450	+0·87	±0·17	25·13
(2) Well adjusted	100	−1·12	±0·20	13·87
(3) Clinical 1	265	−0·63	±0·21	23·73
(4) ,, 2	413	+2·54	±0·18	26·14
(5) ,, 3	383	+0·58	±0·21	28·73
(6) ,, 4	236	−0·39	±0·24	25·87
(7) Institution	108	+11·86	±0·40	29·18

(2) Score and C.A.

A regression of score on chronological age of 0·1 (i.e., −0·7 points of score per year) indicated that any relationship between these factors was statistically insignificant.

(3a) *Score and M.A.*

A similar regression (0·1) of score on mental age showed that there was also no significant association between these two factors.

(3b) *Score and I.Q.*

A correlation of + 0·04 (S.E. ± 0·05) showed no significant association between these factors.

(4) *Type of Problem and Deviation Score Sign.*

Of the 1,297 subjects in the " problem groups " when those from the institution were excluded, there were 678 who could be grouped as behaving in ways which made them " active nuisances," and 619 whose difficulties were not manifested in overtly aggressive symptoms, who could be classed as " passive." When these two groups were arranged according to sign and extent of score there was a slight (2 per cent.) majority of cases in the active group, but score distributions for both groups were essentially symmetrical.

In the active group about half (52 per cent.) of the scores fell within the central range of deviations (− 17 to + 17), as compared with 55 per cent. of the controls and 46 per cent. of the passive group.

In the extreme ranges (i.e., those exceeding ± 52) there were nearly 4 per cent. of the active group and about the same percentage of controls, but 8 per cent. of the passive group.

Between the mean scores of the active and passive groups no significant difference was found, nor was there any significant difference between the means of either group and that of the controls. There were, however, notable differences in variance and standard deviation between the groups. Between control and active groups these differences were negligible, but between control and passive, and active and passive groups, the differences showed a high degree of significance.

While, of those 26 subjects in the active group whose scores exceeded ± 52 a majority had positive deviations, among the 51 subjects classified as passive, and with scores exceeding ± 52, less than half had positive deviations. Further inquiry, however, showed that any association between problem type (active/passive) and sign of deviation score (− /+) among subjects with scores exceeding ± 52 was relatively insignificant.

TABLE II.—*Distribution of 1,297 Cases according to Behaviour Type and Deviation Score.*

Deviation scores.	Actual incidence.				Percentage incidence.		
	Active.	Passive.	Total.		Active.	Passive.	Total.
+53 and over . .	16	24	40	.	40	60	100
+18–+52 . .	159	143	302	.	53	47	100
−17–+17 . .	349	284	633	.	55	45	100
−18––52 . .	144	141	285	.	51	49	100
−53 and under . .	10	27	37	.	27	73	100

(5) *Sex Differences.*

The deviation scores for each of the two sexes were symmetrically distributed, both when subjects from all sources were grouped and when they were classified. In the control and well adjusted groups the differences between the mean scores for the two sexes were small and without significance. A more marked sex difference was found, however, when all the problem groups, including that of the institution subjects, were amalgamated. When the institution subjects were extracted, however, and the remaining subjects classified into clinical groups, there was no significant sex difference in groups 1 and 4, a just significant difference between the sexes in groups 2 and 3, and an obvious difference between the mean scores for the two sexes only in the institution group.

TABLE III.—*Sex Differences in Deviation Score Means.*

Group.	Sex.	N.	Mean.	Diff.	S.E. of diff.
Control	M.	236	+1·10 ⎫	0·48	2·45
	F.	214	+0·62 ⎭		
Well adjusted	M.	65	0·00 ⎫	3·20	2·70
	F.	35	−3·20 ⎭		
All problems	M.	838	−1·30 ⎫	7·28	1·20
	F.	567	+5·98 ⎭		
Clinical 1	M.	234	−1·35 ⎫	6·08	4·41
	F.	31	+4·74 ⎭		
,, 2	M.	176	−0·72 ⎫	5·68	2·58
	F.	237	+4·96 ⎭		
,, 3	M.	231	−1·79 ⎫	5·98	2·93
	F.	152	+4·19 ⎭		
,, 4	M.	143	−2·74 ⎫	5·98	3·99
	F.	93	+3·24 ⎭		
Institution	M.	54	+2·85 ⎫	18·02	5·09
	F.	54	+20·87 ⎭		

