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This paper supports the hypothesis that picture vocabulary tests should not be used as interchangeable measures of intelligence for complex, lengthy intelligence tests (WISC and Stanford-Binet). In picture vocabulary tests assessing receptive functions (input), the child recognizes a word by pointing to or stating the number standing for an object. In WISC and Stanford-Binet tests assessing expressive functions (output), the child articulates the definition of a word. Subjects were drawn from three groups: (1) 56 retarded children from a psychodiagnostic laboratory; (2) 41 children from a child guidance clinic; and (3) 41 from multiply handicapped children. They were tested to see if differences in vocabulary input and output scores would vary according to physical setting, diagnosis, intellectual functioning, and educational achievement. The results showed that input-output differences may be predictive of educational achievement in children of borderline mentality but tend to be influenced by diagnosis, cerebral dysfunction or behavioral disturbance in children of average intelligence. Children's intellectual and educational potential is more precisely evaluated by judging both the input and output of a child's vocabulary. Correlations between picture and WISC vocabulary scores do not justify equivalence of measure and functions, especially with deviant groups of children. (DO)

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Differences in Vocabulary Input-Output in Psychodiagnosis of Children[1]

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The relatively recent enthusiasm for picture vocabulary tests as short, quick indices of intellectual functioning has brought about a long list of studies reporting high correlations with WISC and Stanford-Binet tests (Dunn, 1963). On the basis of these correlations many investigators (Burnett, 1965; Gage & Naumann, 1965; Hughes & Lessler, 1965) suggested that these tests could be used as interchangeable measures of intelligence for tests that are more difficult and lengthier to administer.

It is the thesis of the present study that the foregoing conclusions concerning the usefulness and interchangeability of picture vocabulary tests with more complex tests of intelligence are based on faulty conceptual grounds and on inadequate understanding of the limitations of this type of test. Even average correlations in the low 80's are not sufficient statistical grounds for equivalence. There is still more than one third of the variance unaccounted for. Furthermore, the relationship between these scales could be curvilinear rather than linear as generally assumed. Lastly, the functions tapped by these tests may be different.

To support the foregoing thesis, the following arguments are in order. In the first place, picture vocabulary tests measure receptive vocabulary functions rather than the expressive vocabulary functions measured by the WISC and Stanford-Binet. The relative superiority of passive, receptive functions would explain also the consistent superiority of Picture vocabulary scores reported in the literature (Budoff & Purseglove, 1963; Burnett, 1965; Mold, Wright, and James, 1963; Throne et.al., 1965). The superiority of receptive over expressive functions has been noted not only in reference to verbal skills (John, 1963; L'Abate, in preparation; Sapon, 1964) but also in the lag between perceiving and performing (Maccoby & Bee, 1965)

In the second place, these picture vocabulary tests are really based on auditory verbal input--the child hears a word said to him by the examiner and recognized the object in question by either pointing with his finger or by saying the number standing for that object. He matches what he hears--a sound--with what he sees. He is not asked by the requirements of the task to express verbally anything except, at most, a number. On the other hand, when the child is asked to define words on the WISC or Stanford-Binet vocabulary scales, he

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[2] I am indebted to James D. Buchanan, Mary Anne Norman, and Jerry Tessman for collecting some of these data and especially to Mr. Buchanan for helping with the statistical analysis.

hears the word but then he must articulate verbally what that word means.

It is submitted, therefore, that even though there should be a certain degree of relationship between receptive input and expressive output, especially in a normally distributed population, this relationship is still not sufficient to justify the interchangeability of functions. These picture vocabulary tests and conventional tests of intelligence not only differ in the nature of the task presented to the child, but differ also and more importantly in the nature of the response performed by the child. Picture vocabulary tests tend to assess the more receptive functions of vocabulary (input = 1), while the WISC and Stanford-Binet vocabulary scales tend to assess the more expressive functions of vocabulary (output = 0).

To demonstrate the foregoing thesis, this study was set up to find whether differences in vocabulary input-output (Picture Vocabulary IQ score minus extrapolated WISC vocabulary IQ score) would vary according to physical setting, diagnosis, intellectual functioning and educational achievement.

Method

Subjects: Three samples of children were drawn from the files of three physical settings. The general characteristics of these samples are contained in Table 1. Sample 1 was drawn from the files of a psychodiagnostic laboratory in the pediatrics department of St. Louis Children's Hospital and was divided into three subgroups: behavioral disturbance, brain damage, and retardation (Table 3). Sample II was drawn from a private and semi-private child guidance clinic in Atlanta. Its characteristics are in Table 4. Sample III was drawn from the Crippled Children Service of the Georgia Health Department in Atlanta. The characteristics of Sample III cannot be reported according to any meaningful classification, because in this sample we were dealing with multiply handicapped children with no dividing lines among behavioral disturbance, brain-damage, and other medical or orthopedic disabilities.

