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THE COLOR PYRAMID TEST:

A NONVERBAL TECHNIQUE FOR PERSONALITY ASSESSMENT [1]

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A description of the Color Pyramid Test (Farbpyramidentest) and its interpretive rationale which has received much attention in the German psychological literature but is almost unknown in this country. Review of the research literature suggests that: the CPT is about as reliable as most of the personality inventories in current use; it is easy to administer and is applicable over a wide range of ages, educational and cultural backgrounds; it is useful for the gross differentiation of groups with deviant personality characteristics and for obtaining information on the control of affect and other behavior traits in individual Ss. Although some of the reported studies lack adequate experimental controls and statistical treatment the CPT promises to be a useful tool for research and clinical personality assessment.

One of the major technical problems limiting the range of applicability of most of our major diagnostic instruments for personality study is their requirement that the subject must react to a standard set of stimuli by means of a verbal response. This requirement restricts the range of responses available from persons with limited vocabularies (e.g., children, bilingual subjects, etc.) and impairs the usefulness of many techniques with subjects who are unable or unwilling to communicate by verbal means. Another limitation of personality tests requiring verbal response is the difficulty of constructing such tests so as to be truly objective in the sense that they do not involve self-appraisal (Cattell, 1959). Even in the projective techniques the subject generally has the benefit of clues inherent in the stimulus structure and may organize his verbal response to conceal some of the very personality attributes which are to be assessed.

Our criteria for an objective nonverbal personality assessment technique therefore require a procedure which does not involve introspective self-evaluation, where the subject does not know (and where the stimulus structure provides no clues) what aspects of his performance will be interpreted, and where no verbal response is required. Recent discussions on the unimportance of test item content (Berg, 1955, 1959) suggest that many more operations than have hitherto been utilized might be found to meet these requirements. In fact any set of stimuli which can elicit a wide variety of responses will be a suitable vehicle provided that (*a*) the subject cannot infer the relation between his response to the stimulus and the attribute to be predicted therefrom; (*b*) the subject's response to the stimulus does not occur randomly, but in a consistent manner showing stable associations to the behavior to be predicted; and (*c*) that the range of individual differences be sufficiently large above and beyond such consistent associations to permit clinical application.

One of the most promising stimulus variables likely to meet the above criteria is the use of response to color or color preference. The literature on color preference and its cultural and biologi-

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cal concomitants has been reviewed by Pressey (1921) and by Norman and Scott (1952). Most of the older studies utilize terms which lack operational meaning, are largely anecdotal, and are not designed with the express purpose of relating response to color to personality evaluation. Some of the more recent studies concerned with the semantic connotation of color and the attribution of affective states to different hues, however, suggest consistent and stable associations (Schaie, 1961b; Tannenbaum & Osgood, 1957; Wexner, 1954). There is evidence also that individual differences beyond group consistencies are sufficiently large to indicate potential clinical utility (Schaie, 1961a).

Most of the studies in the English language literature on response to color are concerned with semantic connotations and group differences in a specific preference, but with the exception of investigations of the response to color on the Rorschach (Siipola, Kuhne, & Taylor, 1950) and a monograph on the color preference of psychiatric groups (Warner, 1949), no attempt is found involving the systematic exploration of response to color as a personality assessment technique. The German literature on the other hand contains at least two systematic procedures for utilization of response to color as a clinical tool (Luescher, 1950; Pfister, 1950). One of these techniques, the Color Pyramid Test (*Farbpyramidentest*) (CPT), although originally proposed primarily as a new projective method for the study of affect, also appears to meet the criteria specified above for an objective nonverbal personality assessment tool.

The CPT was originally devised by the Swiss psychologist Max Pfister (1950). Most of the systematic development work, however, was conducted at the Psychological Institute of the University of Freiburg by Robert Heiss, Hildegard Hiltmann, and their students. Much of the work on this technique is therefore found in doctoral dissertations at Freiburg. A respectable volume of published research has also been accumulated on the technique during the decade since its introduction but almost none of this material has been published in English. It is the purpose of the present paper to bring this promising technique to the attention of American psychologists and to review the relevant research literature.

Description of the Technique

The material used for the test consists of a piece of white paper on which a pyramid has been drawn which leads in five steps from the base to the apex (see Figure 1). The pyramid contains 15 fields, each of which is 1 inch square. In addition to this form there are many pieces of colored paper in 24 different hues, also 1 inch square. A record form contains six small replicas of the pyramid and various tabulations which facilitate recording and scoring.[2]

[2] The test materials (including the colored gummed paper, test manual, and record forms in German) are available from the publishers, Hans Huber, Bern, Switzerland. A total of

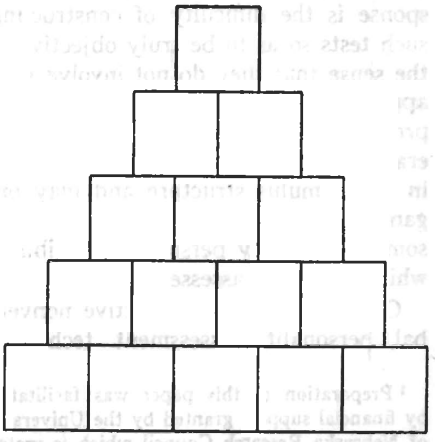

Fig. 1. Design for Color Pyramid Test.

