

# Color-form responses of mentally retarded as a function of etiology

By

Dairin NAKAGAWA

## Introduction

A considerable number of recent studies regarding the mentally retarded were concerned in the examination of psychological features of the mentally retarded on the basis of the etiology.

Werner H. & Strauss A. A. (18), Aita J. A., Armitage S. G., Reitan R. M. & Robinsvitz A. (1), Bender M. B. & Teuber H. (2), McMurray J. G. (11), and Weir A. & Werner H. (21) maintained that the disorders of the visual perceptions were found markedly in the mentally retarded with exogenous sources. Werner H. & Strauss A. A. (19), Ross A. O. (17), and Parker J. W. (15) found that the exogenous subjects exposed the disorders of the tactual perceptions in performances on the problems, including tactual kinesthetic materials.

Bensberg G. J. (3), and Halpin V. G. & patterson R. M. (6) indicated that the performances of the brain-injureds on the Bender Gestalt Test were inferior to those of the familial mental defectives of the same level in mental age.

Some studies (10, 23) suggested that Kohs Block Design Test might be adopted as a method to classify the mentally retarded. Miyamoto S. (13) investigated the performances of the endogenous and exogenous feeble-mindedness on the Suzuki-Binet intelligence scale. He found that the former was superior to the scores of arithmetical reasoning and comprehension, and the latter to those of remembering some immediate stimuli. Goldstein K. (8) reported that the brain-injured indicated the impairment of the abstract attitude. McMurray J. G. (12) found that the mental set of the subjects with the exogenous sources had little flexibility in conceptual thinking.

It was also reported by some (4, 5, 20) studies that the Rorschach technique might be used as a method to divide the mentally retarded into the endogenous and the exogenous subjects diagnosely.

The above mentioned studies indicate the several psychological differences between the endogenous and exogenous mentally retarded. But, there were some studies (7, 9, 16, 22) that did not find any significant differences between the experimental results from the subjects with the endogenous and those from the subjects with the exogenous sources.

In the previous paper (14) the author reported some findings on the color-form responses of the infants and the feeble-mindedness.

The purpose of this study was to test whether the color-form responses of the mentally retarded changed as a function of the endogenous and exogenous sources. If the mentally retarded could be significantly divided into the endogenous and exogenous subjects by means of the color-form responses, then the distribution of color-form attitudes might be applied as the cue to classify the mentally retarded to the endogenous and exogenous subjects diagnostically.

### Method

**Subjects** The subjects for this investigation consisted of 74 children and adolescents from the three homes for the mentally retarded. There were 44 males and 30 females in the subjects. These subjects were carefully selected on the basis of the endogenous and exogenous sources for the mentally retarded. The mean I. Q. scores of the endogenous and exogenous group on the Suzuki-Binet intelligence scale were 54.4 and 52.0 respectively. The sources determined the endogenous subjects used in present study included feeble-mindedness, serious tuberculosis, psychosis of the parents or a parent, feeble-mindedness of the brother or sister, heavy drinking of the father, consanguineous marriage, and serious illness or dietary deficiencies of the pregnant mother. On the other hand, those of the exogenous subjects included meningitis, encephalitis, polioencephalitis, birth injury, and illness or dietary deficiencies of the developing infant.

The color blind was excluded from the subject.

**Procedure** All subjects are tested individually on the same problems which are administered in the same order. The problems used are similar to the one in the previous study. It involves the setting up of an experimental situation in which the subjects are required to choose between alternatives in matching a series of materials. When the materials chosen are similar in form, they are invariably dissimilar in color, when color is the same, form can not be matched. Present study involves 14 subtests.

**Test 1** The experimenter places a red circle (3cm in diameter) and a blue square card (3cm×3cm) before a subject on the desk and holding another red square card (3cm×3cm) as a sample the experimenter makes a subject choose the same card with the sample out of the two cards. The instruction given to a subject is "Point to a card that looks most similar." If a subject chooses a similar card to the sample in color out of the two cards, it is determined that he responds to color in visual stimuli. On the other hand, by selecting a similar card to the sample in form out of the two cards, it is determined that he responds to form in visual stimuli. The similar procedure to that

used in Test 1 is administered to the subsequent Tests 2, 5, and 6. All the cards used were made of the cardboard.

