ON THE VALIDITY OF THE RORSCHACH TEST IN THE DIAGNOSIS OF INTRACRANIAL DAMAGE AND PATHOLOGY

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INTRODUCTION

SINCE the publication of Rorschach's Form Interpretation Test in 1921, its applications have been extended to cover an increasing number of clinico-psychological problems. Of these, one of the most important and difficult is the diagnosis of organic brain damage and pathology.

It is the purpose of this paper both to investigate the validity of five sets of Rorschach signs used in the diagnosis of organic brain damage and pathology and to discuss the problems of interpretation to which these signs give rise. The signs are those of Piotrowski (1936, 1937), Harrower-Erickson (1940), Ross *et al.* (1944), Hughes (1948) and Dorken *et al.* (1951).

In one of his researches (1937) Piotrowski made use of 33 Rorschach records of which 18 were cases of brain injury, 10 non-cerebral disturbances of the central nervous system and 5 conversion hysterias. On the basis of these records, his own previous work and that of others,* he formulated ten signs which would differentiate his cortical-subcortical group from the others.

He found an average of 6·2 signs in the cortical-subcortical group and only 1·5 in the group which showed no cerebral involvement (cortical or sub-cortical) but who were suffering from an organic disease of the central nervous system. Each of the cortical groups had more "signs" than any member of the non-cortical group. No member of the non-cerebral group had more than 3 "signs", whilst no one in the cortical group had less than 4. His conclusion was, "If one finds five or more abnormal signs in a Rorschach record, one's conclusions of the existence of an organic cerebral involvement can be suggestive but not decisive". He added that the signs should not be used without taking into account qualitative features of the record and should not omit clinical material gained from other diagnostic methods. But he failed to mention the location, type of lesion, and whether it was pre- or post-operative. It is almost as though he considered the various lesions without distinction, apparently similar conclusions on this point were reached by Nadel (1938) and Dorken *et al.* (1951).

Harrower-Erickson (1940a) investigated the usefulness of the Rorschach test as a means of estimating the "changed" personality of patients with cerebral tumours. This was done by contrasting the results of 28 cases with verified brain-tumours, with normal psychograms obtained from 2 normal groups and a hypothetical normal person. The two normal groups were provided by 10 scientists and 10 hospital employees. The outstanding characteristics of tumour cases were their uniformity and constriction. It was as though the brain injury resulted in a uniform personality which depended little on age, sex, education and experience. She revised this view (1940b) after investigating patients with

* Oberholzer (1931), Rorschach (1932).

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focal epilepsy—". . . it is obvious that the restriction and constriction shown in the records of patients with cerebral tumour are not characteristic of all types of cerebral lesions. Of the 10 patients with focal epilepsy studied pre-operatively and post-operatively, the record of only one showed a similarity to this Rorschach picture."

In the first of her studies the 28 tumour cases consisted of ten who had rapidly growing tumours (glioblastomas and carcinomas), whilst the remaining eighteen records were of slowly growing tumours (astrocytomas, meningeal fibroblastomas, oligodendrogliomas and cystic astrocytomas), i.e. all were infiltrating lesions.

The second of her investigations dealt with the records of 24 patients with focal epilepsy. They had all been operated on for the removal of scar tissue or areas of atrophy or microgyria, i.e. all were non-expanding atrophic lesions.

The focal epileptics with non-expanding atrophic lesions failed to give the typical organic pattern as found in the study of expanding lesions. From the 2 studies the following observations were made:

1. "The approximation of the tumour psychogram appears to be correlated with topographically extensive or diffuse cerebral damage" (1940b).
2. "Although widespread and diffuse cerebral damage (tumours, increased intracranial pressure and large incomplete removal of tissue) may yield Rorschach records of the restricted type, cerebral damage of a more discrete type, such as is seen in many cases of focal epilepsy, need not give such a personality picture. In these cases the Rorschach records may (pre-operatively) be of such a type as to suggest that the patient is capable of a wider range of psychological reactivity but is inhibited by mental and physical factors from functioning adequately" (1940b).

Ross *et al.* (1944) extended the sign approach to include the measurement of "neurotic" and "organic" symptoms in the same Rorschach protocol. An instability and disability rating was developed to measure the neurotic and organic symptoms respectively.

