

The Performance of Mentally Defective Children on the Color Pyramid Test¹

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Personality assessment procedures are typically restricted in their usefulness with a mentally defective population due to the fact that these procedures capitalize heavily on verbal behavior. It is the rare exception (and then generally only for Ss at the borderline level of intelligence) that a self-report technique is responded to in other than a random fashion. When projective techniques such as the Rorschach or TAT are used, meaningful responses may be obtained, but records are generally characterized by poverty of content and by a stereotypy which seems to defy interpretations going beyond broad generalizations which could be provided with greater parsimony by direct behavior observations. Non-verbal methods such as doll-play techniques may be more applicable but raise the question whether the relative complexity of verbal instructions and examiner-client relationship can lead to meaningful results with defective Ss.

It is therefore of interest to consider a technique which is of minimum complexity both in terms of the task involved and in the instructions required. Such material needs to be non-verbal, but in other populations must have been clearly related to personality attributes and behavior variables. These conditions are met by several of the techniques involving color preference or color structuring.² While a

good deal is known about the color preferences and color connotations of normal subjects (Guilford, 1959; Norman and Scott, 1952), little work has been done with mentally defective subjects in this area. Search of the literature yielded only one study (Stacey and Reynolds, 1953) which described the preferences of sub-normal children, but this study does not provide normal controls nor does it employ a method which has been related to other behavior variables.

The present study is concerned with the analysis of the response of a group of mentally defective children to the Color Pyramid Test (CPT), a formalized color arrangement task which seems to fit the above criteria. Since several personality and behavior correlates of this test have been investigated (Heiss and Hiltmann, 1951; Schaie, 1962, 1963), it may be possible to generate hypotheses and predictions about such attributes in mentally defective children on the basis of their CPT performance.

The Color Pyramid Test is described in greater detail elsewhere (Heiss and Hiltmann, 1951; Schaie, 1962b). It will suffice here to indicate that in this test the subject is presented with a selection of 1" squares in 24 different hues (including all the major colors of the spectrum plus black, gray, brown, and white) and is asked to fill the fifteen fields of a pyramid, a reproduction of which is shown in reduced size in Figure 1. The subject is instructed to make the pyramid as "pretty" as possible using any colors he wishes and arranging them at his pleasure. Three repetitions are required; then the instruction is changed to require construction of an "ugly" pyramid, again with three

¹The author is grateful to the Research Council of the University of Nebraska for financial assistance of this research, to John D. Burchard who participated in the data collection, to Stanford Gilbert for assistance with the data analysis, and to M. E. Wyant, Superintendent of Beatrice State Home, for permission to test subjects in his institution.

²The rationale for the use of response to color as a tool for personality assessment is considered elsewhere (Schaie, 1961a; 1961b).

trials. The frequency with which each hue is used is tabulated and the pattern of colors and frequency of use of each color is hypothesized to yield information relevant to the individual's control of affect as well as other personality attributes.

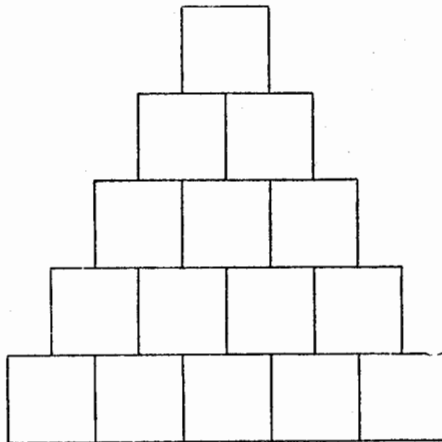


FIGURE 1—Reduced Reproduction of the Pyramid Form.

Since evidence is accumulating that CPT responses are subject to developmental shifts (Heiss and Hiltmann, 1951; Karl, 1956; Schaie, 1961c) it is appropriate to examine the hypothesis that the test will be sensitive to and will detect developmental retardation. Furthermore, if the CPT is to be used for the description of affect and other personality attributes in a retarded population it is necessary to identify those variables in which retardates differ from a normal population on the basis of their retardation, and those variables which may be indicative of emotional disturbance. It is the purpose of this paper to examine these questions by comparing the performance of a group of mental defectives with a sample of normal children.