The instructions for administering the test are simple and require a minimum of training beyond the usual considerations of good testing practices. The examiner places the pyramid form and the shuffled colored papers before the subject. He then gives the following instructions:

> Take some of these colored chips and place them on the fields of the pyramid in any way you prefer. You may exchange the chips on the pyramid in any way you please. Be sure to make as pretty a pyramid as you can. Tell me when you are finished, but take your time, as it is not important to finish quickly.

When the subject indicates that he has finished, the color of each chip on the pyramid is recorded on the corresponding fields of the pyramid on the examiner's record form. The chips are then returned to the container, shuffled, and the subject is instructed to arrange another pyramid. The instructions are:

> Now make another pyramid. Make it as pretty as you can.

After the second pyramid has been completed, the colors are again recorded by the examiner and the subject is asked to arrange a third pyramid. After the third pyramid has been completed and recorded the examiner instructs the subject:

> Now make a pyramid which is as ugly as you can make it.

After the first ugly pyramid is completed the colors are again noted and the subject is asked to arrange a second and finally a third "ugly" pyramid. A total of six pyramids are thus required from each subject.

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21 chromatic and 3 achromatic hues are used and the chromatic hues are classified further by major color. Thus there are four reds, greens, and blues; three purples; and two oranges, yellows, and browns. Throughout this paper we shall use "hues" to refer to the 24 distinct stimulus shades and "colors" to refer to the 10 color groups used as major scoring categories.

In order to permit the subject to choose any combination of colors, it is necessary to have as many colored chips available as there are fields in the pyramid. This means that there must be 15 pieces of each hue. Precautions need be taken to avoid examining color-blind subjects. It is desirable therefore to use a device such as the Ishihara plates to pretest all subjects. Since the results of the CPT with the color-blind would require alternate norms (which might have to differ with respect to the various types and degrees of color defect) their study by means of this test is probably best avoided.

Scoring Procedure

The first step in scoring the CPT consists of counting the frequency of occurrence of each hue in each of the pyramids and recording these frequencies in the appropriate column of the record sheet. Frequency of occurrence is then totaled separately for the three pretty and three ugly pyramids for each hue and for each color. As a result of these operations one obtains the rank order of frequency (called "color formula" in the German literature) with which the various colors were chosen. It has also been customary to transform the raw frequencies into percentages prior to further analysis. This latter step may seem unnecessary, however, and American psychologists will probably prefer using the raw scores directly to compare them with normative data expressed in some standard score form (see Schaie, 1962a; Michel, 1959).

The next scoring step is the determination of the "sequence formula" which has four digits. The sequence formula is obtained by examining the occurrence of the different colors over the three pyramids in each series. The four digits of the formula represent the "constant sum" (CS) which is the num-

ber of colors which appear in all three pyramids, the "sum of minimal change" (MiS) is the number of colors appearing in two of the three pyramids, the "sum of maximal change" (MaS) is the number of colors appearing in only one of the three pyramids, and the "avoidance sum" (AS) identifies the number of colors constantly avoided. As there is a total of 10 colors, the sequence formula 5:2:1:2, for example, would mean that 5 colors had appeared in all three pyramids, 2 colors in two out of three, 1 color only once, and that 2 colors had been avoided.

A number of other complex characteristics are usually computed. They are the so-called "color syndromes" and involve the computation of the total frequencies or proportions of incidence for certain color combinations. The most frequently mentioned ones are: The "stimulation syndrome" (Ssyn) which includes yellow, orange, and red; the "normal syndrome" (Nsyn) including red, blue, and green; the "achromatic syndrome" (Asyn) including black, white, and gray; and the "drive syndrome" (Dsyn) including green, yellow, and brown. The proportion of responses utilizing "warm" and "cold" colors are also frequently computed. Of the 21 chromatic hues, all yellows, oranges, and reds, as well as $brown_1$, $green_1$, and $green_2$ are considered warm hues. All purples, blues, $brown_2$, $green_3$, and $green_4$ are considered cold hues.

While the scoring procedures so far described are clearly unambiguous and straightforward, the final step concerned with the identification of the structural properties of the subject's response in laying the pyramid, involves somewhat subjective judgment. Scoring rules have been specified, however, which should lead to high interscorer agreement. The major distinctions made about the pyramidal structure are based on the assumption that the subject may either attend to the form qualities of the pyramid or that he may ignore such qualities and simply regard the pyramid as a flat surface. A distinction is further made between orderly and irregular structuring with the implicit assumption that any orderly structure takes cognizance of the pyramidal form. Irregular structures are those where a harmonious blending of colors is interrupted by unsuccessful attempts at structuring.

In terms of the use of color, three major structural categories may be described. The subject whose response is color dominated will lay a carpetlike design of characteristic color scatter. Where a need for organization prevails but color dominated responses still predominate more or less well-ordered "layer" designs involving color separation will appear. Finally where need for organization of the subject's experience predominates the so-called "structures" involving color organization will appear. Twelve distinct types of pyramid structure have been described (Heiss & Hiltmann, 1951) and may be recognized by the following characteristics:

Patterns Indicating Color Dominated Response. No attention is paid to the pyramidal aspects of the design nor to the center, base, and top of the pyramid. Colors are scattered so as to achieve a harmonious result. This type is called a "carpet" (*Teppich*) and several subtypes are recognized.

