1955

# Color-form preferences and efficiency in problem solving

BOSTON UNIVERSITY
GRADUATE SCHOOL

Dissertation

# COLOR-FORM PREFERENCES AND EFFICIENCY IN PROBLEM-SOLVING

by

Gershen Rosenblum

(A.B., Harvard College, 1947; A.M., Boston University, 1949)

Submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy

1955

PhD
1955
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Approved by the Committee

Chairman Chester L. Brownfield
Professor of Clinical Psychology

Austin V. Berkeley
Associate Professor of Psychology

Larry Margolius
Assistant Professor of Psychology

ACKNOWLEDGEMENTS

The writer would like to extend his grateful acknowledgement to Professors Chester C. Bennett, Austin W. Berkeley, and Garry Margolius for their aid and many valuable suggestions which helped to shape this study.

I wish also to express my appreciation to Mr. Lowell Trowbridge of the Department of Human Relations, Boston University College of Business Administration, who permitted the use of his evening classes for the gathering of data.

I am especially indebted to my wife, Eleanor, whose patience and moral support made the completion of the dissertation by this date possible.

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# CHAPTER I

## INTRODUCTION

Generations of psychologists have been intrigued by problems arising from the study of perception. Throughout the years many perceptual theories have been evolved, modified, and discarded in an attempt to delineate the mechanisms involved ( 9, 10 ). Interest in color perception, in particular, dates from Helmholtz ( 25 ) and Hering ( 26 ) who attempted to account for the perception of object color or "color constancy" by means of sensory theories. Many investigators have since been attracted by the propositions which were advanced to explain color phenomena and the literature abounds with experimentation in this field. Likewise, increasing attention began to be paid to the various aspects of form perception long before the Gestalt school came into being as a protest against the then current form perception theories. Early Gestaltists laid the groundwork for much of the present theorizing about perception and its relation to the perceiver.

Recently there have evolved two approaches to the general problem of perception - one which may be defined as "stimulus centered" and the other as "individual centered" ( 84 ). In experiments which emphasize the former approach the perceiver is utilized as an average sounding board for stimulus changes; individual-centered investigations, on the other hand, select the stimulus with the express purpose of maximizing individual differences. These divergent points of view have been made explicit by Bruner:

> "One approach to perception is primarily concerned with perception in and of itself, without primary regard for the

> manner in which perception is imbedded in the other ongoing activities of the perceiver. There is relatively little concern with the role of perception in the adjustment of the organism."
>
> "The second approach attempts to treat perception in a broader behavioral context. For its primary concern is with the manner in which perceptual functioning is imbedded in and interacts with other forms of psychological functioning. Perception (in this context) is viewed as instrumental activity." ( 13, pp.14-15 ).

It is within the framework of this latter approach to perception that the present study proposes to investigate the relationship of color-form preferences to a behavioral measure of efficiency of performance. The term color-form preferences is used in this experiment to denote the consistent predisposition of an individual to select unknowingly either the color or the form aspects of a perceptual stimulus when equal alternatives are presented to him.

Efficiency is defined for the purposes of the study as the productive performance of an individual in a problem-solving situation. The assumption is made that color-form preferences constitute a property of the perceptual apparatus through which stimuli are selected and organized in a lawful manner consistent with the individual personality structure ( 36 ). It is likewise assumed that efficiency of performance is an adequate measure of certain aspects of behavior.

The impetus for this study stemmed from assumptions normally employed in interpretations of the form and color determinants on the Rorschach test. Form is considered by Rorschach workers to reflect emotional control and a propensity for deliberative and rational thinking, while emphasis on the color determinants is usually associated with impulsiveness, emotional excitability, and a tendency toward restless, random activity. Although these suppositions form one of the main bulwarks of Rorschach theory they have not been subjected to close experimental scrutiny. Zubin comments:

> "The basic significance of these determinants that color under certain circumstances reflects emotion rests solidly on intuition but not on science." (83, p. 569 ).

Several investigators have attempted in recent years to relate form and color determinants on the Rorschach test to selected measures of personality and behavior ( 15, 28, 80 ). Others ( 69, 82 ) have experimented with standard and achromatic Rorschach cards in an effort to determine whether significant differences were attributable to color. There are conflicting viewpoints regarding the value of these methods of validation. While the above authors apparently believe in the correctness of their approach, others ( 8, 34 ) question the propriety of using the Rorschach test to validate one or more of its own determinants. As Klein states:

> "There are practically no convincing demohstrations of clearcut links between cognitive patterns and Rorschach score categories; yet ..... the Rorschach often turns up as the validating rather than the validated instrument in research designs. Worse than this; by a questionable twist of circular reasoning such validation of other measures by Rorschach categories are used on occasion to sell the validity of the Rorschach itself!" ( 8, p. 344f ).

The present study proposes to investigate specific empirically derived assumptions regarding the significance of color and form on the Rorschach by means of an independent measure of these two variables. The general plan of the experiment will be to regard efficiency of performance in an independent, standardized behavioral situation as a function of variation of color-form preferences as measured by the Thurstone- Schmidt Color-Form Test ( 77 ). This will make it possible to ascertain whether assumptions which have been made in respect to the Rorschach test have meaning when applied to color-form preferences outside of the Rorschach situation.

# CHAPTER II

## AN HISTORICAL SURVEY

This chapter reviews the literature pertaining to color-form perception. It places special emphasis on those studies which have attempted to posit a specific relationship between color-form preferences and personality patterns. The general order of presentation is as follows:

1. Introduction. In this section two early basic contributions to color-form perception are discussed.
2. Genetic psychological experiments. This section is devoted to a brief survey of some color-form experiments with children which served as an impetus for later studies.
3. Typological and temperament studies. The contributions of the typologists are reviewed. Their assumptions and techniques are subjected to critical analysis.
4. Rorschach studies. In this section theories and experiments on the Rorschach test are summarized and certain assumptions inherent in these studies are questioned.
5. General personality and behavioral studies. Other pertinent studies are presented, terminating with those which are directly relevant to the present investigation.

# I. INTRODUCTION

Most of the early experimentation upon the abstraction of form and color took place in Europe although the first reference to this problem appeared in the United States at the turn of the century. In 1904 Kuhlmann ( 40 ) conducted an experiment in which eight mentally deficient boys were instructed to differentiate between form and color on two color-form tests. He noted that the discrimination time for form was longer than that for color. He explains this in terms of his subjects' institutional training which he felt placed more emphasis on color than on form. Kuhlmann concluded from his study that perception of color and form was an individual matter which varied with each case. He made no attempt to formulate a consistent theory for his findings but merely discussed the results descriptively.

Külpe ( 41 ) in the same year read a report at the Congress for Experimental Psychology in Leipzig of his experiment upon color-form abstraction. Three subjects were shown four meaningless symbols in different colors. One of his subjects attended mainly to the form aspects of the symbol, another to the colors, and the third showed no marked preference to either the color or the form. From these meagre data Külpe divided people into three basic types of personalities: the formal type (Formbeachter), the informal or material type (Farbbeachter), and an intermediate type. Although Külpe's research design would not be considered adequate today he nevertheless served to initiate inquiry into the connection between color-form preferences and personality types.

## II. GENETIC PSYCHOLOGICAL EXPERIMENTS

Although the genetic aspects of color-form preferences are beyond the scope of this study it may be helpful to review briefly a few of the major color-form experiments performed with children. These studies are important because they preceded and provided the stimulus for later experimentation with adults. Also many of the later studies copied or modified the methods and procedures utilized by their predecessors.

Katz's color-form sorting experiments with children in 1913 led him to the conclusion that color discrimination was more primitive than form perception ( 31 ). In order to confirm this point of view, he gave a tachistoscopic test to four adults and found that the tendency to pay attention to the similarity in color was quite pronounced. He felt that this result corroborated his original premise concerning the primitive nature of color preference. Other experimenters using Katz's tests (Eljasch ( 18 ), Revesz ( 56 ). and Tobie ( 78 ))came out with similar results although von Kuenberg ( 39 ) had contrary findings.

Descoeudres ( 17 ) devised a series of "lotto" games in which children and adults were requested to match up a colored figure with one of eight colored figures on the board. She found that most of her subjects chose either form or color alone, although some were aware that they had a choice. She concluded from her experiments that: 1) the choice of color decreases with age; 2) persons below 8 and above 18 show no sex difference but between the age of 10 and 18, girls are more color dominant than boys; 3) the number of subjects who arrange the cards consistently in accordance with color or form preference increases with age.

Engel ( 20 ), using an elementary school population of 800 children, has performed perhaps the most extensive investigations in studies of this nature. His children were required to match figures of varying colors and shapes with a figure placed at the bottom of four boxes. He found that the majority ( 54% ) sorted the cards according to the color. In an additional experiment an inverse ratio was shown to exist between the child's color responses and his age and intelligence.

The genetic experimenters in general tended to support the conclusion that age, at least from three and a half years to adolescence, plays an important part in preference for color or form among normal children. With increasing age there is a progressive and more consistent shift from color preference to form preference. These researchers held that color-form perception is not related to personality characteristics but is a developmental process, the nature of which they never adequately explained.