PROCEDURE

The Color Pyramid Test was administered according to standard instructions to 29 girls and 29 boys at

a State Home for the Mentally Retarded. Ss were selected by inspecting the alphabetical roster of patients and selecting all those whose record showed no apparent organic pathology or severe emotional disturbance and whose mental age (as measured by the Stanford-Binet) was 5 years or greater.³ All Ss were native-born whites. The male Ss had a mean C.A. of 13.8 years with a S.D. of 3.1. Their mean M.A. was 7.3 years with a S.D. of 1.7 and their mean IQ was 51.3 with a S.D. of 6.4. Female Ss had a mean C.A. of 13.8 (S.D. = 2.4); a mean M.A. of 7.1 years (S.D. = 1.3) and a mean IQ of 51.8 (S.D. = 5.4). Three Ss were tested at one time, in such a manner that they could not transmit response cues to one another.

Raw scores for each of the 24 hues were combined for the 10 major colors into which the hues are conventionally grouped and were then converted into Sten scores utilizing norms for normal school children (Schaie, 1961c). These tables, providing separate norms for boys and girls in the Lincoln, Nebraska, public school system, were constructed using random samples of 50 school children for each 2 year age interval from 6 to 18 years of age. The tables were entered once with the S's chronological age (the resulting Sten scores to be referred to as CA scores) and once using the S's mental age (to be referred to as MA scores).

RESULTS

The first question to be investigated was the hypothesis that there might be no differences in CPT performance between normal and retarded children. Means and S.D.s were computed for the CPT-CA scores separately for boys and girls in our retarded sample and the *t* test was utilized to examine the significance of the difference be-

³The lower age limit was imposed, as normal subjects below five years of age frequently tend to see their task as filling the pyramid without attention being paid to either colors or form, the primary stimulus variables.

tween the obtained means and those of the normal sample for each of the 10 colors⁴. Since the data for the normal group are in Sten score form, means and sigmas for the normal Ss on all variables were 5.5 and 2.0 respectively, based on a sample size of 50 subjects. Table I gives the means and standard deviations for each of the CPT-CA scoring variables, as well as the results of the *t* test comparisons with respect to the above hypothesis.

Examination of Table I shows a considerable number of significant discrepancies between the mental defectives and the norm group. On the pretty pyramids, both male and female Ss were significantly high on Purple and significantly low on Blue. The female Ss alone were also significantly high on Orange and the male Ss were high on Brown⁵. On the ugly pyramids, both males and females were significantly high on Yellow, Blue, and White, but significantly low on Black. The males alone were also significantly low on Brown and Gray.

These results, particularly those which hold for both sexes, appear quite consistent with the interpretive rationale suggested by Heiss (1952), as well as some German experimental findings with subnormal children (Heiss and Hiltmann, 1951). Following these authors, the high Brown is considered evidence of developmental disturbance, the high Orange of excessive externalization of affect, the high Purple of emotional disturbance, and

⁴Since multiple comparisons are involved, the analysis of variance was first used to test the hypothesis of overall differences. The overall differences between normals and defectives, simple interaction between groups and colors, triple interaction between groups, instructions and colors, and the fourfold interaction between groups, instructions, sex and colors were all significant at or beyond the 1% level of confidence. The analysis of variance data are not reported in greater detail since primary interest is in the mean comparisons.

⁵The female Ss show a trend for a high score on Brown also. The mean difference here, however, was significant at only the 10% level of confidence.