Test 2 The sample stimulus—the yellow triangle card (3cm in side). The selection stimuli—the red triangle (3cm in side) and yellow square card (3cm×3cm). The size of the circle, square, and triangle cards used in the subsequent tests is similar to that of cards as mentioned above respectively.

Test 3 The sample stimulus—the red square card. The selection stimuli—the yellow and the blue square cards. A subject is asked whether the same card with the sample card is in the selection cards, and if he answers "Yes", it is suggested that he responses to form in visual stimuli. On the other hand, if he answers "No", it is suggested that he responses to color in visual stimuli.

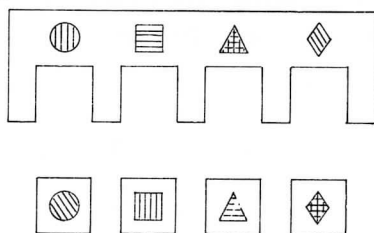
Test 4 The sample stimulus—the green circle card. The selection stimuli—the blue and the yellow circle cards. The procedure is similar to that of the Test 3.

Test 5 The sample stimulus—the blue square card. The selection stimuli—the three red square cards and the three blue triangle cards.

Test 6 The sample stimulus—the green circle card. The selection stimuli—the three yellow circle and three green square cards. The instruction given in the Tests 5 and 6 is similar to that of the Test 1. A subject is expected to sort three cards according to the category of color (or form) in visual stimuli.

Test 7 This is a sorting test involving a definite shifting from the one principle of order to the other. A cardboard frame and four cards, as is shown in Fig. 1, are used. At first, the frame on which the colored papers

Fig. 1



cutting off four geometric figures are pasted is placed on the desk before a subject. The figures with the relation of the same form and dissimilar color or the same color and dissimilar form with the four geometric figures on the frame respectively, are placed at random before the subject. The subject is asked to interpose a card of the figure that looks most similar to a figure on the frame, to a hollow under its figure on the frame. If a subject has arranged the four cards according to color (or form) in visual stimuli, he is asked

to sort them again, by means of another principle of order. Then, the instruction given is "Sort again in a different way".

**Test 8** The four figures used in this test are of the familiar things. The procedure is similar to that of the Test 7.

**Tests 9, 10, 11, and 12** All the figures used in these tests are similar to those used in Tests 1, 2, 5, and 6 respectively, but framed with a black line of 2mm in width. This black line was used to strengthen a feature of the figure.

**Tests 13 and 14** A black line of 1mm in width is given in all the figures used in the Tests 7 and 8. The procedures used in Tests 9, 10, 11, 12, 13, and 14 are similar to procedures mentioned in each Test 1, 2, 5, 6, 7, and 8 respectively.

Each test as mentioned above is administered with unlimited time.

**Evaluation** The criteria evaluating the experimental results and the signs of the evaluated results are as follows.

Selection on the basis of color in visual stimuli—C.

Selection on the basis of form in visual stimuli—F.

Selection on the basis of color (or form) as a feature in whole stimuli and capability changing the arrangement on the basis of form (or color) respectively—W-P.

Selection on the basis of form in the test using the familiar figures only and color in the other tests consisting of geometric figures— $\mathbb{M}$ .

Disordered Response without any understanding of the meaning of the problems—M.

## Results

Table 1 Distribution of color-form responses as a function of I. Q.

S	I Q R	20	30	40	50	60	70	80
I	C	1	1	2	2			
	F			1	1	1	1	1
	W-P			5	4	4	1	1
	$\mathbb{M}$				1	1		
	M		1	3	6	3		
	T	1	1	11	14	9	2	2
II	C	2		1				
	F		1	2				
	W-P		1	2	7	4	1	3
	$\mathbb{M}$		1					
	M		1	4	3			
	T	2	4	9	10	4	1	3

I shows endogenous subjects and II shows exogenous subjects. These notes are common to Tables 2, 4, and 6.