## III. TYPOLOGICAL AND TEMPERAMENT STUDIES

There were a group of investigators who felt that reactions to form or color could be linked up with temperament. Most of these authors used either Kretschmer's ( 38 ) or Jaensch's ( 29 ) typological classifications.

Kretschmer classified his types as cycloid or schizoid. The person of cycloid temperament is described by MacKinnon ( 44 ) as sociable, good natured, friendly, and genial and is characterized by a readiness of response and by an immediacy of giving expression to his emotions. The schizoid type of person, on the other hand, is depicted as reserved, serious and unsociable, whose mode of expression is characterized by stiffness and

restraint and a lack of immediacy. The traits of cyclothymia and schizothymia represent the cycloid and schizoid types in moderation as found in the behavior of average persons. Table I presents a more exhaustive summary of the contrasting characteristics of Kretschmer's cycloid and schizoid types.

Jaensch's classification differentiates between the integrate and the disintegrate types. According to this typology the integrate type of person is artistically inclined, lively and changeable, with the emphasis on feelings. In contrast, the disintegrate type tends to be inflexible and rigid, controlled in affect and given to reflection, with the emphasis on will. The contrasting characteristics of Jaensch's integrate and disintegrate types are presented in Table II and are reproduced from MacKinnon ( 44 ).

Among the foremost advocates of Kretschmer's school of thought was Scholl ( 66 ) who believed that even in childhood typological differences determined preference for form or color. He spoke of form and color types and a mixed type. In order to obtain more reliable results, he tried to eliminate the conscious attitude factor in his tests by employing a tachistoscope and using short exposure times. Of 40 students tested, he found that 18 were of the form type, 10 were of the color type, and 12 were of the mixed type. He retested the subjects, using color-form sorting tests, and obtained similar results. From these tests Scholl concluded that "the predominating observation of form or color is an expression of the psychical personality."

In a later study ( 67 ) Scholl reported that cyclothymes were mostly

TABLE I

CONTRASTING CHARACTERISTICS OF THE CYCLOID AND SCHIZOID TYPES (Kretschmer)*

| | CYCLOID | SCHIZOID |
|---|---|---|
| 1. | Sociable | Unsociable |
| 2. | Good natured | Reserved |
| 3. | Friendly | Eccentric |
| 4. | Jolly | Humorless |
| 5. | Characterized by readiness of response. | Stiff, cramped, restrained movements |
| 6. | Tendency to give self up to immediate present situation. | Timid, shy, cold, stubborn, pedantic temperament. |
| 7. | Gives immediate expression to emotions and moods. | Characterized by lack of immediacy. |

* Presented from MacKinnon ( 44 )

TABLE II

CONTRASTING CHARACTERISTICS OF THE INTEGRATE

AND DISINTEGRATE TYPES (Jaensch)*

| | INTEGRATE | DISINTEGRATE |
|---|---|---|
| 1. | All psychophysical functions react as a closed whole. | All psychophysical functions react more or less separately from each other. |
| 2. | Feeling emphasized. | Will emphasized. |
| 3. | Open to environment. Outwardly and inwardly vigorous, moving with others, adaptable, with hearty mood changes. More childishly gay and pulsating. | Closed against the world. Outwardly a mask, inwardly often fully controlled affect, or at one and the same time excitable and apathetic. More earnest, austere, given to reflection. |
| 4. | Plastic nature. | Rigid nature. |
| 5. | Artistically or esthetically inclined. | Conscientious, men of conflict. |
| 6. | Visionary. | Theorist. |
| 7. | Lively, often rapidly changing association of ideas. | Slow, dragging association of ideas. |
| 8. | Changeable. | Persevering. |
| 9. | An artist in life and a skillful practical person. | A hard and harsh person. |

* Reproduced from MacKinnon ( 44, p. 21 )

found among his color reactors and schizothymes among his form reactors. He postulated a constitutional basis for this discrimination and criticized Tobie ( 78 ) and Eljasch ( 18 ) who felt that change from color to form preference was a developmental phenomenon.

Dambach ( 16 ) and Lutz ( 43 ) worked along the same lines as Scholl and emerged with similar findings, namely that cyclothymes notice color whereas schizothymes take more notice of forms. This was found to be true in children as well as in adults.

Ritter ( 58 ), using Descoeudre's methods as well as Scholl's sorting procedure, found that form reactors belonged to disintegrate types and color reactors to integrate types according to Jaensch's nomenclature.

Poppinga ( 54 ) limited the analysis of his material to 30 subjects who showed pronounced preferences for color or form. Using the tachistoscopic method, he introduced new experiments with complex forms and colors but was unable to find any significant correlations in his sample. However, he reported some connections between pronounced color reactors and cyclothymics and between pronounced form reactors and schizothymics which he attributed to emotional characteristics. He considered the discrepancies in the findings of others to be due to the defects in the tests which were employed and to the ambiguous instructions which were given to the subjects.

Meanwhile, in England, Oeser ( 50 ) continued with tachistoscopic experiments in an effort to abstract form and color reactors. He noticed that previous investigators failed to take into account the relative intensity of the forms and colors which were used and he attempted to remedy these sources of error. Oeser arranged in a circle definite

geometrical shapes of varying intensities of color, ranging from weak form in weak color to strong form in strong color. These designs were shown tachistoscopically to 19 females and 13 male students of whom 21.5% were found to be form-dominant and 12.5% color-dominant. Of the remaining 66% about half were color-form types and half form-color types. He found that the C types were far more emotional and less critical than the F types. In general, their intellect was more stereotyped, their emotions were less stable, and they were excitable, gregarious, and practical. On the other hand, his F types were emotionally more stable and controlled, and were more solitary and impractical.

Oeser then administered the Rorschach test to his 32 subjects and found that those who preferred form on his color-form tests emphasized form on the Rorschach and vice versa. His findings were opposed to those of Scholl, Dambach, and Lutz. Most of his color-dominant subjects proved to be schizothymes rather than cyclothymes. Oeser noted that the subjects who gave extreme color or form responses were not consciously aware that a choice was possible nor were they susceptible to suggestion by the more intense forms or colors. Instead, they seemed impelled to make their selection on the basis of form solely or color solely, according to their type. He concluded that "the predilection for either form or color seems to be something inherent in the psycho-physiological structure." ( 50, p. 210 ).

Kibler ( 35 ), Enke ( 21 ), Braat ( 11 ), and Schmidt ( 64 ) examined various clinical groups (schizophrenics, manic-depressives, etc.), as well as normal samples, with a number of color-form abstraction tests. Using Kretschmer's typology they concluded that in general cyclothymes are sensitive to color whereas schizothymes are sensitive to form. Reaction

to color or form was considered to be a constitutionally conditioned mode of reaction not influenced by age.

Lindberg ( 42 ), in a very intensive typological study, examined 3088 subjects (2670 boys and girls, 218 surgical patients, 200 psychiatric patients) in order to ascertain a connection between color, non-color attitude and age, sex, intelligence and temperament. Children who were in his most intelligent group were found to have a lower percentage of color responses than those in the least intelligent group. Further, a certain connection was shown to exist between color attitude and degree of liveliness, the most lively group having a higher color percentage than the calm and quiet group. His main purpose, however, was to examine the relationship between color and non-color attitude and its condition in different personality types as defined by Sjöbring and body types according to the anthropometric index of Strömgren. Lindberg found that schizoid personalities were more frequently characterized by non-color attitude while cycloid were more frequently characterized by color attitude. In his normal sample ( N = 218 ), 26% of the adult males and 16% of the adult females were color reactive; of his schizophrenic group ( N = 200 ), 29% were color reactors. The percentage of color reactors among his group of school children decreased with advancing age, while the age factor in adults did not seem to play any noteworthy part in color attitude.

Eysenck ( 22 ), using three different tests of color attitude, examined 50 hysterics (25 males, 25 females) and 50 dysthymics (i.e.; persons manifesting the syndrome of anxiety, reactive depression, and obsessional tendencies). He found no evidence of any consistent difference between the two groups on his three tests, but noted that men tended to be

slightly more color reactive than women and that his neurotic groups tended to be more color reactive than his normal group. He related the results of his work to the Freudian concept of regression and suggested the possibility of testing "depth of regression" with the use of color-form tests.

The typological experimenters have advanced weighty arguments to prove the validity of their constitutional theories. Scholl and other followers of Kretschmer reported consistently that cyclothymes preferred color, whereas schizothymes took more notice of form. On the other hand, advocates of Jaensch's psychology in general criticized Kretschmer's types as being too limited and restrictive. They associated form reactors to the disintegrate types and color reactors to the integrate types. Some of these investigators ( 42, 54 ) found limited correlation of color-form preferences along Kretschmer's lines; others ( 50 ) found a negative correlation in the relation of color and form dominance to cyclothymia and schizothymia, respectively; while Eysenck ( 22 ) was unable to find any evidence of consistent differences in his groups.