TABLE I—Means and Standard Deviations for the CPT-CA Scores of the Mentally Defective Ss and Results of the *t* Tests of Differences of the Means with Those of the Norm Group of Normal Ss

Colors	Pretty Pyramids			Ugly Pyramids		
	Males	Females		Males	Females	
	Mean	S.D.	<i>t</i>	Mean	S.D.	<i>t</i>
Red	5.03	1.50	1.18	6.76	2.17	2.57**
Orange	6.00	1.71	1.18	7.17	1.95	3.64**
Yellow	5.07	1.64	1.03	6.66	1.88	2.58**
Green	5.59	1.66	.22	4.90	1.84	1.35
Blue	4.55	1.16	2.68**	6.52	1.88	2.27*
Purple	7.14	1.13	4.66**	4.93	2.09	.90
Brown	7.10	1.54	3.97**	4.48	2.18	2.06*
White	5.58	2.17	.16	6.17	1.44	1.72*
Gray	6.07	1.91	1.26	4.66	1.45	2.15*
Black	5.66	1.34	.42	4.45	1.50	2.64**
				Mean	S.D.	<i>t</i>
				5.00	1.58	1.23
				5.62	1.52	.30
				6.48	1.55	2.28*
				5.00	1.77	1.15
				6.79	1.78	2.97**
				5.55	1.99	.11
				4.86	2.01	1.36
				7.52	1.35	5.34**
				5.62	1.76	.28
				4.35	1.66	2.27**

*Significant at or beyond the 5% level of confidence.

**Significant at or beyond the 1% level of confidence.

the low Blue of failure to develop cognitive means for the control of affect. The responses to the ugly pyramid instruction are said to reflect rejection of affective models. Thus, again using the test authors' rationale, the high Yellow reflects rejection of emotional investment in object relationships, the high Blue rejection of cognitive or rational modes of affect control, the high White the rejection of internalization or withdrawal and the low Black lack of sensitivity to the inappropriateness of depressive modes of affect control.

The question arises, however, whether the above attributes are indeed dominant personality attributes of the mentally retarded population, or whether they appear as an artifact of mental age and thus indicative of developmental retardation at a given chronological age. The latter hypothesis seems a reasonable one when one observes the gradients of CPT performance for normally developing children (Schaie, 1961c). The frequency for Blue for example, shows a positive age gradient, suggesting that the lower mean for the defective group may indicate performance typical of a younger age level. Similarly, Purple shows a negative age gradient for both sexes, while the gradients for the other variables showing significant age differences are somewhat more complex.

The above considerations suggest that a formal distinction needs to be made between those CPT variables on which the defectives differ from the normals due to intellectual retardation; and the variables which reflect personality differences not directly related to such retardation. To permit such an analysis, all raw scores were re-entered in the tables of norms using the S's mental age as the reference age. The resulting CPT-MA score means were then compared with the CPT-CA score means.

If differences in CPT performance by the defective group are indeed due to intellectual retardation, then the

CPT-MA scores should be closer to the population mean than the CPT-CA scores. A one-tailed *t* test is therefore appropriate, with the null-hypothesis depending upon whether the CPT-CA mean is above or below the population mean. Thus, if $m_{CA} > 5.5$, then $H_0: m_{CA} \geq m_{MA}$ with $H_1: m_{CA} < m_{MA}$; and if $m_{CA} < 5.5$, then $H_0: m_{CA} < m_{MA}$ with $H_1: m_{CA} > m_{MA}$. Results of the *t* tests are given in Table II and it appears that more than half of the variables are affected by the re-scoring procedure. On the Pretty Pyramids, means for both male and female Ss shift significantly in the predicted direction for Orange, Blue, Purple, and Gray. In addition significant shifts occur for male Ss alone on Blue, and for female Ss alone on Red, Green, and Black. On the Ugly Pyramids, significant shifts in the predicted direction occur for both male and female Ss on Red, Green, White, and Gray; for male Ss alone on Blue, Purple, and Brown; and for female Ss alone on Yellow. It may thus be concluded that performance on these CPT variables is at least in part affected by the Ss' level of intellectual development.