Table 1 indicates the distribution of color-form attitudes from the mentally retarded with the endogenous and exogenous sources as a function of I. Q.. The over-all tendency of the distribution evinces the result that was reported in the previous paper. Compared the trend of the endogenous with that of the exogenous subjects, it is noticed that both the C and F responses from the latter are fewer than those of the former, and are limited to the subjects of low rank I. Q., as is shown in Table 1. Since the scores of C, F, M and  $\bar{M}$  responses in the two groups were small in number, however, a difference of the two groups in making W-P response was investigated.

The results which the scores of the W-P response in two groups were summarized as a function of I. Q. level are shown in Table 2. The statistical significance of these results was determined by an analysis of variance through inverse sine transformation (Table 3). Statistical analysis revealed a significant difference between the endogenous and exogenous source, and between the subjects of high rank and those of low rank in I. Q.. The source  $\times$  I. Q. interaction was also significant at 0.01 level, indicating that the exogenous subjects with high I. Q. had more W-P responses than the endogenous subjects with the same level in I. Q..

Table 2 W-P response of subjects of high rank and low rank in I. Q. within two groups

S R	I Q	I				II				Total	%
		~50	%	50~	%	~50	%	50~	%		
W-P		5	36	10	37	3	20	15	83	33	45
Others		9	64	17	63	12	80	3	17	41	55
Total		14	100	27	100	15	100	18	100	74	100

Table 3 Analysis of variance for evaluating differences between endogenous and exogenous factor, and between high rank and low rank in I. Q. in making W-P response

Source	SS	df	$\chi^2 = SS/\delta w^2$	P
A	74.834	1	6.876	< 0.01
B	393.824	1	33.922	< 0.01
A $\times$ B	370.370	1	31.901	< 0.01
Total	844.028	3	72.699	< 0.01
$\delta w^2$			11.609	

A shows the etiology of the mentally retarded and B shows I. Q..

Table 4 shows the W-P responses made by the subjects over 8 years old and under 8 years old in mental age (M. A.) within each group. The W-P responses made by the subjects over 14 years old and under 14 years old in

chronological age (C. A.) within each group was shown in Table 6.

Table 4 W-P response of subjects of high rank and low rank in M. A. within two groups

S R	MA	I				II				Total	%
		~ 8	%	8 ~	%	~ 8	%	8 ~	%		
W-P		11	35	4	40	8	36	10	91	33	45
Others		20	65	6	60	14	64	1	9	41	55
Total		31	100	10	100	22	100	11	100	74	100

Table 5 Analysis of variance for evaluating differences between endogenous and exogenous factor, and between high rank and low rank in mental age in making W-P response

Source	SS	df	$\chi^2 = SS/\delta w^2$	P
A	287.472	1	16.741	< 0.01
B	418.069	1	24.346	< 0.01
A × B	222.541	1	12.959	< 0.01
Total	928.082	3	54.046	< 0.01
$\delta w^2$			17.172	

A shows the etiology of the mentally retarded and B shows M. A..

Table 6 W-P response of senior and junior within two groups

S R	C A	I				II				Total	%
		~14	%	14~	%	~14	%	14~	%		
W-P		7	29	8	47	7	54	11	55	33	45
Others		17	71	9	53	6	46	9	45	41	55
Total		24	100	17	100	13	100	20	100	74	100

The differences in the W-P responses between the subjects of high rank and low rank in mental age, and between senior and junior subjects in chronological age were significant, as is shown by the statistical analysis summarized in Tables 5 and 7. The interaction between causal factors of mentally retarded and mental age in making the W-P response was significant at 0.01 level. The interaction between causal factors and chronological age in making the W-P response was significant at 0.05 level.