For the most part, the typologists agreed that discrimination of color and form was constitutionally determined, rather than developmental. Connections were established between the friendly, lively, sociable, impulsive, emotionally labile (i.e.; cyclothymic or integrate) type of person and a preference for seeing color; and between the quiet, reserved, restrained, inflexible, controlled (i.e.; schizothymic or disintegrate) type of person and a tendency to perceive form. However, some ( 22, 54 ) did admit the possibility that the connections posited above might be influenced by emotional factors.

Generally, it can be said that the adherents of the various typologies

were quite subjective with their diagnostic terminology and partial in interpreting their results ( 42, 49 ). MacKinnon has this to say of typologies:

> "Types are crude pictures of personality. They are so easily developed and yet so difficult to prove or disprove. Many of the relationships assumed to exist among the dichotomous typologies have been investigated, both clinically and experimentally, but with little success so far. For the most part, these studies have been made by partisan investigators; the details of the experimental procedure have not been clear; the bases of selection of subjects, extremely important in studies of this sort, have not been specified; and the statistical treatment of results demanded by the very nature of these investigations have been lacking." ( 44, p. 23 ).

Bartlett ( 4 ) perhaps touched upon the essential weakness of the typological systems when he pointed out that separation into types, though useful at times, in reality solved no theoretical problem. He felt that it was more important to endeavor to show the relationship of the different characteristics found together in a type and the nature of their development.

From the point of view of methodology, the major criticism that might be leveled against the majority of the genetic and typological experiments (aside from the paucity of statistical data and poorly controlled sample selection procedures) concerns the selection of tests and the instructions given to the subjects. The tests fall mainly into two categories: sorting tests, and tachistoscopic tests. In the former, the subject is asked to sort, arrange, or match similar forms of varying colors. The forms vary from geometrical designs to usually perceived forms of animals and objects. The subjects theoretically have the option of choosing according to the form or the color qualities of the card. Although many of the investigators were convinced that the subject was unaware of

the alternative choice ( 20, 31, 50 ), others reported statements of their examinees which did indicate some awareness of the two choices ( 17, 42, 72 ). Hence, sorting tests cannot be considered too valid on this score since the subject's performance may represent merely a fortuitous choice or set, rather than a predilection for form or color.

Investigators, recognizing early the limitations of the sorting tests, devised the tachistoscopic experiment whereby they hoped to do away with the spectre of the conscious attitude. However, as Lindberg ( 42 ) has pointed out, tachistoscopic conditions do not give the subject an equal opportunity to discriminate between color and form. Color perception requires just a streak across the screen. Form discrimination, on the other hand, needs a firmer fixation of the object in the visual field and thus takes longer to assimilate.

Early experimenters overlooked the sources of error introduced into their experimental designs by not considering the relative intensities of the different forms and colors in their tests. Oeser ( 50 ) duly noted these heretofore unaccounted for variables and corrected for them in his designs. Even so, he found that his color reactors had difficulty reading them and made numerous mistakes in estimating the number of shapes which were flashed on the screen. Thus, it is hard to state for certain whether the tachistoscopic tests really discriminate between color reactors and form reactors or whether they merely measure visual acuity and visual capacity.

## IV. RORSCHACH STUDIES

### A. General Statements Pertaining to Form and Color on the Rorschach Test.

Much of the recent interest in the relationship between personality variables and color-form preferences stems from Rorschach's statements of the meaning of these perceptual determinants in his ink blot test. He states: "The influence of colors in perceiving the figures may be taken to represent the extent of emotional excitability and actual excitement." ( 59, p. 98 ). For Rorschach, the color answers represent impulsiveness. The greater the number of C the greater is the tendency to act impulsively. Form is discussed in relation to the emotions. "The more stable the emotions, the better the form visualization." ( 59, p. 31 ).

Schachtel relates form perception to a critical, detached, objective, deliberate attitude where no emotional significance is required ( 63 ). On the other hand, color perception, he feels, evokes an emotional response which is impulsively impelled and conveys lively, excitable feelings of pleasure or displeasure ( 62 ). According to Schachtel, the two most noteworthy characteristics of the experience of color and affect are the passivity of the subject (i.e.; the relationship between affective drives and ego) and the immediacy of the relationship between the stimulus and the person affected by this stimulus.

Beck ( 5 ) equates color responses on the Rorschach with irritability, excessive sensitivity, suggestibility, agitation, and restlessness. The high F person, he feels, is intelligent and undeviatingly realistic with no richness or glow. In an early study he found little correlation between sum C and intelligence ( 6 ).

Hertz and Baker ( 27 ) likewise do not consider sum C as an intellectual factor. From a survey of the Rorschach literature pertaining to the color factors they also conclude that F represents reality and conscious

control whereas pure C reveals lack of control over the emotions, impulsiveness, and no feeling for reality.

Bell ( 7 ) correlates a high F% with intellectual activity, inflexibility, depression, and emotional control whereas color used apart from form reveals "impulsive emotionality."

Klopfer ( 37 ) regards persons with a high number of form responses on the Rorschach as inflexible, impersonal, lacking in spontaneity, overcautious in emotional contacts, and colorless. Those who emphasize C or CF responses are said to manifest impulsive emotional reactions rather than a rational approach to their environment.

For Piotrowski, C shows a "propensity for impulsive emotional behavior from which all thought of social adjustment is absent." ( 53, p. 98 ). Recently ( 52 ), he expressed the view that color responses indicate merely the intensity, frequency, and kind of feelings subjectively experienced by the subject and do not necessarily disclose his overt behavior (i.e.; the manner and degree in which those feelings are expressed in motor action). Form responses, he feels, represent those activities which are under the influence of the relatively more intellectual or rational processes. They indicate the individual's degree of conscious control over his thought processes and have a definite relationship to intelligence.

Rapaport et al. ( 55 ) see in the subject's reaction to the Rorschach ink blots a perceptual organizing process which has a fundamental continuity with perception in everyday life.

> "Psychologically, the form responses refer to processes of formal reasoning which should pursue their course without anxiety and affects intruding into and disrupting them. The coming about of form responses represents a capacity for delay of discharge of impulses." ( 55, p. 91 ).

The form percent ( F% ) was highest in their clinical group characterized

by extremely rigid or compulsive character formation. The authors assert that the way the subject uses color on the Rorschach refers to his characteristic expression and control of affects and impulses. "Persons prone to quick and violent emotional outbursts .... will be greatly stimulated by and will cling to the colored areas of the inkblots." ( 55, p. 238 ).

In an analysis of their control group of patrolmen for the trait of impulsiveness (on the basis of clinical ratings), Rapaport and his coworkers found that the sum C (as well as CF) increased as impulsiveness increased. This also proved true with their clinical groups.

B. Experiments Relating to the Form or Color Determinants on the Rorschach Test.

Ruesch and Finesinger ( 61 ) demonstrated a correlation between color responsiveness on the Rorschach and the use of color in drawings. They held that the orientation of the individual in relation to color is independent of test procedures. Other aspects of behavior were seen as being involved in the selection of color in their experiment.

Siipola ( 69 ) performed a noteworthy experiment in which a standard and an achromatic series of Rorschach cards were presented to her subjects. She found an increase in the number of emotional attitudes when the individual was confronted with the colors. She felt that severe stress and conflict may result from difficulties in dealing with hue-form incongruities.

In an analysis of the items of the Minnesota Multiphasic Personality Inventory in relation to the Rorschach CF scoring category, Clark ( 15 ) reported that the CF responses were linked with impulsiveness and a lack of social consciousness. His findings were confirmed by Gardner ( 23 ) who employed the Rosenzweig P-F test to measure the trait of impulsivity and its relation to the Rorschach color responses.

However, Holtzman ( 28 ) was unable to establish significant correlations between impulsiveness in normal subjects (determined by ratings of each subject on himself as well as others in the group) and the number of color responses having indefinite form. This led him to conclude that impulsiveness is revealed in the Rorschach in a number of ways depending upon the personality structure of the individual. Consideration of a single aspect of the Rorschach, he felt, often leads to invalid conclusions.

Williams ( 80 ) noted a high and significant correlation between Rorschach form quality scores and performance under the stress of social pressure. He concluded from his results that "poor integration of form with color in the Rorschach reflects poor control and non-efficient mental activity." ( 80, p. 28 ).

Using only 14 subjects, Baker and Harris ( 3 ) correlated F+% and FC on the Rorschach with variability of speech intensity in a stress situation ( i.e.; threat of shock in a finger tapping test). Although the results were not statistically significant with this small sample, correlations were in the expected directions ( r=.45 and .42 respectively) and tend to confirm Williams' findings of the importance of form quality as a measure of control with normals. This hypothesis was extended to an appraisal of a neurotic group by York ( 82 ) who found that colors interfered with intellectual functioning and mental control as measured by a lowered form level on the Rorschach test.

Among the various authors who have attempted to relate color or form perception on the Rorschach test to personality characteristics, there is general agreement concerning which traits are associated with each of these determinants. The perception of pure form on the Rorschach denotes to these

writers emotional stability; control over affectivity (i.e.; delay of discharge of impulses); a detached, impersonal, objective, deliberate attitude; intellectual and rational thought processes; inflexibility; lack of spontaneity; and overcautiousness. Table III lists the frequency with which fifteen personality traits are attributed (in 26 studies) to form-oriented individuals. Emphasis on the color aspects of the cards is closely associated with emotional excitability and lability; impulsive behavior; feelings of pleasure and displeasure; a lively, vivid, excitable attitude; irritability; undue sensitivity; suggestibility; agitation; and restlessness. Table IV presents the frequency of personality traits which are ascribed in the same 26 studies to color-oriented persons.