Four groups of signs were found which differentiated between normal, "organics", and psychoneurotics. They were:

(*a*) Those common to neurotic and "organic" groups.
(*b*) The neurotic differential signs.
(*c*) The "organic" differential signs.
(*d*) The "organic" excluding signs.

Weights were given to each sign in approximate proportion to its incidence in the groups compared. The four sets of scores were then combined to give 2 ratings. The "common" and "neurotic" scores were added together for the "Instability Rating" whilst the "Disability Rating" was obtained by adding the "common" and "organic" scores and substracting the "neurotic" and "organic excluding" scores.

Tentative levels of ratings were given:

1. Without any evidence of neurotic trends or any significant evidence of brain damage, with an I.Q. around 100, Instability 12·1 plus, minus 1·24; Disability 8·0 plus, minus 1·61.
2. Neurotic personality background, no significant brain damage elicited, I.Q. around 100, Instability rating 18·4 plus, minus 1·61; Disability 8·4 plus, minus 1·34.
3. Manifest psychoneurosis, unknown I.Q., Instability 17·9 plus, minus 1·53; Disability 8·4 plus, minus 1·3.

4. Evidence of brain disease or damage, unknown I.Q., Instability 8·75 plus, minus 2·42; Disability 25·1 plus, minus 2·69.
5. No symptoms, I.Q. probably over 120, Instability 3·6 plus, minus 0·66; Disability 1·1 plus, minus ·75.

The ratings were found capable of differentiating significantly between "neurotics" and "organics" (i.e. for both the Instability and Disability scores), and between "slight" and marked brain damage (only significant for Disability Scale).

Hughes (1948) started with the hypothesis that if psychoneurosis, schizophrenia and organic pathology exist as clinical entities, and if they are measured by any Rorschach signs, then these signs should be intercorrelated and form definable clusters or factors.

For his initial factorial analysis he used 32 "organics", 39 neurotics and 29 schizophrenics, for a later investigation 50 "organics", 18 schizophrenics, 74 neurotics and 26 normals. The presence or absence of each of the psychoneurotic, organic and schizophrenic signs of Harrower-Erickson, Piotrowski and Klopfer and Kelley respectively, were recorded. A factorial analysis using Thurstone's complete Centroid Method was carried out. Rotation was continued until loadings were either maximal or vanished. Eight orthogonal factors were obtained. The factor loadings were then assigned weights which were used on each record and the distribution of each factor's scores in each entity calculated. The next step was the calculation of the correlation between the presence or absence of each diagnostic entity and obtained factor score. Finally the probability, using these signs, of correctly diagnosing the organic cases was calculated. If a "cut-off" score of 7 was taken as diagnostic of organic pathology or damage, 82 per cent. of the organics in his sample would be correctly diagnosed with a misclassification of 1 per cent.

Dorken *et al.* (1951) following work with Piotrowski's (1937) organic signs and Ross's (1944) Disability Scale came to the conclusion that the capacity of these ratings varied according to whether the lesion was diffuse or localized or according to the localization of the lesion.

They attempted to describe organic brain damage in terms of deficit. The absence of 7 quantitatively evaluated signs was a probable indication of organic impairment, whilst their presence to a specified degree served to exclude the diagnosis of organic defect. The 7 signs were applied to 4 separate groups of patients with known localized brain lesions, and to two groups of patients with diffuse lesions. Control groups of schizophrenics, manic depressives, psychoneurotics, and superior and average "normals" showed the differentiating ability of these signs. From the absence of these signs an "organic deficit" rating was calculated. The authors give the warning that the ratings are sensitive to both limitations and impairment of intelligence.

Problem I

The problem is to assess the validity of the five sets of signs and to note the percentage of misclassifications. For this purpose the first investigation was carried out irrespective of such important variables as age and intelligence, i.e. under such conditions of referral as obtain in hospitals. From the results obtained it may be possible to suggest reasons for the inadequacy of the signs to discriminate between organics and functionals and to account for the large number of misclassifications.