1. The pure carpet (*Der reine Teppich*). There is complete scatter of colors and no two patches of the same hue are used adjacently. The hues blend into a scatter which does not show marked brightness contrasts.

2. The unbalanced carpet (*Der unausgewogene Teppich*). This pattern contains adjacent pieces of the same or

similar hue or shows adjacent pieces with marked brightness contrast. An example of contrast would be the lightest shade of red next to the darkest shade of green. The unbalanced carpet suggests a lessened attention to color without substitution of constructive structuring.

3. The torn carpet (*Der zerrissene Teppich*). Use of white pieces which are not blended into a design gives certain patterns the appearance of being torn or destroyed. One or more white pieces which are not part of a design in an otherwise typical carpet pattern qualifies for assignment to this category.

4. The structured carpet (*Der Teppich mit Ordnungsansatz*). Some attempt towards structure is made by using the same color for the corners or the pyramidal axis (top, center, and base point). Any other partial attempts at symmetry or a single layer of the pyramid arranged in similar hues should also be placed in this category.

Patterns Indicating Responses Involving Color Separation. The construction of the pyramid in this type of design pays attention to the layers or rows of the pyramid. There is generally a separation from one layer to another. The following subtypes are recognized:

5. The monochromatic layer (*Die einfarbige Schichtung*). This is the special case where the whole pyramid is either laid in the same hue, or more frequently where the layers are obtained by using the different hues of a given color.

6. The multichromatic layer (*Die farbige Schichtung*). Every row of the pyramid is laid in a single color. Ordinarily adjacent rows will be in different colors, but patterns with adjacent rows in the same color would also be classified here as long as at least two different colors are used in the pyramid.

7. The symmetrical layer (*Die symmetrische Schichtung*). This pattern has a symmetric arrangement within one or more of the layers. The design within each layer is independent of and not integrated with the symmetric design in any other layer of the pyramid. The symmetry may be a function of different hues of the same color or of different colors. It might also be a function of brightness; e.g., black - light blue - dark purple - light purple - dark green.

8. The structured layer (*Die Schichtung mit Strukturtendenz*). This is a transitional pattern and may be recognized by the identification of a structured design within a pyramid which retains the general characteristics (i.e., color separation) of the layer type.

Patterns Which Are Structure Dominated. These patterns are characterized by an arrangement of the colored pieces in a specific design within the pyramid. There is evidence that the subject has recognized the pyramidal form and is aware that some rule or orderly principle is appropriate for his task. Such principles are no longer restricted to a separation of colors as in the layer patterns but are now directed towards designing an integrated whole. The following subtypes are recognized:

9. The symmetrical structure (*Die symmetrische Struktur*). This type involves a systematic organization of colors about the axis of the pyramid in contrast to the structured layer, it involves the entire pyramid without color separation among the rows.

10. The mantle pyramid (*Die Mantel-Pyramide*). In this pattern the two sides and sometimes also the bottom row of the pyramid are in the same color or a single but different color is used for each of the sides. The core of the pyramid may be a single color or any color combination.

11. The asymmetric-dynamic struc-

ture (*Die asymmetrisch-dynamische Struktur*). This category includes pyramids containing monochromatic triangles or two triangular combinations which have identical multichromatic components even though they are not in symmetric position. This category must not be confused with the structured carpet or structured layer type.

12. The staircase structure (*Die Treppen-Struktur*). Layers are arranged in ascending order beginning from the left or right corner of the pyramid to form a staircase. Most frequently only two colors are used. Use of more colors is rare and would represent a rotated multichromatic layer.

Brehmer (1960) derived an index of form dominance by combining all types of carpets, layers, and structures, and assigning scores for any individual record on a seven-point scale as follows:

1—three carpets
2—two carpets and one layer or structure
3—one carpet and two structures
4—three structures or one carpet, one structure and one layer
5—two structures and one layer
6—two layers and one carpet or one structure
7—three layers

Brehmer assumes in this scale that layers are more form dominant than structures, an assumption that would probably be questioned by other investigators.

Normative Data

The original test manual (Heiss & Hiltmann, 1951) presents data on 300 normal subjects covering a wide age range. Means for the pretty pyramids are reported in percentage values for the colors with no measures of score dispersion. Normative data on the color syndromes and the sequence formula are scattered throughout the manual but are difficult to use.

A much more satisfactory collection of norm tables is provided by Becker and Karl (1955). Their tables include norms for a sample of 300 adults stratified by sex, age, occupation, and education according to the 1950 census for the Federal Republic of Germany and West Berlin. These tables give mean percentages and their standard deviations for the colors in both the pretty and ugly pyramids. Similar norms are provided for 150 boys and 150 girls in high school, with the additional indication of the range ± 1 P.E. Norm tables for the pretty pyramids alone, giving mean percentages, standard deviations, and ranges of ± 1 P.E. are provided for 60 preschool children (aged 2-8–4-2); 68 6-year-old, 61 10-year-old, 56 12-year-old, and 55 13-year-old primary school students. Data for another sample of 120 boys and 113 girls (aged 10–14 years) in another grade school is also given.

Schaie (1962a) provides norms for children and adolescents based on a sample of 650 American public school children from kindergarten to Grade 12. He provides sten (10-point scale with ½ sigma intervals) tables separately for boys and girls for samples from two adjacent grades, each table based on an *N* of 50 subjects. Data for both major colors and hues are given for the pretty and ugly pyramids.