Procedure: For Sample 1, Ammons' (1948) Full Range Picture Vocabulary Test (FRPVT) was used as a measure of input. For Sample II and III, the Peabody Picture Vocabulary Test (PPVT) was used. Each child's protocol was routinely scored for extrapolated WISC Vocabulary IQ scores (output). The difference score for each child was obtained by subtracting the WISC vocabulary IQ from the picture vocabulary IQ score. Quotients for the Wide Range Achievement test on reading, spelling, and arithmetic were obtained on the basis of educational age equivalence and chronological age. When the reading quotient was higher, equal, or four points below the WISC Full Score IQ level, reading achievement was considered high. When the reading quotient was five or more points below the full IQ score, reading was classified as low. Values for these measures are in Table 3 for Sample 1 and in Table 4 for Sample II.

Results

The coefficients of correlation among the FRPVT for Sample 1 and PPVT for Samples II and III and other WISC measures are shown in Talbe 2. Except for the correlation between FRPVT and WISC Voc. scores, the correlations between PPVT and WISC Voc. scores of Sample II and III are substantial, equal, or greater than other correlations with WISC measures.

An analysis of variance for Sample 1 input-output difference scores yielded a main effect ($F = 4.28$; p .05) for reading. Overachievers in reading had a difference score about twice as great (Mean 20.85) than underachievers (Mean 11.59). In Sample II diagnosis produced a significant main effect ($F = 5.68$; p .025), with the brain-damaged children showing much larger input-output difference (Mean = 11.33) than behaviorally disturbed children (Mean = 1.46).

The fact that the two picture vocabulary tests are not comparable precluded any statistical analysis between Samples 1 and II, while the difference in socioeconomic background between Samples II and III makes a statistical analysis almost irrelevant. In Sample III, however, such a classification yielded nonsignificant results with a slight trend for the underachievers to receive a somewhat higher input-output difference (Mean ca. 13) than the overachievers (ca. 8). The only meaningful classification, therefore, would have been in terms or reading achievement.

This type of results suggested another kind of analysis of the data. On the basis of the input-output scores, each distribution was separated into three subgroups: difference scores one S.D. above the mean, scores within one S.D. around the mean, and scores one S.D. below the mean. The results of this analysis for Sample I are contained in Table 5. From these data, it appears that input may decrease with age. The most relevant result pertains to educational achievement. There is a curvilinear relationship between input-output and achievement in reading, spelling and arithmetic. It remains to be seen whether this result occurs in the other samples. When the same type of analysis was performed on Sample II (Table 6), age did not change, while the relationship between input-output differences and educational achievement was consistently linear. WISC scores alone were better predictors of educational achievement. PPVT and WISC scores were also directly related.

The only meaningful classification for Sample III was actually in terms of the input-output difference (Table 7). In this sample the same type of results found in Sample 1 was replicated. The same type of curvilinear relationship between input-output difference scores and educational achievement was found. The medium group input-output was superior to the two extreme groups in educational achievement, as found in Sample 1 (Table 5).

Discussion

On the basis of these results, some tentative conclusions are in order:
a) Input-output differences may be predictive of educational achievement in children of borderline to dull-normal intellectual level.
b) In children of average intelligence, input-output differences will tend to be influenced by diagnosis, cerebral dysfunction, or behavioral disturbance. At this level, WISC scores are better predictors of educational achievement than PPVT scores or input-output difference scores.
c) Taking into account the input as well as the output of a child's vocabulary brings about a more precise evaluation of the child's potential--intellectually as well as educationally.
d) Even though correlations between PPVT and WISC vocabulary scores may be high in normally distributed samples, they are not high enough to justify equivalence of measures and functions, especailly with deviant groups of children.

The results are sufficiently encouraging to support our initial contention concerning the role of picture vocabulary tests in assessing input factors. They also suggest strongly that these tests, although necessary, cannot be used

interchangeably with, or instead of, more complex and lengthier intelligence tests. If one is pressed for time one should at least use a picture vocabulary test together with a vocabulary scale such as WISC's or Stanford-Binet's. Our results should be convincing in demonstrating the fallacy of using only a picture vocabulary as predictor of overall intellectual functioning as well as educational achievement. The comparison of two picture vocabulary tests tends to favor the PPVT. As Grossberg (1964) and Smith and Fillmore (1956) have already found, the FRPVT tends to overestimate WISC IQ scores grossly and to show inadequately low correlations with these scores. It is evident that the PPVT may be more sensitive and precise a test of vocabulary input than the FRPVT.