METHOD

The Rorschach records of an unselected group of patients and "normal" subjects were analysed and scored according to the signs of Piotrowski (1937), Harrower-Erickson (1940), Ross *et al.* (1944), Hughes (1948) and Dorken *et al.* (1951).

The group consisted of 125 subjects of whom 13 were normals of superior intelligence, 41 neurotics, 22 schizophrenics, 11 mental defectives, 12 psychopaths, 10 idiopathic epileptics and 16 organics.

The validity of these signs in correctly diagnosing organic brain damage and the extent of the misclassifications in diagnosing as brain damaged subjects in the remaining groups was noted.

RESULTS I

TABLE I

The Percentage Validity and Misclassification Using Piotrowski's (1937) Signs

	Normals	Neurotics	Schizophrenics	Idiopathic Epileptics	Psychopaths	M.D.'s	Organics
Total Number	13	41	22	10	12	11	16
5 or more signs ..	0	1	3	1	0	5	9
Validity (per cent.)	100	97·56	86·36	90	100	54·55	56·25
Misclassification (per cent.) ..	0	2·44	13·64	10	0	45·45	43·75

Total Validity (per cent.)—56·25.
Total Misclassification (per cent.) (excluding organics)—9·18.
Total Misclassification (per cent.) (including organics)—13·6

TABLE II

The Percentage Validity and Misclassification Using Harrower-Erickson (1940) Signs

	Normals	Neurotics	Schizophrenics	Idiopathic Epileptics	Psychopaths	M.D.'s	Organics
Total Number	13	41	22	10	12	11	16
4 or more signs ..	0	5	5	2	2	10	12
Validity (per cent.)	100	87·81	77·28	80	83·34	9·1	75
Misclassification (per cent.) ..	0	12·19	22·72	20	16·66	90·9	25

Total Validity (per cent.)—75.
Total Misclassification (per cent.) (excluding organics)—22·02.
Total Misclassification (per cent.) (including organics)—22·4.

TABLE III

The Percentage Validity and Misclassification Using the Ross et al. (1944) Signs

	Normals	Neurotics	Schizophrenics	Idiopathic Epileptics	Psychopaths	M.D.'s	Organics
Total Number	13	41	22	10	12	11	16
Score of 17 or 17+	0	1	5	3	1	10	10
Validity (per cent.)	100	97·56	77·28	70	91·67	9·1	62·5
Misclassification (per cent.) ..	0	2·44	22·72	30	8·33	90·9	37·5

Total Validity (per cent.)—62·5.
Total Misclassification (per cent.) (excluding organics)—18·34.
Total Misclassification (per cent.) (including organics)—20·8.

TABLE IV

The Percentage Validity and Misclassification Using the Hughes (1948) Signs

	Normals	Neurotics	Schizophrenics	Idiopathic Epileptics	Psychopaths	M.D.'s	Organics
Total Number	13	41	22	10	12	11	16
Score of 7 or 7+	0	1	0	0	0	2	11
Validity (per cent.)	100	97·56	100	100	100	81·82	68·75
Misclassification (per cent.) ..	0	2·44	0	0	0	18·18	31·25

Total Validity (per cent.)—68·75.
Total Misclassification (per cent.) (excluding organics)—2·75.
Total Misclassification (per cent.) (including organics)—6·4.

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TABLE V

The Percentage Validity and Misclassification Using the Dorken et al. (1951) Signs

	Normals	Neurotics	Schizophrenics	Idiopathic Epileptics	Psychopaths	M.D.'s	Organics
Total Number	13	41	22	10	12	11	16
Score of 2, 3 or below	1	15	9	5	3	11	12
Validity (per cent.)	92·31	63·42	59·1	50	75	0	75
Misclassification (per cent.) ..	7·69	36·58	40·9	50	25	100	25

Total Validity (per cent.)—75.
Total Misclassification (per cent.) (excluding organics)—40·366.
Total Misclassification (per cent.) (including organics)—38·4.