Michel (1959) gives similar tables for a modified 14-hue CPT set based on a *T* transformation of the raw data for a sample of 180 German adults selected according to census classifications with respect to age, sex, occupation, and education.

Interpretation of CPT Scores

Color Frequencies

Pfister (1950) had originally proposed an intuitive rationale based on folklore and clinical experience to interpret the meaning of high or low preferences for specific colors. To provide a more rational basis for interpretation,

Heiss and Hiltmann (1951) examined the color frequency patterns of normal and abnormal groups of subjects. They assume that preference or rejection of those colors which are preferred or rejected by specific diagnostic groups are related to the salient personality characteristics displayed by members of such deviant groups. They assume further that one may legitimately assign similar characteristics to individuals showing similar CPT color choice patterns. Since many diagnostic groups show overlapping CPT patterns their work consists essentially of identifying a consistent system of apparent relationship. This is again a rather intuitive patchwork, but at least conducted with the benefit of some empirical data.

Heiss (1952) comes closest to giving a concise set of interpretive statements on the meaning of high or low color choices. He describes high red as being characteristic of impulsive affect while low red is considered to be concomitant with reduced responsivity and affect. Orange is considered to be an extraversion-introversion indicator, with high orange related to the ability to establish good interpersonal relations. A similar interpretation is given to yellow, except that this color relates to the ability to establish objective and rationally controlled rather than emotionally determined interpersonal relations. Green is linked to sensitivity and internalization of affect. A high green may be characteristic of imaginative individuals who are well able to internalize and sublimate, or it may reveal an individual who is being overwhelmed by his emotional experience and as a result shows symptoms of psychological disturbance. A low green in contrast is considered characteristic of low sensitivity and blandness. Blue is representative of cognitive impulse regulation, with high blue characteristic of individuals using rational modes of response and low blue being associated with aimless and poorly regulated behavior. High purple is considered to be evidence of anxiety and emotional disturbance. Brown is related to need determined negativism. High white is characteristic of schizophrenic blandness and reduction of inhibitions and high black is considered to be evidence of depressive repression.

Seeger (1954) suggests that an interpretive system derived from the behavior of abnormal groups cannot be very satisfactory in normal personality functioning. This criticism has been met in part by Spreen (1955) who tried to determine the meaning of the achromatic colors for a sample of 100 normal adults by comparing their CPT patterns with those of abnormal groups. He agrees generally with Heiss' descriptions but much of his discussion appears to be purely speculative.

Schaie (1962c) in an attempt to validate Heiss' descriptions examined the patterns of teacher trait ratings assigned to subjects with low and high values for the various colors. He finds that although several of Heiss' propositions appear valid, it is necessary to devise separate interpretive systems for male and female subjects and that important variations from Heiss' suggested inferences appear at least for normal children and adolescents.

Color Syndromes

Hiltmann and Heiss (1950) suggest further inferences to be drawn from the color combinations which they denote as color syndromes (see section on scoring above). They suggest that Nsyn which includes the colors most frequently used by normal subjects gives an indication of general psychic balance. A high Nsyn would go with overcontrolled or constricted personalities while

a low Nsyn would suggest loosening of controls and fluidity of defenses. The Ssyn is supposed to give an indication of the individual's mood state, with a high Ssyn being indicative of elation. The Dsyn is said to be positively related to the individual's energy level (see Karl, 1953) and Asyn is considered evidence of denial and withdrawal tendencies.

Sequence Formula

This set of scores is considered to reveal some of the most stable information on the individual's personality structure. Heiss and Hiltmann (1951) suggest that the total number of different colors used gives an indication of the breadth or narrowness of the individual's response repertory, the middle digits of the formula (MiS and MaS) give an indication of the continuity or discontinuity of the individual's capacity to respond to different types of stimuli, and the last digit of the formula (AS) gives the individual's tendency towards response avoidance. They further present a scheme which permits making statements from the sequence formula about constriction and lability, flexibility and anxiety, as well as the stability of the individual's personality pattern. An analysis of the various types of sequence formulas has been made by Wewetzer (1954) and a further contribution by Hiltmann (1954) attempts to integrate interpretive statements made on the basis of both color choices and the sequence formula.

Pyramid Structure

Wewetzer (1951b) proposes that the patterning of the pyramids will yield information on structural aspects of personality. He suggests that carpet types, indicating color dominance, may be characteristic of a labile personality structure as seen in young children but when a successful blending of colors is achieved may also suggest creative flexibility. He distinguishes special subtypes of which the unbalanced carpet with darkness-lightness contrast is deemed characteristic of the prepubertal personality, the torn carpet with its white patches of personality disturbance of a schizophrenic type, and the structured carpet is a transitional pattern, frequently seen in adolescents, indicating increasing stabilization of personality structure.

Another set of patterns involves color separation. The most striking type is that of the monochromatic pyramid, rarely seen in normals and is deemed characteristic of developmental retardation or pathological constriction. The multichromatic layer shown by many children and adolescents is characteristic of an incompletely differentiated personality structure, the symmetric layer still suggests some lability which is being hemmed in by caution and timidity, and the structured layer is another transitional type towards increasing differentiation of personality structure.

Among the structure-dominated patterns, Wewetzer distinguishes the symmetric structure which is characteristic of a stable well-differentiated personality, the mantle pyramid which is deemed characteristic of neurotic repression and denial, the asymmetric-dynamic structure which suggests a well-differentiated and flexible but also relatively vulnerable personality, and the staircase structure related to a well-differentiated but conflict dominated pattern.

