

THE TEST PERFORMANCE OF THE ENCEPHALOPATHIC.

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ALLEN'S work (1, 2, 3, 4) in this series has dealt with the test performance of the brain injured and brain diseased patients. Results of the two groups on the Bellevue Intelligence Scale, Form I, have been adequately reported both separately and comparatively. The purpose of this paper is to combine the two groups in order to analyze the test results as one group, i.e. encephalopathic group. The study of these test results includes an item analysis of sub-test results obtained by this group, and a comparison of verbal with performance scores to ascertain a valid basis for scatter analysis.

Rationale for this combining procedure may be found in Cobb (5, p. 553), who reviews the literature on the effects of brain lesions: ". . . no two human brains are alike. Lesions destroying exactly the same areas in two different brains would not cause exactly similar symptoms. This is because the life experience of each person has conditioned and changed the brain so that it is unique." Also, though the brain of man is more highly developed and specialized, from the point of reference of evolution, its functional variability is demonstrable. Injury or disease in specific areas of the brain may indicate impairment of functions mediated by those areas. However, the variability of function is sufficient to preclude adequate prediction from localization of the encephalopathy alone. From such a point of view, therefore, the etiology of the encephalopathic processes is not the concern of this paper.

Wechsler (6, p. 153) does not make any differentiation between such groups when he gives "illustrations of the disorganization of the intellectual processes observed in most organic brain cases irrespective of type." The history of encephalopathy studies has been indicated by Allen in the previous studies of this series.

PROCEDURE.

The encephalopathic group consists of 50 brain injured and 36 brain diseased patients in a veterans' hospital, making a total of 86 subjects. The brain injured are those who sustained actual penetration of the encephalon by bullet or shrapnel piece, i.e. traumatic. The brain diseased includes those patients with intracranial organic pathology, non-traumatic. Not included in this group are patients suffering from epilepsy, psychomotor seizures, convulsive disorder, aphasia or psychosis.

The chronological age range is 20 to 55 years, the median age-point is 28 years. The distribution is skewed toward the older end, with modes occurring at years 21, 22 and 30, which includes nearly a third of the cases. Of 59

patients for whom school achievement is recorded, one had two years of college, one had one year of college, 22 completed the 12th grade, 13 did not finish high school, 14 reached the 8th grade, and 8 did not finish grade school. All patients were given routine psychological examinations, of which the Bellevue Intelligence Scale, Form I, was part.

RESULTS.

The mean intelligence ratings for the group are distributed as follows: Full scale I.Q., 97, 1.9; verbal, 101.1, 1.5; performance, 92.6, 2.5. The mean I.Q. ratings fall within the limits of the normal range. An 8.5 difference between verbal and performance scores results in a critical ratio of 2.9, which may be considered significant.

TABLE I.—Mean Subtest Weighted Scores.

	V.	I.	C.	A.	D.Sp.	S.	P.A.	P.C.	O.A.	B.D.	D.Sy.
Mean . . .	10.4	11.1	10.4	9.1	7.1	9.2	8.5	9.5	8.0	7.9	6.9
Sigma mean29	.28	.27	.41	.31	.38	.31	.33	.44	.36	.32

Table I presents the means of the 11 subtest weighted scores. The order of *resistance* for each of the subtests to the encephalopathic processes from greatest to least is: Information, Vocabulary, Comprehension, Picture Completion, Similarities, Arithmetic, Picture Arrangement, Object Assembly, Block Design, Digit Span and Digit Symbol.

The critical ratios for the differences between subtest scores are shown in Table II. Italicized numbers are the significant C.Rs. Digit Span and Digit Symbol deviate most significantly and consistently from Vocabulary, Information and Comprehension. The rank-order differences indicated by an inspection of Table I are supported in Table II. Block Design, Object Assembly,

TABLE II.—Summary of the Inter-subtest Mean Weighted Score Critical Ratios.