(6) *Weighting Profiles and Problem Types.*

Four distinct types of profile made by the successive subtest weightings were noted in the course of the analysis. No mention of this had been made by the authors of the scoring system, so the possibility of there being any significant association between profile type and problem was investigated.

The profiles were classified as under :

C (consistent), in which the successive test year scores were either all −, or all +, throughout the whole test range.

B (broken), in which an otherwise consistent pattern of −, or + scores, was interrupted by not more than one reversion to the opposite sign.

R (reversing), in which there was first a succession of either − or + test year scores and then a change to scores with opposite sign, this being maintained throughout the remaining tests.

L (labile), in which, throughout the range of test year scores, there were frequent reversals of sign.

A symmetrical distribution of deviation scores was found with each type of profile.   When comparisons between the percentage incidence of the four types in the control, well adjusted and amalgamated problems groups were made, the well-adjusted group alone appeared to show any obvious difference in distribution.   When, however, the problem groups, including institution subjects, were classified according to behaviour into clinical groups 1–4, further differences in profile distribution were apparent.

TABLE IV.—*Percentage Distribution of Profiles* (1,955 *cases*).

Groups.	C.	B.	R.	L.	Total.
Control	23	18	30	29	100
Well adjusted	8	16	37	39	100
All problems	25	17	31	27	100
Clinical 1	19	15	27	39	100
,, 2	20	19	33	28	100
,, 3	30	16	33	21	100
,, 4	34	18	27	21	100

Since the C type profiles were conducive to higher deviation scores, a distribution was then made, according to profile type and behaviour, of the 1,094 problem subjects whose scores lay within the more restricted range of deviations ($\pm$ 32) within which all profile types were found.   A χ^2 (9 degrees of freedom) of 32, giving P — ·001, for association between problem and profile type, indicated the highly significant heterogeneity of the groups of problem subjects.   In the profile distributions of subjects in clinical groups 1 and 2 there was a greater incidence of lability and a lesser incidence of consistency than normal expectancy would suggest.   Among subjects in groups 3 and 4, however, this position was reversed, the incidence of labile profiles being less than expectation, while that of the consistent type exceeded it.

From inspection it was clear that profile type and range of test scatter tended to vary directly with each other, the consistent profiles being found more generally among records with responses spread over a narrower range of test years, and the labile type more commonly among those in which the responses spread over a wider range of years.

(7) *Test Scatter and Type of Problem.*

Most of the inquiries into test year scatter on the Binet scales were made before 1940, and hence on earlier forms of the test than the 1937 Revision.   Although diagnostic value of scatter did not, in itself, form part of Myers and Gifford's inquiry, the considerable amount of data available for the present study afforded a good opportunity of considering this matter again with reference to the most recent revision.   In Table V the institution subjects are included in clinical groups 1–4.

TABLE V.—*Test Scatter Means of Normal and Abnormal Groups* (1,955) *cases.*

	Problem groups.					
Groups.	1.	2.	3.	4.	Adjusted.	Control.
Mean scatter in years	5·1	4·7	4·4	3·8	4·8	4·5

The more obvious differences are those between the control group and groups 1 and 4 ; but, except between the control group and group 3, all differences had statistical significance.

(8) *Discussion.*

Among subjects aged 7–14 years, the only large and significant difference found between mean deviation scores was that between the control and institution group means, the difference here, + 11·9 points of score, being nearly as large as that found by Myers and Gifford (+14·4 points) between their normal and schizophrenic (mild and severe) adults. Any differences between the control and other groups in the present inquiry were insignificant (from − 1·3 to + 1·7 points), and were smaller than those found by Myers and Gifford between their normal and neurotic (− 1·8) and normal and affective disorder (+ 3·7) groups of adults.