Ugly Pyramids

Heiss, Honsberg, and Karl (1955) extend the CPT by adding to the conventional instruction that the subject is to form three "pretty" pyramids, a demand for a further three pyramids with

the instruction to make them as "ugly" as possible. Several hypotheses for an interpretation of the results of the second series are given in their paper. They suggest that the unconscious aspects of personality may be more adequately portrayed under the ugly condition. Another hypothesis suggests that the pretty pyramids reveal the "actual" aspects of personality while the ugly pyramids yield insights about the "latent" facets or potentialities. Similarly, Karl (1956) argues that the pretty pyramids indicate behavioral modes which the subject in fact utilizes, while the ugly pyramids refer to those behaviors which may be available but are low in the response hierarchy. These authors suggest further that test results for both series must be interpreted in conjunction with one another. Those variables receiving similar scores under both conditions may refer to the stable aspects of personality, while discrepancies may point to areas of conflict. Karl specifically proposes that one ought to use the average values for both series in making inferences about the test results.

Reliability of the CPT

Most of the reported reliability studies use test-retest methods although the structure of the test lends itself readily to internal consistency analyses. The resulting reliability coefficients seem no better or worse than those given for most other instruments in the area of personality measurement with average values at about the .60 level. As will become apparent by examining some of the pertinent studies, reliabilities vary considerably for the several scoring variables as well as depending upon the particular conditions of experimental situations.

Test-Retest Reliability. Jolas (1953) administered the CPT to 50 adults retesting after an interval of 4 weeks. Reliability coefficients are reported for the pretty pyramids ranging from .47 to .81 with a mean coefficient of .61. Reliabilities for the individual hues ranged from .33 to .72 with a mean of .56. Coefficients for the sequence formula ranged from .57 to .83.

Pflanz (1954) readministered the CPT under nonstandard conditions to 50 hospital patients who were placebo subjects in a drug experiment. He reports reliabilities for the various hues ranging from .14 to .61. Reliabilities for CS and AS of the sequence formula are reported as .52 and .46, respectively.

Brehmer (1960) gave the CPT to 45 male and 63 female Swedish extension students with retesting after 5 weeks. She obtained average reliability coefficients for the 10 colors of .41 for her male and .55 for her female subjects. Reliabilities reported for the CS and AS of the sequence formula are .58 and .47 for male and .52 and .58 for female subjects. Reliabilities are also reported for the identification of the structural properties of the pyramids, as well as for Brehmer's index of form dominance, which have a magnitude of .62 and .66 for male subjects and .77 and .52 for female subjects.

Internal Consistency. Since each experimental series contains three trials (pyramids) it is possible to use the analysis of variance to get an estimate of internal consistency. One may partial out the components of variance associated with the scoring categories (colors and instructions) and individual differences and thus estimate the proportion of "reliable" variation. Schaie (1962a) administered the CPT to a group of 43 delinquent girls in a state training school. He used the analysis of variance to estimate internal consistency in the above manner and obtained an overall coefficient of .74.

Reliability of CPT Modifications. Some investigators have attempted to increase the reliability of the CPT by suggesting modifications of administration and scoring procedures. In particular, the effect of the reduction of the number of hues offered the subject has been investigated in several studies. Michel (1959) constructed a 14-hue set by removing two of the reds, blues, and greens and one of the purples and browns. He reports reliabilities on a group of 45 normal adults with retesting after 5 weeks. His values range from .54 to .83 for the pretty pyramids, from .60 to .79 for the ugly pyramids, and from .58 to .76 for the values of the sequence formula.

Reinert (1958) retested 100 normal adults after an interval of 4 weeks with a 10-hue set retaining only 1 hue for each color. His reliabilities range from .63 to .78 for the pretty pyramids and .62 to .76 for ugly pyramids. The coefficients for the sequence formula ranged from .61 to .69.

Apparently reliability can be increased by reduction of the stimulus complexity. Whether such reduction is accompanied by information loss is as yet to be ascertained. It seems clear, however, that other modifications of the CPT might well merit study (see Luthe & Salman, 1953).

Validity of the CPT

Most of the validity studies to be reported are concerned with the power of the CPT in distinguishing pathological from normal groups of subjects and as a device for differential diagnosis among different pathological categories. A limited number of studies is also concerned with validating the CPT as a device for the description of personality dynamics or relating particular scoring variables to other observable behavior characteristics. Part of this literature is reminiscent of the discussions on the possibility of validating projective techniques (Ebermann, 1955; Seeger, 1954) appearing in American journals in the late thirties and will therefore be ignored or mentioned in passing. Since many of the interpretive statements proposed by Heiss (1952) are based on group characteristics, evidence relating to the test's use as a tool in differential diagnosis will first be considered. Much of the literature to be reviewed was published before the addition of the ugly pyramid instructions (Heiss et al., 1955). Reported results on color choice therefore refer to performance on the three pretty pyramids unless otherwise indicated.