TABLE VI

Validity of the "Signs" for the Brain-damaged Group Diagnostic of Brain-damage (X)

Subject	Age	Sex	Pre or Post Operative	Diagnosis	Piotrowski	Harrower-Erickson	Hughes	Ross and Ross	Dorken and Kral
1.	56	M	Pre	Left parietal cerebral tumour ..	X	X	X	X	X
2.	40	M	Pre	Right temporal cerebral neoplasm ..	—	—	—	—	—
3.	38	F	Pre	Cortico-thrombo phlebitis	X	X	X	X	X
4.	40	M	Post	Aneurysm anterior communicating artery, 2 recent subarachnoid haemorrhages with right hemiparesis following the last	X	X	X	X	X
5.	27	F	Post	Aneurysm of right middle cerebral artery, 2 recent subarachnoid haemorrhages	—	X	X	X	X
6.	43	M	Post	Aneurysm of right anterior cerebral artery. Right frontal craniotomy performed	X	X	X	X	X
7.	46	M	Post	Frontal lobectomy—excision of left frontal cystic glioma	X	X	X	—	X
8.	51	F	Post	Calcified glioma posterior part left temporal lobe	X	X	X	X	X
9.	16	F	—	Sydenham's Chorea	—	—	—	—	—
10.	43	F	—	Huntington's Chorea (early)	—	X	—	—	X
11.	13	M	—	Toxic Confusional State	X	X	X	X	X
12.	49	M	—	Carbon Monoxide Poisoning	—	X	X	X	X
13.	39	M	—	Acute Alcoholism with early D.T.'s ..	—	—	—	X	X
14.	58	F	—	Organic Dementia	—	—	—	—	—
15.	68	F	—	Organic Dementia	X	X	X	X	X
16.	45	F	—	Organic Dementia	X	X	X	—	—

DISCUSSION

All of the signs are capable of varying degrees of validity in the diagnosis of "organic" brain damage, though the number of misclassifications in the "functional" illnesses and organics is still far too large (see Tables I–V). Similar misclassifications to these were obtained by Ross (1941), who carried out a cross validation study of Piotrowski's ten signs. His results, showing the total number and total percentage per group of cases with five or more signs are:

Group	5 or more Signs	Per cent. of Subjects with 5 or more Signs
1. Cerebral Lesions*	10 / — / 18	55
2. C.N.S. Lesions†	3	
—non-cortical	—	30
—sub-cortical	10	

* Cerebral Lesions—These included tumours, G.P.I., Hydrocephalus (inflammatory), Post-traumatic Epilepsy, Post-traumatic Confusion.

† C.N.S. Lesions—Multiple Sclerosis, Tabes Dorsalis, Parkinsonism, Huntington's Chorea.

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Group	5 or more Signs	Per cent. of Subjects with 5 or more Signs
3. Psychoneurotics	6/42	14
4. Somatic illnesses free from neurotic features*	1/19	5
5. Somatic illnesses with neurotic features	0/26	0
6. Psychotics	3/15	20
7. Epileptics†	7/19	37
8. Soldiers	1/53	2
9. Superior normals	0/34	0

* Somatic illnesses free from neurotic features—Hypertension, coronary occlusion, toxic goitre, gastric and duodenal ulcer, rheumatoid arthritis, acromegaly, myasthenia gravis and migraine.

† Epilepsy—"Clinically diagnosed epileptics in which no specific conclusion was reached as to the pathological basis" (Ross, 1941).

His conclusion was, "It would seem, then, that, although five or more of these signs occur most often in patients with diseases of the cerebral cortex and subcortical tissue, they are not specific for these lesions. They would seem to represent a deviation which is shown to a most marked degree when there is considerable involvement of the cerebral cortex, but which occurs to varying degrees with other disturbances of the nervous system, including the so-called 'functional-disturbances.' "

Evidently the signs fail to discriminate adequately between organics and functionals, show too many misclassifications and are susceptible to the influence of a considerable number of variables.

Such reasons as the following may account for the inadequacy of the existing criteria.

1. *Low intelligence seems to be an important determinant in the incidence of Rorschach organic signs, irrespective of the presence or absence of cerebral damage.* In contrast the number of misclassifications for the "superior" normals is negligible. The very high percentage of misclassifications for the M.D. group and negligible misclassifications for the "superior" normals are illustrated (see also Tables I–V).