The results of the mental age correction will, of course, seriously affect possible interpretations of personality attribute differences made on the basis of the original scores. For those variables where significant shifts occurred, it is therefore necessary to examine the CPT-MA score means to see whether the correction has eliminated the previously noted significant differences from the normal comparison population, or whether in spite of such significant shift in the direction of the population mean, a significant difference remains. It was therefore necessary to repeat the analysis summarized in Table I, but using the CPT-MA instead of the CPT-CA scores for the comparisons with the norm group. Means, Standard Deviations, and results of the appropriate *t* tests for this further analysis are listed in Table III.

It now appears that originally reported differences for the male Ss on

TABLE II—Mean Differences Between the CPT-CA and CPT-MA Scores and Results of the *t* Tests of the Significance of the Mean Differences

Colors	Pretty Pyramids		Ugly Pyramids	
	Males	Females	Males	Females
	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.
Red	.24	.66	.48	1.31
Orange	1.00	.97	.34	-1.14
Yellow	-.21	-.83	.21	.31
Green	-.07	.69	.45	.52
Blue	.41	.76	.31	.03
Purple	.55	1.62	.45	-.76
Brown	1.55	.14	.24	-.34
White	-.24	.17	.34	1.10
Gray	1.10	.41	.41	.83
Black	.10	.69	.00	-.90

Colors	Pretty Pyramids		Ugly Pyramids	
	Males	Females	Males	Females
	t	t	t	t
Red	.98	3.00**	2.32*	9.92**
Orange	5.21**	4.95**	-3.35	-5.04
Yellow	-.86	-5.71	1.14	1.79*
Green	-.57	3.03**	3.09**	4.83**
Blue	2.11*	3.09**	2.35*	.22
Purple	3.43**	7.24**	4.23**	-7.09
Brown	6.31**	.89	2.04*	-2.57
White	-2.04	.96	3.03**	8.82**
Gray	6.59**	.41	3.04**	4.90**
Black	.59	3.47**	.00	-4.77

*Negative signs indicate shifts of means in the opposite of the expected direction.

**Significant at or beyond the 5% level of confidence.

***Significant at or beyond the 1% level of confidence.

TABLE III—Means and Standard Deviations for the CPT-MA Scores of the Mentally Defective Ss and Results of the *t* Tests of Differences of the Means with Those of the Norm Group of Normal Ss

Colors	Pretty Pyramids		Ugly Pyramids	
	Males	Females	Males	Females
	Mean	Mean	Mean	Mean
Red	5.28	5.48	6.31	6.31
Orange	5.00	5.66	6.76	6.76
Yellow	4.86	4.14	6.17	6.17
Green	5.66	5.72	5.52	5.52
Blue	4.97	5.59	6.83	6.83
Purple	6.59	5.38	6.31	6.31
Brown	5.55	5.93	4.52	4.52
White	5.83	5.52	6.41	6.41
Gray	4.97	5.31	4.79	4.79
Black	5.55	5.86	3.66	3.66

Colors	Pretty Pyramids		Ugly Pyramids	
	Males	Females	Males	Females
	S.D.	S.D.	S.D.	S.D.
Red	2.23	2.28	1.93	1.42
Orange	2.30	2.24	1.88	1.86
Yellow	2.28	1.93	1.57	1.36
Green	2.00	2.59	1.56	1.70
Blue	1.99	2.41	1.71*	1.67
Purple	1.86	2.35	1.86	1.71
Brown	2.35	1.60	1.89	1.88
White	1.65	1.96	1.42	1.35
Gray	2.25	1.63	1.28	1.74
Black	2.01	1.81	1.57	1.72

Colors	Pretty Pyramids		Ugly Pyramids	
	Males	Females	Males	Females
	t	t	t	t
Red	.44	.04	1.71*	2.10*
Orange	.98	.32	4.49**	2.60**
Yellow	1.26	2.98**	2.34*	1.76*
Green	.34	.39	.40	.05
Blue	1.14	.17	1.71*	3.17**
Purple	2.44*	.23	.27	1.90*
Brown	.10	1.05	1.73*	2.18*
White	.79	.04	.85	2.41*
Gray	1.05	.46	1.17	1.66
Black	.11	.82	2.59**	4.82**

*Significant at or beyond the 5% level of confidence.