Table 8 indicates the summary of the W-P response made by males and females within each group. An analysis of variance showed the significant differences between the endogenous and exogenous factor, and between the male and female at 0.01 level respectively, but, did not find the significant interaction between causal factors and sexuality.

Table 7 Analysis of variance for evaluating differences between endogenous and exogenous factor, and between senior and junior in making W-P response

Source	SS	df	$\chi^2 = SS/\delta w^2$	P
A	93.123	1	16.468	< 0.01
B	31.809	1	5.625	< 0.05
A $\times$ B	25.604	1	4.528	< 0.05
Total	150.536	3	26.621	< 0.05
$\delta w^2$			5.655	

A shows the etiology of the mentally retarded and B shows C. A..

Table 8 Analysis of variance for evaluating differences between endogenous and exogenous factor, and between male and female in making W-P response

Source	SS	df	$\chi^2 = SS/\delta w^2$	P
A	77.440	1	20.509	< 0.01
B	110.670	1	29.309	< 0.01
A $\times$ B	1.613	1	0.427	
Total	189.723	3	50.245	< 0.01
$\delta w^2$			3.776	

A shows the etiology of the mentally retarded and B shows sex.

## Discussion

The fact that the distribution of the W-P response has a relation to I. Q., C. A., and M. A. of subjects respectively confirms the previous findings. Furthermore, the findings: the significant difference in the score of the W-P response between the endogenous and exogenous subjects; a high score of W-P response from the subjects of high rank in each I. Q., M. A., and C. A.; and the effects of the interactions between the etiology of mentally retarded and each I. Q., M. A., and C. A. upon making W-P response, were brought in light in present investigation.

The W-P response indicates that a subject is able to categorize the objects according to their color or according to their form when he is asked to differentiate among two dimensional stimulus objects. It is regarded as a reflection of abstract attitude or whole-part attitude. If it is true, the findings obtained in this study is inconsistent with those of studies reported up to this time, and especially with the finding of Goldstein (8) maintaining the impairment of abstract attitude in subjects with brain-injuries.

There are, indeed, some studies such as the study of Halpin and Patterson (6), using Goldstein-Scheerer Cube Test, and indicating the results disagreed with Goldstein's finding.

The questions now arise whether the subjects investigated by Goldstein are similar to the exogenous subjects used in the present study as a group, and whether the exogenous subjects used in a number of previous investigations are really homogeneous one another. Though the subjects who were hardly distinguishable from each other in etiological grouping were excluded from those of the present study as mentioned, it is a question whether the subjects divided into the exogenous and endogenous group are appropriate respectively, because the subjects classified into the exogenous group might have hidden endogenous factor. It remains to be studied, how are the color-form attitudes of the strictly exogenous and strictly endogenous subjects. So far as the subjects used in the present study are concerned, it is concluded that the exogenous subjects in high rank in I. Q., M. A., and the senior endogenous subjects are superior in making the W-P response, in other words, they might be mentioned to have considerably abstract attitude.

### Summary

The color-form attitude of the mentally retarded involving the 41 endogenous and the 33 exogenous subjects was examined. The procedure is the same one as used in the previous study. The results indicated: (a) that the over-all trend of color-form attitude from the mentally retarded is similar to that shown in the previous paper; (b) a greater tendency to whole-part attitude of the subjects of high rank in each I. Q., M. A., and C. A.; (c) that females tend to make more W-P response than males; (d) the significant difference between the tendency to whole-part attitude of the endogenous and that of the exogenous subjects; (e) a high score of whole-part attitude from the exogenous subjects who is high rank in I. Q., and M. A.; (f) a high score of whole-part attitude from the senior endogenous subjects; (g) the effects of the interactions between the etiology of mentally retarded and each I. Q., M. A., and C. A. upon W-P response.

In a word, the exogenous subjects of high rank in I. Q. and M. A., the senior endogenous subjects, and females are superior in making the W-P response.

The tendency toward whole-part response in the exogenous and that of the endogenous subjects was discussed.