Differences between Normal and Abnormal Subjects

Wewetzer (1951a) examined a group of 90 schizophrenics, 25 manic-depressives, and 70 epileptics as compared with 100 normal controls. He found displacement of the color hierarchy for the abnormals and suggests a scheme of "rising" and "falling" colors which will distinguish normal from abnormal CPT records. The rising colors were those which in abnormal subjects attained a higher rank ordering than in normal subjects (purple, green, white, gray, and brown), while the falling colors were those which attained a lower rank in abnormal than in normal subjects (yellow, blue, red, and black). Brengelmann (1957) presents evidence supporting this hypothesis for a group of depressives who show means in the expected directions significant at the 5% level of confidence. Schizophrenics, however, could not be differentiated by the above criterion. Wewetzer also concluded that the abnormal group as a whole demonstrated greater choice frequencies for green and purple, a significantly lower Ssyn (red-

orange-yellow), and a more frequent choice of white and gray. The incidence of structuring was much lower for the abnormals with color domination as much as three times as frequent as in normals but with about equal emphasis on color separation. Brengelmann (1953a), using a sample of 30 nurses and 30 soldiers for his normals, and 30 neurotics, 30 depressives, and 30 schizophrenics for his abnormal subjects, confirms increased choice of purple for his abnormal subjects as well as an increased choice of brown and a lowered choice of blue. An examination of the hypothesis of lessened structuring for abnormals led to its rejection (Brengelmann, 1953b). Heiss, Karl, and Wewetzer (1953) on re-examination of Brengelmann's data, however, claim that his data in fact supports the hypothesis. Their criticism seems justified, particularly as several other studies with abnormal groups lend further support to the notion that lessened structuring with accompanying color dominance seems characteristic of abnormal CPT response (see Frohoff, 1953; Seyfried, 1957).

O'Reilly and Blewett (1959) administered the CPT to 43 schizophrenics, 22 nonschizophrenic psychiatric patients, and 48 normal control subjects. Their findings indicate that nonschizophrenic psychiatric patients show significantly greater preference for purple than do normals but that schizophrenics and normals cannot be differentiated by this criterion. On the other hand the whole group of abnormal subjects showed significantly higher preference for orange while the schizophrenics showed higher preference for white. Nonschizophrenic psychiatric patients also showed greater preference for yellow and brown. An examination of the validity of Nsyn (red-green-blue) as a differentiating characteristic gave negative results.

Another differentiating characteristic which has received some attention is concerned with the subjects' deviation from the expected frequency of the distribution of hues for each color. Conrad (1954) names this distribution the "standard probability" of CPT response and argues that a random choice of colors would result in an approximation to the standard probability. He shows that the characteristic behavior of his abnormal subjects (100 schizophrenics and 50 depressives) was a regression of their mean scores to the expected frequency, while an examination of the means of normal subjects in Heiss' sample (1951) indicated that these subjects showed quite significant deviations from expected frequencies. Conrad interprets these findings as implying that subjects with behavior pathology no longer select colors but choose them randomly. An increase in the frequency of carpet patterns shown in records of abnormal subjects which is typically accompanied by greater randomness of color choice is also cited as evidence for Conrad's hypothesis. Brengelmann (1955) argues that re-examination of the evidence presented by Conrad does not support the hypothesis of greater deviation from "standard probability" by normal subjects. In a later study (Brengelmann, 1957), this author reports no significant differences between normal and abnormal subjects with a trend for schizophrenics to show higher deviation than any other group.

Brengelmann (1957) also investigated the variability of color choice as a differentiating criterion between groups of normal and abnormal subjects. Variability is found to be greater for abnormal subjects but an interaction with the specific color involved was noticed. Thus, neurotics are found to be more variable than depressives on blue, red, brown, and gray; normals more variable

than depressives on green, yellow, purple, gray, and white; schizophrenics more variable than normals on blue, red, yellow, purple, gray, and white; neurotics more variable than depressives on blue, red, black, gray, and white; and depressives more variable than neurotics on orange. Individual variablilty from empirical norms was also investigated. Brengelmann computed averages for a random half of his control group, then computed deviations for the other half and the abnormal groups in his study. Results for overall variability show significant differences with normals being less variable than all the abnormal groups.

While the evidence is somewhat confusing, fair agreement seems to obtain that abnormal subjects produce pyramids with less structure and that high preference for brown, purple, and white may be taken as possibly pathognomic indicators.

Schizophrenics

Wewetzer (1951a) studied 90 schizophrenics and concluded that in this group green assumes first preference in rank order. He also found this group to give greater preference to purple, brown, white, and gray. He also found substantial differences in pyramid patterning. Sixty-one percent of his subjects had color dominated patterns (as compared to 19% of Heiss and Hiltmann's normal subjects while only 18.4% had structure dominated patterns (52% of normal records). Of particular interest was his finding that almost a third of the schizophrenic records were of the "torn" pyramid type, i.e., white had been used without being blended into a design or color mixture.

The incidence of white as a pathognomic sign of schizophrenia has also been reported by O'Reilly, Holzinger, and Blewett (1957). These investigators administered the CPT under nonstandard conditions to 43 schizophrenics, 25 nonschizophrenic psychiatric patients, and 48 student nurses. They found white being chosen at least once by 76.7% of the schizophrenic, but only by 8% of the nonschizophrenic patients, and by 29.1% of the nurses. They also report the incidence of torn pyramids to be twice as great among the schizophrenics as among the normal controls.