Although Rapaport ( 55 ) asserts that color perceivers are "prone to quick and violent emotional outbursts," Piotrowski ( 52 ) cautions that the perception of color indicates merely intense subjective feelings which may or may not be translated into impulsive motor behavior. Schachtel ( 62 ) emphasizes the underlying passivity of the color-dominated person and the immediacy of the subject-object relationship. This passivity apparently does not relate to the subject's overt behavior but only to the relation between his affective drives and his ego. Siipola ( 69 ) contends that it is not the color, per se, which is important but the response to color, and feels that it is the incongruity of color and form which arouses the emotional reaction. Thus the question of the nature of this perception-personality relationship is still open to debate.

Generally, the various Rorschach experiments tend to support the relationships between color-form perception and personality traits as set forth in statements by Rorschach workers and others. Clark ( 15 ) and

TABLE III

PERSONALITY TRAITS ASCRIBED IN 26 STUDIES

TO FORM-ORIENTED INDIVIDUALS

| TRAIT | NO. OF STUDIES |
|---|---|
| Controlled affect | 10 |
| Schizothymic (Kretschmer)* | 7 |
| Detached | 5 |
| Inflexible | 4 |
| Intellectual | 4 |
| Realistic (or Rational) | 4 |
| Disintegrate (Jaensch)** | 3 |
| Emotionally stable | 3 |
| Quiet | 3 |
| Rigid | 3 |
| Deliberate | 2 |
| Formal | 2 |
| Critical | 1 |
| Depressive | 1 |
| Overcautious | 1 |

* Schizothymia includes the following traits: unsociable, quiet, reserved, timid, restrained, lack of emotional expression.

** Disintegrate personality includes the following traits: inflexible, rigid, reflective, controlled affect, emphasis on will.

TABLE IV

PERSONALITY TRAITS ASCRIBED IN 26 STUDIES

TO COLOR-ORIENTED INDIVIDUALS

| TRAIT | NO. OF STUDIES |
|---|---|
| Impulsive | 12 |
| Cyclothymic (Kretschmer)* | 7 |
| Emotionally labile | 4 |
| Sociable | 4 |
| Excitable | 3 |
| Integrate (Jaensch)** | 3 |
| Lively | 3 |
| Egocentric | 2 |
| Irritable | 2 |
| Pleasurable feelings | 2 |
| Vivid | 2 |
| Poor judgment | 1 |
| Restless | 1 |
| Sensitive | 1 |
| Suggestible | 1 |

* Cyclothymia includes the following traits: sociable, good natured, friendly, cheerful, fluid, immediate expression of emotions.

** Integrate personality includes the following traits: intuitive, empathic, artistic, vigorous, lively, emphasis on feeling.

Gardner ( 23 ) found high correlations between color responses on the Rorschach and impulsivity while Williams ( 80 ), Baker and Harris ( 3 ), and York ( 82 ) were able to correlate form responses with intellectual and affective control of impulses.

However, these studies fail to take into account the fact that many extraneous variables (e.g.; shading, achromatic color, movement) may intervene in the subject's perception of color and form in the inkblots to produce ambiguous and often misleading results. Keehn ( 33, 34 ) feels strongly that the traditional view of the role of color in the Rorschach test is no longer valid and suggests that all past studies which have been drawn from that source no longer be used to support or refute the color-affect hypothesis.

The majority of these Rorschach experiments, although helpful and enlightening, contain a fundamental error in their experimental design which has served to confuse or attenuate the meaning of their findings.

Assumptions regarding form and color perception on the Rorschach test were arrived at by Rorschach and his successors on the basis of prolonged empirical use with the inkblots. Although the relationships posited by these theorists appear to be borne out fairly well in the clinic, they have never been adequately validated by rigorous experimental procedures. At best, they remain good hunches or guesses. Thus, an author is on weak ground when he attempts to utilize the color and form determinants on the Rorschach test in order to measure the validity of personality characteristics as revealed by personality appraisals. In essence, he is employing the same test from which certain assumptions have been derived as a means of validating those assumptions. The results obtained by this method must

be considered suspect since the propositions and conclusions are interdependent rather than independent.

## V. GENERAL PERSONALITY AND BEHAVIORAL STUDIES

Reactions to form or color have also been elicited in other perceptual tests and in motor behavior. James and Domingos ( 30 ) investigated the effect of color on motor performance by conducting tests of dexterity, mirror-drawing, and finger tremor on normal and abnormal groups in a red field of light. While there was no great disturbance in either the dexterity or mirror drawing tests, there was a significant increase in the finger tremor of their normal subjects in the colored field.

Bruner and Postman ( 12 ) presented normal and trick playing cards tachistoscopically to 28 college students and found that one kind of reaction to the incongruous stimuli was that of "dominance" (i.e.; the subject responded to either the form aspects or color aspects of the trick cards.) Out of 27 subjects who gave dominant responses to the trick cards 19 showed preferences for form or color at the 5% level of significance. These preferences were interpreted by the author as a way of rendering an ambiguous stimulus congruent with one's expectancies. The recognition thresholds for the incongruous playing cards were significantly higher than the thresholds for the normal cards. This was attributed by Bruner and Postman to emotional factors:

> "Given a stimulus input of certain characteristics, directive processes in the organism operate to organize the perceptual field in such a way as to maximize percepts relevant to current needs and expectations and to minimize percepts inimical to such needs and expectations." ( 12, p. 207 ).

Thurstone's series of exploratory studies in the field of perception

and personality ( 72, 73, 74, 75, 76 ) are directly related to the present investigation. One aspect of his studies was an outgrowth of the typologists' interest in the problems of color-form perception. In 1944, Thurstone undertook a preliminary study of perception:

> " . . . for the principal purpose of discovering whether the many perceptual effects that have a dynamic character and that are central rather than ocular in nature are associated by functional unities that might be identified factorially." ( 72, p. 2 ).

In order to test this proposition Thurstone administered 57 perceptual tasks to 183 college students and factor analyzed the findings in comparison with the results obtained from three personality questionnaires. From this analysis he hoped to show that some characteristics of the person could be inferred from the dynamics of any of the various functions of perception. The aspect of the investigation with which we are largely concerned here is that which studied the dynamics of color and form perception in an endeavor to identify the differentiating factors involved in this process. Thurstone felt that the spontaneous form or color attitudes adopted by a subject in his experiments reflected in some way his unique individual characteristics.

Of the three color-form tests which Thurstone employed in his initial study ( a color-form memory test, a color-form sorting test, and a color-form eatio test), the color-form ratio test proved to be the most valid. This test of apparent movement was conceived by Schmidt ( 64 ) as a means of determining unconscious preferences for form or color. In Thurstone's experiment it was adapted for use with slide projectors. Colored shapes were projected onto the screen in such a manner that they produced apparent movement in a circle to the right or left direction, with form going one way and color the other. The direction of rotation that a subject reported would thus depend on his perceptual preferences. He was usually unaware that

rotation could be seen in the opposite direction from that which he reported to the examiner. If he followed the movement of form for example, he would not realize that color could also be perceived. The majority of the subjects were form-dominant on this test although there were some subjects who were color-dominant without any alternations.

The results of this preliminary experiment were generally disappointing. Color and form dominance did not emerge as a distinguishable category and Thurstone wondered whether this problem was still worth investigating. However, there were some hints from his factor analysis that a color-form differentiation did have some validity and this suggested the possibility that the particular personality tests which were employed in the study did not serve the purpose for which they were intended.

During the ensuing years, Thurstone sharpened his technique and revised his tests ( 73, 76 ). In July, 1952, he published a progress report on the results of his preliminary investigations with a new revision of the Schmidt Color-Form Ratio Test (which shall hereafter be identified in this paper as the Thurstone-Schmidt Color-Form Test) ( 75 ). In this revision a movie film serves to project the stimulus onto the screen ( 77 ). The apparent movement now follows along a straight line instead of a circle. Every design is repeated twelve times, once in each position of the clock. The subject reports the direction of apparent movement thereby indicating whether he is attending to the stimulus of form or color. This test has been utilized in the current study and is described in detail on pages39 - 44. It was administered by Thurstone to 100 adult men and scored under the headings of: color-form scores, up-down direction scores, left-right direction scores. The study will concern itself with the color-form scores

only. In order to get data for the interpretation of these scores the 100 subjects were requested to complete three self appraisal inventories which were devised by Thurstone (the Temperament Schedule, Personality Schedule A, Personality Schedule B). Item correlations were then determined between the color-form scores and the responses to the 500 questionnaire items. A total of 72 items in the three schedules were found to show significant correlations between the test items and the form scores of the color-form test. The distribution of these items is presented in Table V. Eighteen of the items were placed in the category of emotional stability and 10 items came under the heading of "dominance." The traits of social outgoingness, self confidence and orientation to reality showed a smaller number of significant correlations. Although he avoided setting up any propositions in advance Thurstone believes that he is now justified in advancing the hypothesis that those who are strongly form-dominant in this test tend also to be "emotionally stable, dominant, and socially outgoing." ( 75, p. 6 ).