The writer wishes to express his sincere appreciation to the staffs of Shinano-gakuen, Seibi-gakuen, and Takinogawagakuen for good cooperation to the study. The writer is also indebted Prof. S. Miyamoto, Chiba University, for his kind suggestion relating to the etiological grouping of the mentally retarded.



### References

1. Aita J. A., Armitage S. G., Reitan R. M. & Robinsvitz A.: The use of certain psychological tests in evaluation of brain injury. *J. gen. Psychol.*, 1947, 37, 25-44.
2. Bender M. B. & Teuber H.: Disturbances in visual perception following cerebral lesion. *J. Psychol.*, 1949, 8, 223-233.
3. Bensberg G. J.: Performance of brain-injured and familial mental defectives on the Bender Gestalt Test. *J. consult. Psychol.*, 1952, 16, 61-64.
4. Erickson M. R. & Harrower M. R.: Personality changes accompanying organic brain lesions: II a study of preadolescent children. *Arch. Neurol. & Psychiat.*, 1940, 43, 859-890.
5. Fisher J., Gonda T. A. & Little K.: The Rorschach and central nervous system pathology: a cross validation study. *Amer. J. Psychiat.*, 1955, 111, 487-492.
6. Halpin V. G. & Patterson R. M.: The performance of brain-injured children on the Goldstein-Scheerer Test. *Amer. J. ment. Defic.*, 1954, 59, 91-99.
7. Fujimoto F.: The differences of perceptual behavior between exogenous and endogenous mentally retarded. The 1st Meeting of J. E. P. A., 1959 (in Japanese).
8. Goldstein K.: *Human in the light of psychopathology*, 1947.
9. Irori K.: A study on the figure perception of endogenous and exogenous mentally retarded. The 21st Meeting of J. P. A., 1956 (in Japanese).
10. Lubin A., Williams H. L., Gieseck C. & Rubinstein I.: The relation of brain injury and visual perception to block design rotation. *J. consult. Psychol.*, 1956, 20, 275-280.
11. McMurray J. G.: Visual perception in exogenous and endogenous mentally retarded children. *J. consult. Psychol.*, 1954, 18, 366-370.
12. McMurray J. G.: Rigidity in conceptual thinking in exogenous and endogenous mentally retarded children. *J. consult. Psychol.*, 1954, 18, 366-370.
13. Miyamoto S.: Intellectual development of feeble-mindedness. The 2nd Meeting of J. E. P. A. 1960, (in Japanese).
14. Nakagawa D.: Ueber die teilinhaltliche Beachtung von Form und Farbe. *J. edu. Psychol.*, 1954, 2, 43-50, (in Japanese with German summary).
15. Parker J. W.: Tactual-kinesthetic perception as a technique for diagnosing brain damage. *J. consult. Psychol.*, 1954, 18, 415-420.
16. Rafi A. A.: The discriminative power of the Strauss-Lehtinen battery in adult mental patients. *J. consult. Psychol.*, 1955, 19, 135-138.
17. Ross A. O.: Tactual perception of form by the brain-injured. *J. abnorm. soc. Psychol.*, 1954, 49, 566-572.
18. Werner H. & Strauss A. A.: Causal factors in low performance. *Amer. J. ment. Def.*, 1940, 45, 213-218.
19. Werner H. & Strauss A. A.: Pathology of figure-ground relation in the child. *J. abnorm. soc. Psychol.*, 1941, 36, 236-248.
20. Werner H.: Perceptual behavior of brain-injured, mentally defective children: an experimental study by means of the Rorschach technique. *Genet. psychol. Monogr.*, 1945, 31, 51-110.
21. Weir A. & Werner H.: The figure-ground Syndrome in the brain-injured child. *Int.*

Rec. Med., 1956, 169, 362-367.

22. Yamamoto K. & Matsuyama R.: On the feature of the brain-injured child. Jidō Rikai no Hōhō, ed., Kohei M., 1957, (in Japanese).
23. Yates A. J.: The rotation of drawing by brain-damaged patients. J. abnorm. soc. Psychol., 1956, 53, 178-181.