**Significant at or beyond the 1% level of confidence.

the Pretty Pyramids for Blue and Brown are related to the Ss' intellectual retardation. This holds true for Purple also, but since a significant difference from the norm group remains after the MA correction, it must be assumed that the original interpretation of emotional disturbance is supported. The differences reported for the female Ss on the Pretty Pyramids for Orange, Blue, and Purple may also be accounted for by the Ss intellectual retardation.

For the Ugly Pyramids, rather different results obtain. The differences from the norm group for male Ss on White and Gray disappear after the MA correction and may thus be accounted for by intellectual retardation alone. All other significant differences remain and thus reflect other personality differences. Intellectual retardation, however, is involved to some degree in the differences for Red, Blue, and Brown for the male Ss and in the differences for Yellow and White for the female Ss, as evidenced by the fact that the MA correction significantly reduces the magnitude of differences without reducing them to insignificance.

It should be noted that the hypotheses used for the *t* tests assessing the effect of the MA correction do not protect against the alternative that the re-scoring procedure might result in some CPT-MA score means deviating further from the norm-group means than was true for the CPT-CA scores. This alternative in fact does occur for all those variables for which differences have negative signs in Table II. The logical explanation for these shifts is that the performance of mental defectives on such variables appears closer to the norm than is actually the case, with intellectual defect serving as a suppressor variable. Since the appropriate *t* tests for this alternative use hypotheses which are the converse of the ones stated above, the values of *t* with negative signs in Table II may simply be evaluated with respect to their significance for the alternate case.

Inspection of Table III shows that suppressor effect results in significant differences from the norm group for the female Ss alone and is restricted to Yellow on the Pretty Pyramids and Red, Orange, Purple, and Brown on the Ugly Pyramids. Intellectual defect as a suppressor variable also increases the magnitude of significant differences with the norm group after MA correction for male Ss for Ugly Orange and for the female Ss for Ugly Black.

DISCUSSION

The above results clearly show that mentally defective children deviate from the CPT norms both on scoring variables related to their intellectual defect as well as on others which may be related to personality deviations concomitant with but not related to such deficit. It now remains to determine whether data on the discrepancies due to mental defect can be used to aid classification.

Test records were pulled at random from our files of normal children matched by age to the defective Ss to assess the effectiveness of classification criteria derived from the results of the present study. It may be seen from a comparison of Tables I and III that, for both boys and girls, at least two scoring variables may be related to intellectual deficit, with mean scores showing differences from the norm group significant at the 1% level of confidence. As classification criteria it is now specified that a given S, to be classified as mentally defective, should score above the normal mean on the variable on which the defective group was high and should score below the mean on the variable on which the defectives were low. The appropriate criterion variables turn out to be low blue and high brown for boys, and high orange and purple for girls. Table IV shows the results of classifying the defectives and matched normals and indicates that this procedure has been able to classify correctly about 78% of the 116 records involved. Cross-validation with independent

samples is required, of course, before this procedure can be recommended as an useful adjunct to the diagnosis of mental deficiency.

TABLE IV — Classification of Mental Defective/Normal by Means of CPT Scoring Variables

Males			
Criteria: Blue, Sten 5 and below; Brown, Sten 6 and above			
Observed Classification	Predicted Classification		r_{ct} .80
	Normal	Defective	
Normal	24	5	
Defective	7	22	

Females			
Criteria: Orange, Sten 6 and above; Purple, Sten 6 and above			
Observed Classification	Predicted Classification		r_{ct} .76
	Normal	Defective	
Normal	25	4	
Defective	10	19	