Similarly, 57 items showed significant correlations with the color scores. Table VI presents the distribution of these items into their related categories. Seven of the items fell into the category of argumentative and six items were indicative of the trait of impulsiveness. Since the items were scattered so widely Thurstone did not feel confident in setting forth any definite hypothesis pertaining to color dominance on this test. He summed up his progress report with the feeling that "so far the exploratory results with the color-form dominance film seem to be fairly encouraging." ( 75, p. 7 ).

Thurstone hopes to follow up this report by cross validating his find-

TABLE V

CLASSIFICATION OF QUESTIONNAIRE ITEMS WHICH CORRELATE SIGNIFICANTLY WITH THURSTONE FORM SCORES*

| CATEGORY | NO. OF QUESTIONNAIRE ITEMS |
|---|---|
| Emotionally stable | 18 |
| Dominant | 10 |
| Socially outgoing | 9 |
| Self confident | 6 |
| Vigorous | 5 |
| Reality-oriented | 5 |
| Impulsive | 3 |
| Not sentimental | 2 |
| Optimistic | 2 |
| Fluent | 2 |
| Unclassified | 10 |

* Reproduced from Thurstone ( 75, p. 8 )

TABLE VI

CLASSIFICATION OF QUESTIONNAIRE ITEMS WHICH CORRELATE SIGNIFICANTLY WITH THURSTONE COLOR SCORES*

| CATEGORY | NO. OF QUESTIONNAIRE ITEMS |
|---|---|
| Argumentative | 7 |
| Impulsive | 6 |
| Stable | 5 |
| Active | 4 |
| Expansive | 4 |
| Self-centered | 4 |
| Vigorous | 2 |
| Dominant | 2 |
| Confident | 2 |
| Deliberate | 2 |
| Reality oriented | 1 |
| Not sentimental | 1 |
| Fluent | 1 |
| Orderly | 1 |
| Not creative | 1 |
| Unclassified | 13 |

* Reproduced from Thurstone ( 75, p. 8)

ings on a second group of normal subjects and making predictions about their personality configurations from the test results. His approach to date in the area of color-form perception and related personality traits has been largely of an exploratory nature. He has neither formulated any hypotheses in advance nor proferred any rationale for his method or experimental design. Rather he has relied on a vast number of personality inventory items to establish hypotheses for him.

A word might be said about the use of personality inventories as measures of personality characteristics. Although questionnaires apparently enjoyed great popularity back in 1944 when Thurstone began this series of studies, in recent years, numerous experimenters according to Ellis ( 19 ) have begun to raise serious questions concerning their validity and general usefulness in discriminating personality.

Only a few studies have been reported in the literature which deal directly with the problem of color-form preferences and efficiency of performance, although form preferences have been clearly linked to personality traits of intellectual and rational control and a deliberate, reflective mode of behavior. As noted above, Williams' ( 80 ) study has demonstrated convincingly the correlation between lowered form level on the Rorschach with lack of mental control and non-efficient mental activity. In his experiment he induced an artificial stress situation by the threat of an electric shock while his subjects were working on the digit symbol subtest on the Wechsler-Bellevue Intelligence Scale. After repeated test situations when the learning variable had reached a plateau, he found his predicted relationship to be statistically significant. This study has been criticized, both in terms of methodology and results. Schneider ( 65 ) is of the belief that

Williams should not have hypothesized a linear relationship between F + and mental control since overly high form perception is considered by some Rorschach theorists to be a defense against affective instability and as such would be related to loss of control under affective stress rather than increased mental control. Williams was also criticized by Schneider for considering the F + distribution to be continuous with intellectual control under stress since the stress threshold would vary from one individual to the next. Carlson and Lazarus ( 14 ), in a repetition of Williams' study, were unable to replicate his findings and feel that he did not take all the relevant variables fully into account, such as the number of retrials required to reach a plateau in learning. In their repeat study, Carlson and Lazarus' subjects required an average of 17 retrials before the learning curve leveled off, whereas Williams employed only 11 retrials in his experiment. York ( 82 ) found that the F + % was lowered when color was introduced into the Rorschach blots. He also demonstrated that, while his neurotic group fared worse on the chromatic versions of intellectual tasks than on the achromatic series, his normal group actually increased their performance efficiency.

Rosenthal, in a recent study ( 60 ), was unable to find any significant differences in the efficiency of performance between his experimental groups which were differentiated on the basis of their excessive preference for M or C on the Rorschach. When presented with a series of problem-solving tasks the two groups achieved substantially the same number of solutions. Their performances on the Katona tasks are summarized in Table VII.

In summary, the literature has been reviewed to determine what relationships exist, if any, between color-form perception and specific personal-

ity and behavioral variables. Although considerable disagreement remains among the adherents of the various psychological schools of thought as to the etiology of the perceptual-personality relationship, there appears to be a concensus of opinion that form preference is closely associated with cognition, whereas preference for color is related to affective and conative factors.

TABLE VII

CHI-SQUARE TESTS FOR NUMBER OF SOLUTIONS

BETWEEN M AND C GROUPS

| TASK | NO. OF SOLUTIONS BY GROUPS | | | |
|---|---|---|---|---|
| | M | C | $\chi^2$ | P |
| I | 8 | 4 | 1.875 | >.10 |
| II | 9 | 9 | .556 | >.30 |
| III | 8 | 7 | 0 | .99 |
| IV | 2 | 2 | .313 | >.50 |
| V | 6 | 5 | 0 | .99 |
| VI | 5 | 4 | 0 | .99 |
| VII | 4 | 1 | 1.067 | .30 |
| VIII | 3 | 4 | .879 | >.30 |
| IX | 5 | 6 | 0 | .99 |

Reproduced from Rosenthal ( 60, p. 62 )

# CHAPTER III

# PROCEDURES

## I. EXPERIMENTAL PLAN

### A. Purpose of the Study

This investigation was stimulated by studies in the literature which posit specific relationships between color-form perception and selected behavioral traits. The assumption profferred in this study states that perceptual preference for form reflects a tendency to emphasize a conceptual, cognitive mode of approach; whereas a preference for color reflects a tendency to emphasize a manipulative, conative mode of approach.

It will be recalled that statements in the literature cover other aspects of the color-form, perception-personality problem as well. However, it is the intention of this study to examine only that aspect which concerns the relation of color-form perception to performance efficiency in a problem-solving situation. If we accept the above assumption as tenable then it follows that no difference in problem-solving efficiency should exist between form-dominated and color-dominated groups if both are free to employ their preferred mode of approach. This assumption was supported by Rosenthal ( 60 ) and by an exploratory study conducted by the writer. The method, procedure, and results of this experiment are described in pages 61 -62 in the study. The corrolary can be drawn that if one of the two groups is prevented from employing its characteristically preferred mode, that group's efficiency in a problem-solving situation will be impaired and

differences between the two groups should be detected. In terms of this assumption, the following behavioral prediction is set forth. Individuals who prefer form perception will perform more efficiently than color perceivers in solving problems which are constructed in such a manner as to emphasize conceptualized reasoning rather than manipulation and trial and error methods.

An operational prediction, described below, was derived to test this proposition.

B. Derivation of the Operational Prediction.

The operational prediction was formulated in terms of the techniques employed to measure specific variables; namely, the variation in perceptual preference along a color-form continuum and the variation in efficiency of performance in respect to problem-solving.

The Thurstone-Schmidt color-form test, which is described in detail on pages 39 - 44 , was found to be the best measure of variance in color-form preferences among the subjects. Its objectivity and reliability make it an ideal test for this purpose. The method of scoring enables each subject to be ranked along an F continuum ranging from 100 to 0 percent.

A modified version of the Grace Arthur Stencil Design Test ( 2 ) was constructed as the most suitable measure of variation in efficiency of performance as defined by the above proposition. The revised test is described in detail on pages 44 - 47 .

As originally devised, the test requires the subject to select and assemble the proper stencils needed to reproduce a chromatic design.

The subject has the choice of two approaches in solving the tasks. One approach involves extensive experimental activity with the stencils. By constant manipulation and repeated trial and error the correct combination and order of stencils are finally obtained and can then be compared with the stencil design for verification. Often the subject adopting this approach is unaware of how he has obtained the solution and when the next design is presented he has to undergo the same process of repeated experimentation and trial and error. The other approach requires deliberation, reflection, and the adoption of an abstract attitude. In order to achieve success with this approach the subject has to reason out the basic concept inherent in the correct solution of all of the stencil design tasks. Once this universal principle has been isolated it can then be applied to each design as it is presented to him. Very little motor activity is required; rather, the emphasis is on mental activity and application of the general principle. Comparison with the stencil design is not essential since the subject knows that if the principle is applied correctly the solution must be correct.