	Piotrowski	Harrower-Erickson	Hughes	Ross *et al.*	Dorken *et al.*
Misclassification for M.D.'s (per cent)	45	91	18	91	100
Misclassification for superior normals (per cent.)	0	0	0	0	7·69

In addition to these results considerable direct and indirect confirmation can be found in the literature for the hypothesis that low intelligence increases

the number of "organic" signs irrespective of brain damage. In four of the studies quoted, Harrower-Erickson (1940a), Ross (1941), Ross *et al.* (1944) and Dorken *et al.* (1951) some account has been taken of intelligence. Their results revealed the particular sensitivity of Rorschach signs either to low or impaired intelligence. Harrower-Erickson's comment on the comparison of her "superior" and "average" normal groups is significant. "When one compares the 'superior' and 'average' normal groups as to their composite pictures one finds several differences which are not surprising. The output in the superior group is somewhat higher (R, 38 and R, 25). The relation of W:D:d is shifted from the superior group toward emphasis on the W . . . The M responses are more numerous . . . The emotional responses are more numerous . . ." The productivity, movement and colour responses are those which are much reduced in cases with severe cerebral involvement. The lower intellectual levels also seem to bring about the same result. These results are indirectly supported by Ross (1941) who found that none of his 34 superior normals gave 5 or more Piotrowski signs, by Ross *et al.* (1944) who found that their normal group with a probable I.Q. of over 120 gave the lowest "Disability Score" of all the five groups investigated and by Dorken *et al.* (1951) who assert that their own ratings are particularly sensitive to the lower levels of intelligence and to impairment.

Diers and Brown (1951) carried out a study to investigate the relationship of intelligence level to the incidence of Hughes's signs. A group of 36 hospital patients were given the Rorschach test and an intelligence test. The Rorschach records were then analysed for Hughes's signs of intracranial pathology. Twenty-five of these had a diagnosis of multiple-sclerosis, whilst the remaining 11 had non-neurological diagnoses. The multiple sclerotics were dichotomized on the basis of group mean I.Q. The lower group exhibited a statistically significant increase of Hughes's signs and a significantly higher weighted mean score. No significant difference was found between the lower I.Q. Multiple Sclerosis group and the control group. The authors suggest that, ". . . the Hughes's signs inadequately discriminate between patients of low original intellectual endowment".

Much the same conclusion can be drawn from the work of Neff and Lidz (1951). Three groups of normal subjects were studied. Thirty-two per cent. of this group were of superior intelligence, 38 per cent. average and the remaining 30 per cent. of inferior intelligence. Their results show that intelligence level has a strong effect on Rorschach productivity, both in terms of the absolute and relative magnitudes of the significant Rorschach factors. There was a sharp division as opposed to a gradual graduation between the superior and average groups, whilst there seemed little difference in the average and inferior groups.

Zangwill* writing on the Goldstein-Scheerer Tests says that some patients with diagnosed cerebral lesions can perform in an essentially normal way on these tests. He believes that this may be due to a high previous intellectual level or a restitution of cortical function, or a combination of both. He continues, "In view of the possible influence of previous intelligence level on test performance it would be most useful to have a suitable standardized series of abstraction tests of graded difficulty . . . *It is also possible that psychogenic disturbances in patients of low intelligence may lead to patterns of test performance easily confused with the actions of organic patients.*" These comments although applied specifically to the Goldstein-Scheerer tests do raise further the problem of the relationship of intelligence level to the incidence of Rorschach "organic" signs. It might be added that patients with cerebral lesions can perhaps behave

* Buros, Oscar: *The Third Mental Measurements Yearbook*, 1949.

in a "normal" way and deal at an abstract level because the particular lesion has no demonstrable effect on intelligence.