Frohoff (1953) administered the CPT to a group of 100 schizophrenics (37 undifferentiated, 23 paranoid, 20 hebephrenic, 14 catatonic, and 6 schizoaffective subjects; of the total group 50 were male and 50 female). He finds that green is given first preference by his male but not by his female subjects, but does not increase in preference by a significant amount. However, he also reports significant increments for purple, gray, and white, with a corresponding lowering for yellow and orange. Frohoff's data verify the increased color dominance in patterning for schizophrenics, with a more intense shift for male than female subjects. He does not find evidence for the incidence of torn pyramids but since his criteria for identifying these patterns differ from those used by Wewetzer, their material does not seem directly comparable for this characteristic. Catatonics showed particular loss of structure and there were some other significant differences between subgroup means which appear to be related to differential changes of affect. Because of the small frequencies in the subgroups, caution is advocated as to the recognition of pathognomic signs but data for the subgroups are reported in the original paper.

Sacher (1955) was particularly impressed by reported clinical incidence of monochromatic pyramids among hebephrenic schizophrenics. He constructed a modified CPT version using

only 15 hues with oversized chips and pyramid pattern. He obtained a greater number of monochromatic pyramids in a group of so-called apathetic-autistic hebephrenics, with as many as 68% of his 44 subjects constructing monochromatic pyramids. He argues that no similar observations have been reported on other patients with schizoid disturbances and offers the incidence of such patterns as a criterion for differentiating among schizophrenics. Several other studies employing schizophrenic subjects resulting in negative or confounded results have already been mentioned in the section on differentiation between normal and abnormal subjects (Brengelmann, 1955a, 1955b, 1957; Conrad, 1954). A detailed discussion of the individual protocols of eight schizophrenic patients is given by Becker (1955).

Manic-Depressives

Wewetzer's study (1951a) had a group of 25 manic-depressives whose CPT records were characterized by a greater number of color dominated records than his normals but less than the schizophrenic subjects. The manic-depressive group also showed increased preference for purple, brown, and gray, with lowered preference for red, yellow, and orange. Brengelmann (1957) also found a lowered yellow for his 36 depressives.

Epileptics

Wewetzer (1951a) examined 70 epileptics and indicated that this group showed the greatest avoidance of structured patterning. Only 10.8% of the pyramids produced by this group showed structure, 61.4% (about equal to the schizophrenic group) had color dominated pyramids, the remainder (about equal to the normals) showing color separation. The color preference pattern of this group was very similar to the manic-depressives, except that there was an apparently significantly greater preference for green and lower preference for yellow.

Mental Defectives

Spreen (1951a) had a few defectives in a sample of abnormal youngsters. He reports the incidence of monochromatic pyramids and an increase in the preference for yellow and purple. Schaie (1962b) examined a group of 29 boys and 29 girls who were patients in a state home for mental defectives. He found a number of significant differences on color choice when he compared his subjects with data on normal children (Schaie, 1962a). It was postulated that only those differences were related to his subjects' mental defect which would vanish when the subjects' raw scores were re-entered in the norms at ages corresponding to their Stanford-Binet MA. Differences significant at the 1% level showing this characteristic were found to be low blue and high brown for the male subjects, and high orange and high purple for the female subjects. Matching his defectives with normal subjects by chronological age and specifying optimal cutoff points for these criteria Schaie was able to classify correctly 78% of his 116 test records.

Neurotics

Spreen (1951b) reports records on 18 neurotic psychotherapy patients who show high preference for red and black as well as the incidence of "mantle" patterns rarely seen in normal subjects. Brengelmann's (1957) 32 neurotic subjects had a significantly higher preference for brown and significantly lower preference for yellow than his normal controls. Kloska (1958) examined the records of 25 neurotic subjects who as compared with the Heiss and Hiltmann

norms show increased preference for purple and black and decreased preference for yellow. This author next selected the three most typical subjects, in each of four diagnostic groups (schizoids, depressives, compulsives, and hysterics), took their average profile as well as a normal average profile, and computed *Q* correlations which were all substantial except for the depressives whose performance seemed to yield differentiating characteristics. Factor analysis of the *Q* correlations yielded two factors named "stimulus receptivity" and "stimulus assimilation (Reizverabeitung)." Depressives had zero loadings on Factor I while depressives and compulsives had high loadings on Factor II.

Ziolko (1956) administered the test repeatedly to 35 female neurotics in inpatient psychotherapy. Their progress was marked by increasing preference for black, an increase in the frequency of monochromatic pyramids with an accompanying reduction in the number of different colors used. He gives several case histories showing disintegration of form quality followed by reintegration during the therapy process.

Character Disorders

Seyfried (1957) compared 70 institutionalized delinquent boys with a group of 45 normals. Both groups ranged in age from 7 to 16 years with a mean age of 11. The only significant difference in the color choice of the two groups appeared in the delinquents' greater preference of purple. Seyfried agrees with Conrad's hypothesis (1954) that structure tends to influence color choice and conducts separate frequency analyses for subjects whose pyramids have predominant "carpet," "layer," or "structure" characteristics. He shows that subjects with structures in both control and experimental groups deviate more from Conrad's standard probability than the ones with carpet pyramids. In general, delinquents tend to show less structuring than normals and correspondingly the sequence formula for delinquents shows more extensive and consistent use of colors.