The instructions and mode of presentation of the Stencil Design tasks were altered in this study in such a manner as to preclude the use of the first approach. Manipulation was impossible since the stencils were mounted on a cardboard and displayed out of reach. The subject first had to figure out which stencils were necessary to construct the design and then write down their numbers on a scoring sheet. Thus, trial and error methods could not be employed as a technique; instead an imaginal approach had to be devised and applied in order to obtain the correct answer. This was especially true in the more difficult stencil design tasks where four or more stencils had to

be assembled mentally in the proper order if success was to be achieved.

On the other hand, this revised mode of presentation did not affect the latter approach to the Stencil Design tasks since it did not change the requirements of cognition and conceptualization as a preferred method. The scores obtained from this test were defined as a measure of efficiency of performance in a behavioral task. Low scores were considered to be indicators of poor efficiency and high scores were interpreted as denoting good efficiency. By this method, each subject could be ranked along an efficiency of performance continuum ranging from a maximum score of 100 points to a minimum score of 0.

C. The Operational Prediction.

The operations permit a restatement of the predictions in operational terms. The prediction states that form preference scores on the color-form test will correlate positively with efficiency scores obtained on the Stencil Design test.

D. Description of Subjects.

One hundred and twelve subjects (72 males, 40 females) participated in this study. All subjects were obtained from four evening college classes conducted at a local university. Three of these were classes taking a course in Human Relations while the fourth was a general undergraduate psychology class.

Subjects were initially screened to determine the presence of color blindness or uncorrected visual difficulties and any person who presented these physical anomalies was eliminated from the experimental groups. It was further ascertained that no subject had prior acquaint-

ance with any of the tests employed in the study.

The experiment was carried out in two group sessions. During the first session the Thurstone-Schmidt color-form film ( 77 ) and the Shipley-Hartford Conceptual Quotient Scale ( 68 ) were administered. Three weeks later the same subjects were given the group modification of the Grace Arthur Stencil Design Test ( 2 ). Persons who presented incomplete data due to their absence at one of the testing sessions were excluded from the study.

Since sex, intelligence, and age up to 18 years are considered by some ( 5, 42, 52. ) to bear a relationship to form or color preference, an effort has been made to rule out any possible errors arising from these variables. Subjects possessing extremes of intelligence (i.e.; IQ below 80 and above 135) and age (i.e.; below 18 years and above 49 years) have been likewise eliminated from the experimental sample.

## II. METHODOLOGY

### A. The Measure of Perceptual Preference.

#### 1. Selection of the Thurstone-Schmidt color-form test.

It has been demonstrated that the vast majority of the color-form abstraction tests utilized by investigators in the past possess inherent defects in their construction and are generally unreliable for precise experimental research. The basic weaknesses of both the sorting tests and tachistoscopic tests lie in the fact that equal opportunity to choose color or form is not afforded the subject. Either the subject is aware of his choice and therefore his selection

is unpredictable, or else the stimulus is exposed for so short a period of time that the color aspects, which are more immediately perceived than the form aspects ( 42 ), gain an unfair advantage and the results become biassed in their favor.*

The Thurstone-Schmidt color-form test is relatively unencumbered by these limitations. The test asks for a choice based upon the direction of apparent movement rather than color or form. These latter variables can be inferred with a high degree of reliability from the subject's conscious selection ( 75 ). Since each design appears in every position of the clock, positional artifacts are thereby cancelled out. Oeser's ( 50 ) objections to early color-form tests on the grounds that they neglected to account for the intensities of colors and forms have been duly noted in the construction of this ingenious test. Other assets of this color-form test are the ease of administration (20 minutes running time with a 16 mm. movie projector operating at the speed of 16 frames per second), ease of comprehension (the instructions with examples are

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* A doctoral study investigating the validity of the use of color-form attitudes in the assessment of personality has recently been completed by Keehn ( 32, 33 ) at the University of London. Several color-form tests (some of which have been discussed in this paper) were given to 200 male adults and were factorially analyzed. The results revealed the existence of a color-form factor although the average correlation between the color-form tests was quite low. This latter fact led Keehn ( 33 ) to conclude that the reactions to color-form tests are relatively specific to each test. Unfortunately, however, the Thurstone-Schmidt color-form test was not included in his analysis and hence his results cannot be considered altogether appropriate to this study.

included in the introductory portion of the film), and the novelty of the test (in a preliminary study many subjects spontaneously commented that they found the test fascinating and unique).

Thus, the Thurstone-Schmidt test was employed in this study as a means whereby subjects could be ranked along a color-form continuum.

2. Description of the color-form test.

According to Thurstone ( 75 ), this test has been devised "to provide an objective index of color and form dominance."

> "The test consists of a 500 foot reel of 16 mm. Kodachrome movie film and is so designed as to represent conflicting apparent movement. The subject sees colored spots which may move in a straight line in either direction. Some subjects follow constant form in spite of flickering color. Other subjects see the same presentation by following constant color in spite of flickering shapes. In this test twelve different designs are used and each one is presented so that form appears in each of the twelve clock directions. The total test consists of one hundred and forty-four experimentally independent presentations. In every presentation when form goes in one direction color goes in the opposite direction. The presentation is made in random order." ( 75, p. 1 ).

Presentation. The color-form film was shown to four groups of 30-40 subjects who were instructed to determine the direction in which the colored shapes seemed to be moving and to encircle their choices on a scoring sheet provided for that purpose. A small light was kept burning during the film presentation to provide sufficient illumination for recording purposes. The film commenced with a set of instructions for selecting the responses. Three examples were contained in this section of the film and the subjects were encouraged to guess the answers aloud before they

were flashed on the screen. Whereas the film instructions permitted the subject to cross out those presentations which he found doubtful, the revised instructions forced him to encircle all of the 144 presentations. Only those protocols in which the subject complied with these instructions were used in computing the final data. Finally, the film was stopped just before the formal presentation began until all questions were answered and the examiner was assured that the instructions were completely understood. From this point until the termination of the test the film was shown without further comment. After the test was over, the subjects were requested to write down at the bottom of the scoring sheet the amount of difficulty (easy, moderate or difficult) that was experienced in determining the direction of movement. In addition, general written comments concerning the film were invited.

Scoring. The latest revision of Thurstone's scoring procedure was followed ( 74 ). The Thurstone-Schmidt color-form scoring sheet, which is presented in figure 1, was used to record the subjects' responses. On the left of the scoring sheet twelve pairs of numbers for each design are presented for the subjects' use. Each number represents one of the positions of the clock. The digits in the top row refer to color choices while those beneath denote form preferences. A circle drawn around no. 4 in the first presentation of Design I would lead to the inference that the form elements of the stimulus were perceived as predominating. If a circle were drawn instead around no, 10 it would indicate that the

Name_____
Age_____
Sex_____
Class_____

## C - F FILM

| | Encircle choices here. | | | | | | | | | | | | | For examiner's use only | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Σ | R | R | R | R | R | D | L | L | L | L | L | U | Dir | C | F |
| I | 10 | 1 | 5 | 11 | 12 | 7 | 9 | 2 | 3 | 4 | 6 | 8 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 4 | 7 | 11 | 5 | 6 | 1 | 3 | 8 | 9 | 10 | 12 | 2 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| II | 2 | 5 | 1 | 10 | 9 | 4 | 6 | 8 | 3 | 7 | 11 | 12 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 8 | 11 | 7 | 4 | 3 | 10 | 12 | 2 | 9 | 1 | 5 | 6 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| III | 1 | 12 | 6 | 4 | 3 | 11 | 10 | 2 | 9 | 5 | 8 | 7 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 7 | 6 | 12 | 10 | 9 | 5 | 4 | 8 | 3 | 11 | 2 | 1 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| IV | 10 | 8 | 1 | 4 | 3 | 6 | 5 | 2 | 12 | 11 | 9 | 7 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 4 | 2 | 7 | 10 | 9 | 12 | 11 | 8 | 6 | 5 | 3 | 1 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| V | 12 | 2 | 7 | 5 | 3 | 8 | 1 | 10 | 9 | 11 | 6 | 4 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 6 | 8 | 1 | 11 | 9 | 2 | 7 | 4 | 3 | 5 | 12 | 10 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| VI | 8 | 10 | 5 | 6 | 1 | 2 | 7 | 3 | 12 | 9 | 4 | 11 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 2 | 4 | 11 | 12 | 7 | 8 | 1 | 9 | 6 | 3 | 10 | 5 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| VII | 2 | 11 | 8 | 9 | 1 | 3 | 7 | 5 | 12 | 10 | 4 | 6 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 8 | 5 | 2 | 3 | 7 | 9 | 1 | 11 | 6 | 4 | 10 | 12 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| VIII | 12 | 11 | 6 | 1 | 2 | 10 | 9 | 4 | 7 | 3 | 8 | 5 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 6 | 5 | 12 | 7 | 8 | 4 | 3 | 10 | 1 | 9 | 2 | 11 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| IX | 6 | 11 | 7 | 2 | 10 | 9 | 8 | 1 | 4 | 3 | 12 | 5 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 12 | 5 | 1 | 8 | 4 | 3 | 2 | 7 | 10 | 9 | 6 | 11 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| X | 12 | 8 | 2 | 9 | 1 | 6 | 7 | 10 | 5 | 11 | 4 | 3 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 6 | 2 | 8 | 3 | 7 | 12 | 1 | 4 | 11 | 5 | 10 | 9 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| XI | 7 | 3 | 4 | 8 | 12 | 2 | 10 | 1 | 11 | 9 | 5 | 6 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 1 | 9 | 10 | 2 | 6 | 8 | 4 | 7 | 5 | 3 | 11 | 12 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| XII | 5 | 7 | 8 | 3 | 11 | 9 | 1 | 12 | 6 | 4 | 10 | 2 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| | 11 | 1 | 2 | 9 | 5 | 3 | 7 | 6 | 12 | 10 | 4 | 8 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |

Figure 1. The Thurstone-Schmidt Color-Form Scoring Sheet.

color aspects of the stimulus were seen in this case as the more outstanding.