The evidence, from much larger groups of children than were available to Myers and Gifford, appeared to refute their suggestion that an age adjustment to the scores was necessary in so far as this applied to subjects aged from 7 to 14 years. The lack of any significant correlation between mental age and deviation score, found by Myers and Gifford among adult subjects, was confirmed with reference to children with mental ages from 6 to 19 years.

The lack of significant relationship between sex and score found by Myers and Gifford was corroborated in all groups except that of the institution subjects, for whom a large and significant sex difference in mean score was noted. From other evidence, however, it seemed probable that this difference was referable less to the sex factor in itself than to the fact that, apart from problems associated primarily with their mental subnormality, the female high-grade patients frequently exhibited behaviour difficulties of a type different from those found among the high-grade males.

Myers and Gifford's finding, that subjects with poorly integrated personalities tended to have large " plus " deviations, was supported in so far as in the present inquiry, large deviations were found among subjects showing a poverty of effort. No subjects in the well-adjusted group had scores exceeding ± 32, but in other groups where there were subjects with scores of more than ± 52, they showed, without exception, a serious degree of maladjustment. The data also indicated, however, that among children, aged from 7 to 14 years, whose social inefficiency was characterized by apparent passivity and unwillingness, or inability, to make such effort as normal living demands, there was an even greater tendency for their scores to have a heavy " minus " than a heavy " plus " loading.

The standard deviation for the scores of normal children was approximately that found by Myers and Gifford for normal adults. Whereas, however, Myers and Gifford found smaller standard deviations of scores among psychotic than among normal subjects, in the present inquiry, the standard deviations of the less stable children's scores were greater than those of the normal children, while those of the well-adjusted children were very much smaller than those of the control group.

Myers and Gifford did not concern themselves with test year score profiles.

In the present study, score profiles with consistent signs were found more commonly among the records of subjects in groups having the larger deviation score variances; labile patterns of deviation score signs were found, on the other hand, more frequently among the records of subjects from groups in which the score variances were smaller.

The results of profile analysis indicated an association between score profile type and emotional adaptability, but showed also that score profile type and test response scatter were closely connected.

An analysis of test year scatter offered evidence that what had appeared to be incompatible conclusions from certain previous inquiries were not in fact necessarily mutually exclusive. The smaller than average test scatter of subjects whose symptoms of maladjustment were seen in passivity and lack of self-sufficiency and, on the other hand, the larger than average test range found in the records of those whose difficulties caused them to be more actively a social nuisance, seemed to account, to some extent, for the diversity of opinions expressed in the past on the relative significance of test scatter.

(9) *Summary and Conclusions.*

The Terman Merrill (1937) Revision test records of 1,955 children aged 7–14 years were scored for response pattern according to a system devised by Myers and Gifford. Distributions of deviation scores according to chronological age, mental age, I.Q. and sex showed that there was little or no statistically significant association between the scores and these factors, apart from a significant sex difference in the mean scores of mentally defective institution subjects. This difference, however, was probably referable to a difference in the types of problem found among male and female high-grade patients.

No significant differences were found between the mean scores of subjects grouped according to problem type, but significant differences in score variance were found when inter-group comparisons were made. While the scores of a particularly well-adjusted group showed approximately only half the deviation score range of the control group, scores exceeding approximately 2 S.D. were found, without exception, in the records only of those subjects whose behaviour was characterized by a marked degree of social inefficiency or personal maladjustment.

Direction of deviation, − or +, gave no indication of type of behaviour problem; but consistency, or otherwise, of score signs throughout the test years was associated with range of test scatter and deviation score variance.

Though of little value, therefore, in differentiating between specific types of abnormal behaviour among subjects aged 7–14 years, in circumstances in which no information other than the test record of a subject was available, the system of scoring for response pattern would seem to afford a rough measure of personal integration and social adjustment, both for individuals and groups, within this age range.

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