2. *If certain types and areas of organic brain damage do not result in intellectual impairment, and, if it is agreed that low or impaired intelligence contributes to an increased incidence of organic type records, then the percentage of misclassifications should increase and the validity of the signs decrease in the investigation of such cases.* Two cases in the present study are illustrative. Subject number 2 (Table VI) had a right temporal cerebral neoplasm, he was right handed and was subject to attacks of psychomotor epilepsy. Subject number 8 (Table VI) had a calcified glioma in the posterior part of the left temporal lobe. Subject number 2 showed no evidence of brain damage on testing with the Rorschach. Subject number 8 showed evidence of brain damage on each of the five sets of signs. Meyers and Yates (1954) have helped to throw considerable light on this anomaly. They discovered that subjects who were operated on (temporal lobectomy) for psychomotor epilepsy, and the operation was performed on the dominant hemisphere, showed slight intellectual impairment after the operation. For the same complaint, in the same cerebral location, only this time in the non-dominant hemisphere, there was no intellectual impairment. Our two cases are supportive. Subject No. 2 who was right handed, had a neoplasm in the right temporal lobe, did not show any intellectual impairment. None of the 5 sets of signs showed any evidence of brain damage. Subject No. 8 who was right handed and was operated on for a calcified glioma in the posterior part of the left temporal lobe showed a marked impairment. Each of the 5 sets of signs reflected the presence of brain damage. Whilst this evidence does not increase the validity of the signs it does at least explain in part the diagnostic misclassification of Subject No. 2.

It is also questionable to what extent lesions of the basal ganglia (Subject No. 9 Sydenham's Chorea) are expected to reflect organic patterns when indeed there is no impairment of intellectual functioning or is any expected.

In addition to further indicated studies on the relationship between different levels of intelligence in normal subjects and the incidence of Rorschach organic signs, these results further posit the necessity of discovering which areas of brain damage result in severe intellectual impairment and which areas show little though the size of the lesion may be the same. It also posits the necessity of discovering the differential impairment of intellectual functioning in the different "levels" of the brain. For example both Mettler (1949) and Zubin (1952) found that the frontal lobes could be interfered with in many ways without any deleterious effects provided the agranular tissue was left intact. It would seem important to investigate similar problems because if what "organic" signs are really measuring is intellectual impairment or the effect of low intelligence then any areas of brain damage or any levels of cortical dysfunction which do not become apparent in the form of intellectual impairment will not reveal an "organic" condition even though it does in fact exist (Subject No. 2, Table VI).

Unfortunately it is difficult at the present time to synthesize the results of intelligence testing related to lesions of different lobes and hemispheres. This prevents a more adequate appraisal of our brain damaged group on the same scale as subjects Nos. 2 and 8, where we had definite experimental evidence to explain both the validity of the signs for Subject No. 8 and the invalidity of the signs for Subject No. 2 (Meyers *et al.*, 1954). This deficiency points to the need for more carefully planned studies similar to that of Meyers *et al.* The present accumulation of evidence is somewhat confusing. To take for example work reported on the frontal lobe. Freeman (1941), Penfield *et al.* (1950), Partridge

(1950), Greenblatt *et al.* (1950) and Porteus (1950) all claim a reduction in intelligence after operation on the frontal lobes. German *et al.* (1934) found an intellectual defect following frontal lobectomy for glioma, Brickner (1934, 1939) an impairment following bilateral frontal lobectomy; Goldstein (1936, 1948), Nichols *et al.* (1940) and Goldstein *et al.* (1941), an impairment of abstract ability in lesions of the frontal lobe, and Rylander (1939) who found that the extent of the impairment depended on the amount of frontal tissue removed. Little evidence of difference was found between left and right sided lesions.

On the other hand Lidz (1939) found no change in the intelligence quotient after right frontal lobectomy, Penfield *et al.* (1934), Penfield *et al.* (1935) reporting on frontal lobectomy find little change in intellectual functioning, whilst Hebb (1939, 1941, 1945) found little evidence of intellectual impairment in a series of cases with unilateral and bilateral frontal ablations. Zubin (1952) summarizing the results of the Columbia-Greystone 1 Study (Mettler, 1949) says, ". . . On the basis of cytoarchitectonics alone, two divisions of the frontal cortex exist—granular and agranular. It has already been pointed out that the latter when injured produces definite deficiencies in intellect and behaviour. Otherwise no localization has been demonstrated for any function." On the other hand it is perhaps wise to bear Hebb's (1950) warning in mind. "It is still unjustified to conclude that intelligence is unaffected by frontal lobe damage. Pre- and post-operative comparisons in frontal lobotomy procedures are apt to show little apparent effect of the operation. But a pre-operative examination, in a patient whose behaviour and emotions are sufficiently deranged to justify lobotomy, is most unreliable as an index of the premorbid level of intelligence."