Siedow (1958) examined 330 patients in a psychiatric hospital who had been committed primarily because of conflicts with society. Sixty-eight of his subjects were asocial psychopaths, 56 female sexual delinquents (mostly prostitutes), 75 were men who committed sexual assault on children, and 131 were chronic alcoholics. Results for both pretty and ugly pyramids were compared with norms for normal subjects (Becker & Karl, 1955). As compared with normals, the total experimental group was significantly higher on orange and gray and significantly lower on green for the pretty pyramids; orange was significantly higher and green significantly lower on the ugly pyramids. In addition to these differences, the psychopaths were also higher on ugly black; the female sexual delinquents were higher on yellow and blue for the pretty pyramids; and the male sexual delinquents showed greatest preference for blue and yellow on the pretty and for gray on the ugly pyramids. The alcoholics did not show the increased gray preference of the other groups, but did show increased preference for pretty blue.

Schaie (unpublished) studied a group of 43 girls (mean age=16.2; SD=1.2 years) committed to a state home for female juvenile delinquents. Their CPT scores were compared with normative data on normal adolescents (Schaie, 1962a). Differences between delinquents and normals significant at the 5% level of confidence were found. The delinquents were significantly higher on purple and black and signifi-

cantly lower than normals on gray for the pretty pyramids; on the ugly pyramids the delinquents were significantly higher on brown, white, and gray and significantly lower on red and orange.

Normal Personality Characteristics

Although most CPT validity studies have so far been concerned with demonstrating the ability of the technique to differentiate between normals and/or psychiatric classification, an equally valuable application would be that of personality description in normal (and abnormal) subjects. One of the first studies of this type was an investigation by Conrad and Juncker (1954) designed to investigate CPT correlates of differences in constitutional types. The investigators examined the CPT protocols of 40 asthenics and 40 pyknics (Kretschmer) with an equal number of men and women in each group. The only difference in color choice frequencies was a significantly higher purple for the asthenics. However, significant differences also appeared in the sequence formula, with pyknics having a higher Sum of Change and asthenics showing a higher CS. The asthenics also showed more frequent use of the carpet type pattern while pyknic subjects more frequently used the layer type pattern.

Karl (1953) was interested in relating the CPT to drive structure. He used the Pauli Performance Test to select from an initial sample of 200 normal subjects (mean age: 23 years) two groups of 50 subjects each characterized by relatively high or low drive levels. He defines a Dsyn consisting of the colors brown, green, and yellow, the level of which tended to differentiate between the two groups. Thus a high Dsyn was characteristic of individuals with high drive level. Subjects with low drive level also showed an increase in Nsyn (red-green-blue).

Pfitzer, Toennesmann, and Weikert (1955) examined three groups of young children (90 kindergarten children, aged 2-8–4-2; 68 6-year-olds; and 70 primary graders aged 6-3–8-11). There was some question whether the test could be validly used with their very young subjects since color dominated pyramids predominated. They argue, however, that the differentiation of the pyramid was concomitant with the development of increasingly adequate behavior as observed by the kindergarten teachers. In their second group they distinguished on the basis of a school readiness test between the more- and less-developed children. It was found that again the less adequately developed children had a greater incidence of carpet patterns. Data for the older children showed a trend in the direction of adult norms.

Brehmer (1960) correlated the CPT scores of 78 male and 98 female young adult extension students with trait ratings by small groups of fellow students on 20 seven-point trait scales. Several significant correlations were obtained, but all ranged below .30. She does not give any information on how well the raters were familiar with their ratees and the rating variables selected may have been somewhat arbitrary.

Schaie (1962c) administered the CPT to 650 public school students equally distributed for sex and grade from kindergarten to Grade 12. Each subject was rated by his home room teacher on the 42 variables of Cattell's (1957) "normal trait sphere" using a three-point scale. The analysis of variance was used for each trait to identify those CPT variables showing significant differences for subjects in the three rating categories. Trait ratings were also combined into 15 rating factor scores using Cattell's factor weights and these latter scores were correlated with the

CPT scoring variables. Significant relations were found with almost all of the traits, but only few significant relations with low coefficients could be established with the factor scores. He concluded that the CPT variables as conventionally scored seem to relate to surface rather than source traits.

Factor Analysis Studies

Two factor analytic studies of the 24 hues under pretty pyramid instructions are available. Both these studies, however, based correlations on the absolute choice of colors (ignoring frequency counts) and therefore computed tetrachoric correlation coefficients. Rainio and Matikainen (1954) factored correlations among the form qualities and colors chosen on the third pyramid from the protocols of 115 Finnish industrial foremen. They obtained eight factors which were related to brightness, contrasts of light and dark, saturation of color and structural characteristics. A second analysis of the 24 hues based on all three pyramids conducted by Karl has not been published but is described by Reinert (1958). The subjects for this analysis were 250 German male workers (aged 17–22). Good agreement with the earlier analysis is claimed. Reinert tried to define new color groupings on the basis of these analyses by computing the sums of differences between rows of the rotated factor matrix and grouping those variables having minimal differences. As a result of this procedure he arrived at five groupings. Red_1 (pink) becomes a singlet; the two browns form the second group; black, $green_4$, red_1, red_2, red_3, $violet_2$, and $violet_3$ form another. The fourth grouping consists of the blues, $purple_1$ (the lightest purple), gray, and white. The yellows, oranges, and greens (except for the darkest green) form the last group. These results are reasonable but the methods used would appear suspect to many factor analysts. It need also be kept in mind that neither analysis handles the scores as they are computed for clinical interpretation. Further factor analyses would certainly appear desirable using typical scoring procedures and more conventional methods of analysis.

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