What about the meaning of the discrepancies between defectives and normals on those variables which could not be related to defects of intelligence? It has already been indicated that the component of the difference between defectives and normals for Pretty Purple which could not be accounted for by the MA correction may be taken as an indication of emotional disturbance. This makes good sense since evidence abounds that, at least among the mildly defective, emotional problems are frequently concomitant with the intellectual deficit. The discrepancies between defectives and normals on the Ugly Pyramids will generate further hypotheses about the more typical deviant adjustment patterns likely to be prevalent in the defective group. In contrast to the Pretty Pyramids, high scores here are said to reflect modes of affect expression which are either consciously rejected or are latent; or alternate modes which fail to find current expression because of their low order in the S's response hierarchy (Heiss, Honsberg and Karl, 1955).

Proceeding from the interpretive ra-

tionale suggested by Heiss (1952), the high Ugly Red may reflect denial of explosive uncontrolled aggressiveness which may be latent in the defective boys but is not permitted open expression due to the institutional control. The high Ugly Orange similarly may reflect denial of needs for externalization of affect as related to interpersonal function and the Ugly Yellow to denial of needs for emotional investment in object relationships. In the defective girls, the last relationship also applies, but they do not show discrepancies from the normals on Ugly Red or Orange. This suggests either that their needs for aggression and externalization may be lower than for the boys, or may find some other more acceptable outlet. The high Ugly Blue for both boys and girls can probably be attributed to rejection of rationalization as a mode of affect control. The high Ugly White for the girls may suggest schizoid withdrawal tendencies as a denied alternate mode of affect control. This may be the corollary of denied aggressivity as expressed by the high Ugly Red in the boys.

Low scores on the Ugly Pyramids may either be an affirmation of the stability of preferred response modes expressed by corresponding high scores on the Pretty Pyramids, or they may suggest consciously preferred alternate response modes. Thus, the low Ugly Brown in the boys may reflect tendencies towards stubbornness and general resistance to being dominated by others. The low Ugly Black for both boys and girls suggest that depressive mood controls in terms of flattening of affect may be an alternate mechanism. It should be kept in mind that these statements are merely intuitive interpretations of the data and will need to be validated by further studies.

Some comment is in order also as to the color preference behavior of the defective Ss since the comparisons with the norm group used Sten scores and thus gave information about deviation from the norms but not on absolute color preference. Such order of prefer-

ence may, however, be obtained from the Ss' performance on the Pretty Pyramids. It was found that the first ranked colors were Red, Green, and Blue for the boys and Red, Blue, and Green for the girls. The rank order is the same as that for normal girls, but the order of Blue and Green is reversed for the boys (Schaie, 1961c). These results are consistent with most studies of color preference in normal children, which typically show some permutation of Blue, Red, and Green to be the first three preferences (Garth, 1924; Winch, 1909). It appears then that differences between normals and defectives are reflected first of all in the choice of most and least preferred colors as well as the intensity of choice for a specific color. Thus, if response to color is to be used diagnostically, a more complex analysis such as the one possible with the CPT is required.

SUMMARY

The Color Pyramid Test (CPT) was administered to a group of 29 girls and 29 boys who were patients in a State Home for the Mentally Defective. Their scores were compared with those of a norm group of children in the Public School system. When norm tables are entered at the Ss' chronological age significant differences emerge for most of the color choice scores. It was hypothesized that some of these differences could be the effect of intellectual deficit alone. Scores were therefore re-entered into the norm tables at the Ss' Mental Age as estimated by the 1937 Stanford-Binet test. Several of the discrepancies between the normals and defectives disappear as the result of this correction, but others remain. It is suggested that those variables on which differences disappeared due to the MA correction may be useful as classification criteria and validity data are presented showing that approximately 78% of the Ss could be correct-

ly classified from their CPT records as to their respective membership in the groups of defective and normal Ss. A tentative interpretation of the personality attributes of the defective group as inferred from the differences in CPT means not accounted for by intellectual defect is also offered.

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Received March 5, 1962