It should be pointed out that many other pertinent factors such as sex, ethnic origin, and severity of illness were not considered in this study. Furthermore, these results indicate the need for an evaluation of input-output differences in normal children. All of these variables will be considered in future studies where detailed analyses of WISC subtests will also be necessary.

A follow-up of input-output differences (L'Abate, research in progress) and visuomotor functioning, as measured by the Minnesota Percepto-Diagnostic Test and a revised version of Gottschalk's Hidden-Figures Test, shows that, as the input-output differences increase in favor of output, there is a parallel improvement in scores for three groups comparable to those of Sample II (Table 6) and Sample III (Table 7). This finding repeats itself consistently from one sample to another and would be expected from the correlations reported in the literature. Nevertheless, a more detailed and complete analysis of this relationship with younger children is still incomplete.

The results of the present study are in line with those of John (1963, 1964) who pointed out the relevance of social background as measured in the present study by physical setting and intellectual functioning. In reviewing various studies concerning linguistic development in lower class children, she concluded that these children use shorter sentences than their middle-class peers. They have a more limited vocabulary and poor articulation. Their inadequacy in expressive vocabulary functions, of course, would argue strongly in favor of picture vocabulary tests to assess receptive vocabulary functions. Higher picture vocabulary scores in comparison to expressive functions may not be, as pointed out at the outset, an error, as, for instance Hughes and Lessler (1965) interpret their results, may be related to the superiority of receptive over expressive functions (Sapon, 1965).

One of the major implications of these results, however, in the writer's opinion, relates to psychodiagnostic models. As considered in greater detail, elsewhere, (L'Abate, in preparation) psychodiagnostic models have been either nonexistant or inadequate. Whatever unclear psychodiagnostic models may have existed implicitly thus far, they have been based on arbitrarily vague dynamic assumption which emphasize mostly expressive rather than receptive aspects of intellectual functioning. The results of this study suggest the relevance of considering receptive functions not only in auditory-verbal input but also, and especially, in perceptual input. Instead of a dynamic or learning-theory model, in information-theory approach to psychodiagnosis may be conceptually more neutral as well as more inclusive of neurological and educational factors that traditional psychodiagnostic models seem to have forgotten.

Table I

Characteristics of Three Samples of Children

	Sample I N = 56		Sample II N = 41		Sample III N = 41	
	Mean	SD	Mean	SD	Mean	SD
Age (in months)	139.00	20.14	138.46	22.54	155.34	33.11
Picture Voc IQ*	103.82	16.71	99.95	20.05	84.78	16.49
WISC						
Voc IQ	87.43	17.92	94.88	25.31	76.49	18.25
Verbal IQ	88.50	13.03	96.50	20.45	82.24	12.85
Perform IQ	90.20	14.52	96.80	19.90	78.88	13.49
Full Score IQ	88.23	13.69	96.29	20.62	78.78	12.97
Reading	86.09	20.99	90.54	20.81	76.56	17.18
Spelling	80.07	18.24	83.85	17.07	72.56	13.65
Arithmetic	83.00	14.23	84.73	12.85	72.46	16.22

*Full Range Picture Vocabulary for Sample I
Peabody Picture Vocabulary for Samples II and III

Table 2

Correlations Among Two Picture Vocabulary Tests and WISC

Sample	N	Picture Vocabulary	WISC-IQ's Voc	Verbal	Perf	Full
I	56	FRPVT	.54	.58	.42	.57
II	41	PPVT	.83	.83	.68	.79
III	41	PPVT	.78	.69	.47	.64

Table 3

Characteristics of Sample I as a function of
Diagnosis and Reading Achievement

	Behavior Disturbance				Brain Damage				Retardation			
	Reading Achievement											
	High N=11		Low N=11		High N=10		Low N=8		High N=8		Low N=8	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (in months)	139.00	25.64	139.45	18.95	137.40	13.83	140.38	17.36	138.25	22.60	139.75	19.58
WISC												
Verbal IQ	100.55	11.68	95.64	11.92	91.40	7.97	84.75	6.85	74.62	7.61	76.12	7.41
Perfor IQ	94.00	8.54	100.27	15.39	94.00	11.21	98.13	9.17	74.37	7.48	74.25	6.08
Full IQ	97.45	9.80	97.55	12.62	92.10	8.30	90.25	6.45	71.25	4.85	72.75	5.29
Wide Range												
Reading	114.09	10.52	84.36	12.19	95.40	6.46	72.87	14.15	79.12	10.15	58.50	6.71
Spelling	105.54	9.86	80.00	12.21	81.90	9.05	64.88	9.87	79.25	12.29	58.25	6.04
Arith	99.09	15.19	86.36	12.90	85.90	7.07	75.88	5.49	78.50	7.68	64.25	2.98
FPPVT-IQ	115.91	12.03	104.27	11.90	114.70	16.87	101.00	15.44	92.87	11.96	86.75	11.36
WISC Voc IQ	96.00	10.99	94.36	11.95	95.50	15.78	88.13	20.15	68.62	9.88	74.12	12.66
Difference	19.91	10.03	9.90	18.75	19.20	15.92	12.88	14.15	24.25	20.25	12.66	16.58