3. Before the relationship of intelligence, localized brain lesions and the incidence of Rorschach "organic" signs can be discovered, it is necessary:

(*a*) To describe organic lesions more adequately. This deficiency prevents the comparison of appropriate units of behaviour and intelligence with cerebral structure. Halstead (1951) describes this difficulty thus, "It is probably safe to say that no brain lesion has ever been completely specified. To do so would require knowledge that simply is not yet available. Mapping of the lesion by histological techniques, usually possible only with lower animals, maps only a visible, structural feature of the lesion. Details of ultra-structure, metabolic aspects of synthesis of nucleo-proteins, altered circulatory dynamics due to such considerations as changes in vascularity or in sludging of the blood, specified chemical depletions or alterations associated with injury or removal of brain tissue, the temporal course of the lesion, and the extent of the personality trauma are all relevant but usually unknown factors. Until these matters can be taken into account, we cannot be certain that we are juxtaposing appropriate units of behaviour and structure."

(*b*) It is necessary to find accurate pre-operative assessments of intelligence. This is so because pre-operative ratings in organics and psychotics, no matter how good the rapport, are always suspect. Although a considerable mass of evidence argues against any intellectual loss, impairment or deterioration following cerebral involvement of the frontal lobes, a report by Koskoff, Dennis, Lazovik and Wheeler (1942) argues for hesitancy in accepting it. In their group lobotomy was performed for the relief of intractable pain. A mean drop of 20·4 I.Q. points was observed. Similar results to these were reported by Yacorzynski, Boshes and Davis (1948). Although their patient was neurotic or psychotic exceptional co-operation was obtained. The

Stanford-Binet I.Q. dropped from 118 to 97. These results would seem to indicate that generally since pre-operative intellectual assessments are possibly too low because of the varying effects of the patient's personality and co-operation then the difference between pre- and post-operative test scores may not reflect a drop where one does actually exist.

(*c*) Finally it is necessary to know the combined effect of the pre-morbid personality, intelligence and level of aspiration of brain damaged patients. Eysenck (1952) found that if a neurotic group is divided into the introverted (dysthymic) and extraverted (hysteric) patients then these two groups show large differences. For example his introvert group had high levels of aspiration and very markedly underestimate their past performances. The extraverts on the other hand had a low level of aspiration and showed no tendency to underestimate their past performances. Normals occupied an intermediary position. (Himmelweit, 1946; Eysenck, 1947; Miller, 1951.) It may follow from this that introverts are more likely to strive to overcome felt handicaps (e.g. intellectual impairment) and be unsatisfied with their attempts, whereas the extraverts (hysteric) group may give up easily in the face of a felt handicap. It is feasible that a marked dichotomy in productivity alone may exist between the two groups, even though the particular area of brain damage was the same for both groups. One possible ramification is that since the dysthymic group severely underestimate their past performances any of their reactions to the Rorschach test may give rise to serious doubts as to their adequacy. In this way they may show an increase in such responses as score heavily for organic brain damage, e.g. impotence and perplexity. The extraverts on the other hand with no tendency to underestimate the past perceptions may provide records devoid of these high scoring organic indices.

4. The different interpretations of the same Rorschach organic signs may in some cases lead to errors of classification. A relevant criticism of Piotrowski's (1937) signs is contained in Ross (1941).

5. The different degrees of rapport achieved by different examiners and the attitude of the subject being tested may seriously impair the validity of the test. Lord (1950) for example found that performance on the Rorschach varied significantly with good or bad rapport both due to administrative conditions and different examiners. A publication by the Army Air Forces (1949) also showed the influence of the examiner on the number of responses to the Rorschach Test. Luchins (1947) studied the influence on Rorschach productivity of situational and attitudinal factors. The research showed the influence of misunderstanding of directions and the subject's poor ideas of what was expected of him in the testing situation. Since Rorschach productivity has a definite bearing on the absolute and relative sizes of the significant Rorschach factors and since this productivity can be affected along the lines indicated by such as Lord (1950) and Luchins (1947), studies using organic patients and suitable controls under similar experimental conditions should be undertaken. In this way we may learn more about the distorting effects of these additional variables, with especial reference to organics and people of low intelligence.