In scoring the color-form test, the 144 choices made by each subject were first transferred by the examiner onto the right hand side of the scoring sheet. Wherever the same number was circled on both the top and bottom rows of each design, a check was made beneath that pair of digits. Responses of this nature indicated that the colored stimulus was perceived as moving twice in the same clock direction, one time denoting a form preference, the other a color preference. Whenever the preferences for form or color in the same clock position were contradictory as defined above, they were eliminated from the color-form categories and were treated as directional responses. Thus, three independent sets of scores were obtained: color scores, form scores, and direction scores. In the scoring procedure adopted for this study the direction scores were discarded and the remaining color and form scores were treated as a unit totaling 100%.

B. The Measure of Performance Efficiency.

1. The Grace Arthur Stencil Design test.

The Stencil Design test consists of eighteen 3" x 3" stencils of varying colors and cutouts and twenty 3" x 3" colored designs. In the original version of the test ( 2 ) the subject is requested to select the stencils needed to reproduce the design and to place them in the proper order so that they form a gestalt reproducing the design in question. This test was devised by Grace Arthur as a substitute test for the Kohs Block Designs and as such she used it

to measure intelligence in children ( 1 ). Both the method of presentation and the scoring procedure were altered by the writer to conform to the requirements of this study. In order to keep the stencils and designs out of reach of the subjects and at the same time permit them to be readily perceived by all, they were enlarged threefold so that their dimensions were 9" x 9". Except for the proportionate increase in size, the stencils and designs were alike in every detail to the original test materials. The stencils were mounted on a large white cardboard background in three rows in consecutive order. The top row consisted of stencils numbered 1 - 6; the second row comprised stencils 7 - 12; and the bottom row contained stencils numbered 13 - 18. The cardboard was secured to the blackboard in the front of the classroom so that it could be easily observed by all. The participants were urged to sit near the front of the room or in whatever position they could best see the stencils.

Contrary to the original instructions, the subjects here had no way to manipulate the stencils in order to evaluate their ideas nor was there any opportunity to compare their final products with the design for confirmation of an apparently correct solution. In a preliminary informal experiment it was found that these modifications made necessary a further revision in order to facilitate the tasks. For designs 1 - 16 lines were drawn on the scoring sheet to indicate the number of stencils required to solve each design. The Grace Arthur Stencil Design Scoring sheet is presented in Appendix A, figure 2. Instructions were given as follows:

> "You are to try to list in their proper order (from top to bottom) the stencils which are needed to reproduce each design correctly. The stencils are numbered consecutively from 1 through 18. You can tell how many stencils it will take to solve a specific design by counting the number of blank lines marked under that problem. For example, No. 1 has two blank lines, indicating that two stencils are all that are needed to correctly reproduce the design. On the other hand, No. 10 with four blank lines signifies that four stencils will be needed to solve this problem. The number of the stencil that should be on top is to be listed on the first blank line. List on the second line the number of the stencil which you believe goes underneath. This procedure is repeated so that the stencil that goes on the bottom is the last one to be numbered. If you are not sure of the exact order, guess! At least try to put down the numbers of the stencils that make up the design, even if you don't know the order in which they go. Try to do every one."

The experimenter then demonstrated the solution of a practice design and when it was certain that the instructions were completely understood, designs 1 through 16 were presented without further explanation of the nature of the task. Before designs 17 and 18 were presented modified instructions were given as follows:

> "You will notice on the scoring sheet that no lines are drawn under design nos. 17 and 18. In solving these designs I want you to try to figure out which stencils are necessary to construct them and the order in which you think they belong. Even if you are not sure of the correct order try at least to list the numbers of the stencils which you believe go to make up the design. If you are not sure, guess!"

Designs 19 and 20 were excluded from the study. The number of stencils required for a correct solution varied from a minimum of two to a maximum of six. The designs, according to Arthur ( 2 ), are arranged in order of increasing difficulty. As a general rule, the more difficult the designs the more stencils are required for the correct solution. No formal time limit was set for any of the

tasks; after the experimenter felt that a reasonable length of time had elapsed (three minutes or longer), he asked the group whether anyone wished to have more time. If he received no reply he removed the design which was kept throughout this period in full view of the subjects and displayed the succeeding one. Only one design was exposed at a time; once it was removed from view it was not shown again during the session.

In the scoring procedure set forth by Grace Arthur, four minutes was allowed for the completion of each task, regardless of its difficulty, and the item was scored as either correct or incorrect. No partial scores were given. In the current study, the writer devised a scoring procedure which permitted partial scores for an item which was not entirely correct. For designs 1 - 16, $\frac{1}{2}$ point was allowed for any correct stencil irrespective of its order and $\frac{1}{2}$ point was allowed for each correct order; or 5 points were scored if a correct solution was achieved. For designs 17 and 18, one point was allowed each correct stencil regardless of its order; or the subject earned 10 points if the design was solved correctly. Thus, the stencil design score could range from a minimum of 0 to a maximum of 100 points.

C. The Measure of Intelligence.

1. The Shipley Hartford Conceptual Quotient Scale.

Because of the known correlation of intelligence with many varieties of problem-solving tasks, an intelligence measure was introduced into the study in order to isolate this variable.

The Shipley Hartford Conceptual Quotient Scale, which is presented in Appendix A, figure 3, was used as the measure of intelli-

gence for each subject. It consists of a vocabulary test of 40 items and an abstraction test of 20 items. Vocabulary and tests of abstraction are considered by Wechsler ( 79 ) and others to be the most valid indicators of intelligence. The test is easily administered in a group situation; the testing time is brief ( 12 - 15 minutes ); it is easy to score; it has been well standardized; and transformations from weighted scores to mental age scores have been calculated by the authors. For the purposes of this study the mental age scores were converted into intelligence quotients with the aid of Terman and Merrill's conversion scales ( 71 ).

# CHAPTER IV

## RESULTS AND DISCUSSION OF RESULTS

## I. RESULTS

### A. Hypothesis.

The major hypothesis states that form preference scores ( F% ) on the color-form test will correlate positively with efficiency scores obtained on the Stencil Design test.

It will be recalled that the operational definition of form preference is the percentage of F to F + C responses obtained on the color-form film after the D responses have been subtracted from the total score. Behavioral efficiency has been operationally defined as the total score earned on the eighteen stencil design tasks. In order to make tenable the assumption of normality the F% scores were transformed by an arc sine transformation into angle F scores (henceforth designated as $\measuredangle$ F scores) before correlations were computed. The formula employed in this transformation is given by Snedecor ( 125 ) as follows:

$$\text{angle} = \text{arc sine}\sqrt{\text{percentage}}$$

In order to test the assumption that the $\measuredangle$ F scores and stencil design scores yield distributions which approximate the normal curve, tests of goodness of fit were made by means of the chi-square technique. The null hypothesis states that the frequencies of the given distributions follow the frequencies of the theoretical normal curve closely enough to be regarded as chance departures therefrom. The obtained chi-square

values are shown in Table VIII. In both instances the obtained values do not meet the requirements for significance; hence, the fit for the two distributions may be considered to be satisfactory.

Having made tenable the assumption of normality of the 4 F and the stencil design frequency distributions, Fisher's t test was computed to ascertain whether the mean differences between the male and female groups pertaining to the 4 F and stencil design scores could be due to chance sampling errors.

A statistical comparison of the difference between the two sample means obtained by the males and females on the 4 F scores of the color-form test indicates that the value of t is .49. This obtained value does not meet the requirements of significance for 110 degrees of freedom; hence, the null hypothesis cannot be rejected in this instance. Fisher's t test was repeated in order to obtain a statistical comparison of the difference of the sample means derived from the stencil design scores. The comparison yielded a value of t = 2.59. This value meets the requirements of significance at the .02 level for 110 degrees of freedom. The test of significance indicates that the obtained difference between the means for the males and females is greater than can be reasonably attributed to random sampling from a common population. Consequently, we must reject the null hypothesis which states that no difference exists between the two populations with respect to their performance on the stencil design test. An examination of the data of the group means, $\bar{X}_M = 65.7$ and $\bar{X}_F = 56.0$, shows a significantly higher mean score for the male than for the female group. The results of these data are presented in Table IX.