Table 4

Characteristics of Sample II as a Function of Diagnosis and Reading Achievement

	Behavior Disturbance Reading Achievement				Brain Damage Reading Achievement			
	High N=11		Low N=15		High N=11		Low N=4	
	Mean	SD	Mean	SD	Mean	SD	Mean	Range
Age	136.55	26.29	134.60	14.98	144.36	26.00	142.00	116-174
WISC								
Verbal IQ	103.64	17.04	105.50	16.24	91.45	14.43	59.25	52-75
Perf IQ	101.91	17.72	106.22	14.10	93.27	13.59	59.50	44-79
Full IQ	103.00	18.33	105.33	14.75	91.81	14.21	56.25	46-70
Wide Range								
Reading	108.45	20.95	89.27	15.63	82.00	16.51	69.50	63-72
Spelling	96.36	16.91	82.46	10.29	80.72	16.46	63.25	51-66
Arith	90.45	9.32	87.86	9.05	82.72	14.07	62.75	57-69
PPVT-IQ	106.09	24.74	105.60	15.87	95.18	18.08	74.75	63-89
WISC Voc IQ	94.90	26.35	104.60	19.94	86.45	19.73	56.25	45-75
Difference	2.09	14.82	1.00	11.00	8.72	11.87	18.50	19-38

Table 5

Characteristics of Three Groups of Children (Sample I) Differing on Vocabulary Input-Output

	High N=11 Input>Output		Medium N=37 Input=Output		Low N=8 Input<Output	
	Mean	SD	Mean	SD	Mean	SD
Age	130.00	14.07	138.86	18.58	152.00	23.78
FRPVT-IQ	115.09	14.78	102.65	14.60	93.75	18.54
WISC						
Voc IQ	73.73	16.52	88.46	15.52	101.50	17.19
Verbal IQ	81.27	12.21	89.92	12.76	91.88	11.72
Perf IQ	84.82	11.64	90.73	14.73	95.13	15.81
Full IQ	81.45	11.94	89.32	13.28	92.50	14.61
I-O Difference	41.36	5.79	14.19	9.29	-6.88	4.38
Reading	79.91	18.14	90.11	21.06	76.00	8.22
Spelling	76.00	15.63	82.92	19.48	72.50	3.50
Arithmetic	78.82	8.72	85.14	5.04	78.88	8.75

Table 6

Characteristics of Three Groups of Children (Sample II)
Differing on Vocabulary Input-Output

	High N=9 Input>Output		Medium N=23 Input=Output		Low N=9 Input<Output	
	Mean	SD	Mean	SD	Mean	SD
Age (in months)	135.67	23.87	141.61	22.11	133.22	20.89
PPVT IQ	91.00	5.93	100.65	22.36	107.11	19.86
WISC						
Voc IQ	67.44	9.82	95.96	20.61	119.50	18.84
Verbal IQ	81.33	12.23	95.50	27.07	114.11	15.84
Perf IQ	86.33	16.99	96.09	26.83	109.00	19.71
Full IQ	82.33	14.94	95.22	18.92	113.00	17.77
Difference 1-0	23.55	5.50	4.70	6.85	-12.44	2.99
Wide Range						
Reading	79.22	12.89	88.74	21.09	106.44	16.46
Spelling	74.56	12.62	84.30	16.85	92.00	14.08
Arithmetic	79.44	9.57	84.22	13.53	91.33	11.06

Table 7

Characteristics of Three Groups of Children (Sample III)
Differing on Vocabulary Input-Output

	High N=10 Input>Output		Medium N=25 Input=Output		Low N=6 Input<Output	
	Mean	SD	Mean	SD	Mean	Range
Age (in months)	147.50	20.32	153.00	33.69	178.17	130-230
PPVT-IQ	82.50	7.28	87.24	19.95	76.67	71-89
WISC						
Voc IQ	59.10	8.94	82.00	18.44	82.50	69-94
Verbal IQ	73.60	9.77	84.80	13.75	86.00	79-92
Perf IQ	77.40	13.89	78.56	14.28	82.67	75-96
Full IQ	73.20	11.66	79.96	14.03	83.17	71-92
1-0 Difference	23.40	5.29	5.88	4.84	-7.50	(-11)(-5)
Wide Range						
Reading	71.20	15.65	80.52	17.23	69.00	54-95
Spelling	68.93	13.41	75.20	14.10	67.67	54-80
Arithmetic	72.24	8.06	75.37	19.39	73.33	62-95

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