Problem II

Following the large number of misclassifications that occurred in the M.D. group, the almost complete absence of misclassifications in the superior normal groups, and results noted in the literature which substantiated these findings, a second problem was formulated. It was decided to investigate whether the

validity of the signs was increased and the percentage of misclassifications decreased when age and intelligence were taken into account in our normal and functional patients. No person of less than high average intelligence (I.Q. 100+), or more than 40 years of age was included, i.e. the matched group method for the normal and "functional" group was used. No person of more than 40 was included in an attempt to minimize the possible effects of cortical changes with age and any resulting intellectual deterioration or impairment, however mild.

Results II

Table VII

The Effect on the Percentage of Misclassifications when I.Q. and Age are Controlled

	Piotrowski	Harrower-Erickson	Hughes	Ross *et al.*	Dorken *et al.*
Misclassifications normal/functional* uncontrolled (per cent.)	9·17	22·01	2·75	18·34	40·37
Misclassifications normal/functional controlled (per cent)	2·82	11·27	1·41	10·42	28·17

* The functionals include the neurotics, schizophrenics, psychopaths and idiopathic epileptics.

Discussion

Although many variables were not controlled in this second investigation the large drops in percentage misclassifications would seem to add further proof to the distorting effects of low intelligence on the incidence of organic signs. The Piotrowski and Hughes signs seem the least affected by misclassifications in the normal and "functional" groups when age and intelligence are controlled.

Summary and Conclusions

The Rorschach protocols of 125 subjects were analysed and scored according to the signs of Piotrowski (1937), Harrower-Erickson (1940), Ross *et al.* (1944), Hughes (1948) and Dorken *et al.* (1951). The group comprised 13 normals of superior intelligence, 41 neurotics, 22 schizophrenics, 10 idiopathic epileptics, 12 psychopaths, 11 mental defectives and 16 organics.

The first problem was to note the validity and percentage of misclassifications occurring in each of these sets of signs in each of the diagnostic groups. There was no attempt to match the groups, as it was desired to make the selection under conditions which prevail in hospitals. All of the signs were found to be capable of varying degrees of validity, but the number of misclassifications was found to be too large. Several explanations for the inadequacy of the signs were put forward, notable amongst these was the effect of low intelligence. This factor, with age, was controlled in the second investigation. It was found to decrease the percentage of misclassifications in the normal and "functional" groups.

It is further suggested that not only does low intelligence have a distorting influence but certain areas of brain damage which do not result in intellectual impairment will increase the invalidity of the Rorschach "organic" signs. It also points to the fact that if certain areas of brain damage do not result in intellectual impairment, and if the incidence of Rorschach organic signs is proved to be heavily dependent on intellectual impairment, then the Rorschach test can never be used in the diagnosis of organic conditions in these areas.

It is also suggested that part of our difficulties occur because some Rorschach workers, whilst admitting the effects of low or impaired intelligence on Rorschach productivity, etc., look upon the "organic" records as reflections of personality change. This viewpoint appears wrong to the author because it necessarily precludes examination of cerebral localization and structure. Harrower-Erickson for example says, "Although widespread and diffuse cerebral damage of a more discrete type, such as is seen in many cases of focal epilepsy, need not give such a personality picture . . ." (1940b). Might it not also be suggested that the focal epileptics do not give, "such a personality picture", because the lesions do not impair intellectual function whilst "widespread and diffuse cerebral damage" does?

Several aspects of the pre-morbid personality are discussed in their relevance to the present problem. Level of aspiration seems in part at least an important variable to be taken into account in future investigations.

A plea is put forward for more integrated research to incorporate both the latest physiological findings on cerebral structure and psychological findings on the measurement of behaviour and intelligence. It is only in this way that exact experimental control can hope to correlate, "appropriate units of behaviour, intelligence and structure".

The necessity for good rapport between subject and examiner, the necessity of making sure that the subject understands what he is expected to do and the necessity for more exact definitions of the "organic" signs are suggested as further steps to reduce invalidity and the number of misclassifications.

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