	V.	I.	C.	A.	D.Sp.	S.	P.A.	P.C.	O.A.	B.D.	D.Sy.
V	—										
I	1.8	—									
C	0.1	1.7	—								
A	2.6	<i>4.1</i>	2.7	—							
D.Sp.	7.8	9.5	8.0	3.7	—						
S	2.4	3.9	2.5	3.1	4.3	—					
P.A.	4.5	<i>6.3</i>	4.7	1.1	3.1	1.5	—				
P.C.	2.0	3.7	2.2	0.8	5.3	0.5	2.2	—			
O.A.	4.5	5.9	4.6	1.7	1.7	2.1	0.9	2.7	—		
B.D.	5.3	6.9	5.5	2.1	1.6	2.5	1.2	3.2	0.2	—	
D.Sy.	8.2	9.9	8.4	4.2	0.6	4.7	3.6	5.7	2.1	2.1	—

and Picture Arrangement, likewise, indicate significant deviations, though with less difference-reliabilities and in an order in keeping with that shown by the mean weighted scores of Table I. The five subtests at the lower end of the order of resistance, i.e. least resistant to encephalopathic processes, deviate more from Information than from Vocabulary, which is similar to findings in the earlier studies (1, 3).

DISCUSSION.

These results suggest the manner in which the encephalopathic processes are at work in the human individual. In terms of the average weighted scores, there is an 8.5 difference between verbal and performance abilities, in favour of the former. The gross effect of these processes appears to be in the area of motility, or motor co-ordination. However, this obvious deficiency may only be correlative with, or the result of, more insidious disabilities, which are mediated by the patients' performances on the Scale.

The function which this scale taps is the ability of an individual to respond to stimulation in terms of his past experiences. Memory is perhaps the most basic, with the ability to attend its simplest manifestation. Broadly, out of this analysis and synthesis are developed. This complex form of organization includes planning, anticipation and shift. The subtests tap this function in varying degrees, depending upon the items. Vocabulary, Information and Comprehension hold against the encephalopathic processes because memory, without its more complex organizational aspects, is largely dependent on the general training and background of the subject. The other subtests hold less well because of the increasing demand for more organizational activity. The order of resistance noted in Table I acts as a rough indication of the degree of organization necessary. Unless the organic lesion directly involves the motor system of the patient, it is this failure to *organize* the problem adequately which results in difficulties manifested by poor motor manipulation.

The results of the Digit Symbol and Digit Span subtests illustrate this point. Very high critical ratios for the differences between the mean weighted scores for these two subtests on the one hand, and Vocabulary, Information and Comprehension scores on the other, were found. The critical ratios for Digit Symbol and Digit Span decrease as they are compared with other subtests which are themselves affected by the encephalopathic processes. Significant differences between Digit Symbol and all other subtests with the exceptions of Digit Span, Object Assembly and Block Design are shown in Table II. It would appear, therefore, that the absence of significant differences between these four subtests strongly suggests that motor manipulation and motor co-ordination are not the critical functions impoverished by the encephalopathic processes. Digit Span in no way involves motility, while Object Assembly depends very little on motor co-ordination *per se*. From this it seems that the encephalopathic patient has difficulty in conceptualizing a problem, in breaking it up into its constituents and re-grouping the parts into a logical whole.

Correlative aspects of the organizational ability which may be part of its general dysfunction are anticipation and shift. The patient's ability to set himself into a state of preparedness, and to alter this state according to the demands is hampered. Also involved are the patient's reactions to success and failure on the test items. The anxieties which may be a part of his reaction to his physical disability may be provoked to an even greater extent by the testing situation. Time pressure can also serve to disrupt any train of organization.

The order of resistance given above may serve as a point of reference for the design of scatter analysis patterns. The Information subtest weighted score may be used as a basal point for computing the deviation of the other ten subtest weighted scores. This may also be used as a basis for the estimation of the pre-encephalopathic intelligence, since Information, Vocabulary and Comprehension hold well against all except the most insidious deterioration, and, of course, psychotic blocking.

CONCLUSION AND SUMMARY.

The purpose of this paper has been to study the effects of traumatic and non-traumatic encephalopathy on patients as measured by the Bellevue Intelligence Scale, Form 1. A total of 86 subjects were studied, 50 brain injured and 36 brain diseased, in a veterans' hospital. The results indicate a significant difference between verbal and performance abilities, as tested by this scale. The handicap of the organic patient on this scale appears to be most obviously in the area of motor manipulation. It is possible, however, that this difficulty is simply the manifestation of the organic patient's inability to organize, to analyze and synthesize incoming stimuli, which results in the terminal and observable inability to manipulate manually. A basis for scatter analysis and estimates of pre-deterioration intelligence is suggested by the order of resistance of the Bellevue subtests to the encephalopathic processes. This order, from most to least resistant, is: Information, Vocabulary, Comprehension, Picture Completion, Similarities, Arithmetic, Picture Arrangement, Object Assembly, Block Design, Digit Span and Digit Symbol.

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