In order to ascertain whether the significant value of t could be

TABLE VIII

TESTS OF NORMALITY FOR DISTRIBUTIONS OF ANGLE F AND STENCIL DESIGN SCORES ( N = 112 )

| MEASURE | MEAN | S. D. | d/f | $X^2$ | p |
|---|---|---|---|---|---|
| Angle F Scores | 56.8 | 13.6 | 6 | 4.43 | .62 |
| Stencil Design Scores | 62.7 | 20.4 | 7 | 8.20 | .32 |

TABLE IX

SEX DIFFERENCES FOR ANGLE F AND STENCIL DESIGN SCORES

| MEASURE | MALES | | FEMALES | | t | p |
|---|---|---|---|---|---|---|
| | MEAN | S. D. | MEAN | S. D. | | |
| Angle F Scores | 57.6 | 14.2 | 56.3 | 13.0 | .49 | NS* |
| Stencil Design Scores | 65.7 | 20.8 | 56.0 | 17.6 | 2.59 | .02 |

*NS indicates non-signifance

attributed to the differences between the variances for the two samples, an F test was computed. The obtained value of F is 1.34 for 71 and 39 degrees of freedom. This value does not meet the requirements for significance and hence supports the hypothesis that these samples are homogeneous in variance.

In view of this finding of sexual differences, the statistical data will be presented separately for the male and female samples.

The statistical hypothesis to be tested states that the population value of the correlation between form preference scores and stencil design scores in zero. This hypothesis was tested against that class of alternatives which states that the population value of the correlation between form preference scores and stencil design scores is greater than zero. The hypothesis was tested first for the male group by the $\underline{t}$ test. Using Pearson's product-moment correlation as the statistic, the value obtained is $r = .54$. This value meets the requirements for significance at the .01 level for 71 degrees of freedom. When Pearson's $\underline{r}$ was applied to the women's $\frac{1}{4}$ F and stencil design scores, the obtained value was $r = .63$. This value meets the requirements of significance at the .01 level for 39 degrees of freedom. Table X presents the data on the sex differences with respect to $\frac{1}{4}$ F and stencil design scores. The results of Pearson's test of correlation make tenable the assumption that some degree of relationship exists between the $\frac{1}{4}$ F scores and the stencil design scores among both the male and female groups. Consequently, the null hypothesis, stated above, is rejected in favor of the stated alternatives.

It will be recalled that the form preference scores were computed after the direction responses had been eliminated from the total score. In order to

TABLE X

CORRELATIONS BETWEEN ANGLE F AND STENCIL DESIGN SCORES FOR THE MALE AND FEMALE SAMPLES

| MEASURES CORRELATED | SEX | r | p |
|---|---|---|---|
| Angle F Scores - Stencil Design Scores | Male | .54 | .01 |
| | Female | .63 | .01 |

determine whether the highly significant values of r obtained above could be due in part to the excluded direction responses, these scores were correlated with the ∠ F scores and stencil design scores separately for the male and female samples. The following values of r were obtained: (a) the correlation between direction scores and ∠ F scores for the male sample is .02. For the female sample, r = .03. (b) the correlation between direction scores and stencil design scores for the male sample is -.003. For the female sample, r = -.09. These obtained values of r do not meet the requirements of significance for 71 and 39 degrees of freedom for the male and female groups, respectively.

Correlations were computed between the intelligence quotients and the stencil design scores to ascertain whether the highly significant values of r could be attributed to a relationship between intelligence and the problem-solving tasks. For the male group the obtained value is r = .15; the women obtained an r = .07. These obtained values of r do not meet the requirements of significance for 71 and 39 degrees of freedom, respectively.

Correlations were computed between the intelligence quotients and the ∠ F scores to ascertain whether the highly significant values of r reported above could be attributed to the relationship between intelligence and a preference for form. For the male group, the obtained value is r = -.11; the female group obtained an r = -.21. These obtained values of r do not meet the requirements of significance for 71 and 39 degrees of freedom, respectively.

Since age distributions cannot be considered to be normal, chi-square tests were appled to the male and female samples to ascertain whether the subjects' ages and stencil design scores are independent measures. The null

hypothesis states that no association other than chance exists between age and stencil design scores. The chi-square value for the male group is 8.70, $p = .47$; for the female group $X^2 = 3.12$, $p = .96$. These obtained values of $X^2$ do not meet the requirements of significance for 9 degrees of freedom. Chi-Squares calculated between age and $\frac{1}{4}$ F scores likewise do not meet the requirements of statistical significance for 9 degrees of freedom. The males obtained a $X^2$ value of 16.84, $p = .06$ which approaches the 5% level of significance. For the female group, $X^2 = 5.38$, $p = .80$.

It is important to consider the amount of difficulty experienced by the subjects in determining the direction of movement on the color-form film. It will be recalled that all subjects were forced to make a choice, even when they were not sure of the direction in which the flickering colored bands moved. Thus it may be argued that the tendency to prefer form or color reflects the perceptual ease or difficulty in determining the direction of the apparent movement rather than the stated alternatives. In order to test this assumption, pertinent statements which had been written by the subjects on the color-form film scoring sheet at the examiner's request were scrutinized. It was found that among the male group, 30 subjects found the nature of the task to be easy, 20 persons described the test requirements in terms of moderate difficulty, and 9 expressed much difficulty in determining the direction of movement. Thirteen males failed to make any comment pertaining to this question. Among the female sample, all subjects without exception complied with the examiner's request for comments. Of the 40 female subjects, 13 found the task easy, 18 felt that the test was moderately difficult, and the remaining 9 described the test as very difficult Examples of subjects' descriptions denoting easy, moderate, and difficult orders of

difficulty are given below.

Easy - "I felt it easy to follow the motion about 90% of the time."

Moderate - "Some were easy, others were hard."

Difficult - "It was difficult to tell which way the lines moved."

Statistical analyses were made by means of the chi-square test to determine whether the order of difficulty experienced by the two groups on the color-form film was significantly related to their color-form preferences. In the male group, the subjects who failed to comment were excluded from the analysis, reducing the number of the sample to 59. The $X^2$ value for the men is 5.28, $p = .51$; the women obtained a $X^2 = 5.09$, $p = .52$ for 6 degrees of freedom. The results of the chi-square test to determine differences in order of difficulty for males and females is $X^2 = 3.06$, $p = .22$ for 2 degrees of freedom. In all three instances the findings lack statistical significance and hence the null hypothesis cannot be rejected.

The statistical procedures applied above to measure the degrees of relationship among 4 F scores, stencil design scores, direction scores, age, intelligence, and order of difficulty on the color-form film, indicate that these variables (with the exception of the significant $r$ obtained between the 4 F and stencil design scores) bear no significant relationships to one another in either the male or female samples. Thus it appears reasonable to assume that the highly significant values of the correlation coefficients obtained between 4 F scores and stencil design scores for males and females are the results of an actual relationship between these two variables. This lends support to the hypothesis that men and women who prefer form to color perceptually will maintain their efficiency in a

problem-solving situation which forces them to deliberate, reflect, and conceptualize. On the other hand, this type of a problem-solving task will impair the efficiency of those who prefer color perception to form.

In addition to the test of the hypothesis, it is worthwhile to examine the data further in order to ascertain whether significant mean differences in intelligence and age exist between the male and female samples. The hypothesis that the two samples were drawn from a common population with respect to these variables is tenable. Fisher's $t$ test applied to the data on intelligence indicates that $t = .20$, $p = .84$. The Mann-Whitney U test ( 45 ) was applied to the data on age and yields a $CR = 1.43$, $p = .16$. It may be inferred, therefore, that significant differences exist between the male and female experimental groups with respect to the stencil design scores but not with respect to the other known variables (i.e.; form-color preferences, order of difficulty on the color-form test, age, and intelligence). An examination of the stencil design score data reveals that the mean score for the females is lower than that determined for the males. One possible explanation might be offered that, given men and women of equal age, intelligence, and color-form perceptual preferences, males will function more efficiently in solving the type of problem presented in this study than females.

## II. DISCUSSION OF RESULTS

This study set out to examine the relationship of color-form preference to efficiency in problem-solving. It was hypothesized that individuals who prefer form perception will perform more efficiently than color perceivers in solving problemsthat are constructed in such a manner as to emphasize conceptualized reasoning rather than manipulation and trial and error methods. The findings confirm this hypothesis for males and females. In the experimental sample, the form preference scores on the color-form test correlated significantly with the scores obtained on the modified version of the Stencil Design test.

The design of the study was based upon certain assumptions derived from the inferred relationship of F and C determinants on the Rorschach to selected personality traits. These assumptions state that the perception of form on the Rorschach denotes the traits of affective control and conceptual activity whereas emphasis on the color determinant is associated with impulsive behavior and motor activity. Form-preferring people are generally characterized in the Rorschach literature as conceptual, and introspective, with the emphasis on the thought processes. On the other hand, individuals stressing color on the Rorschach seem to rely on motoric, impulsive ways of expressing themselves. These assumptions appear to be indirectly supported by the results in the present study.

Additional evidence, which further tends to support the assumptions pertaining to form and color preference, was acquired by the writer in an exploratory study conducted with pathological groups. It was predicted that exaggerated behavior patterns of motor and mental activity as observed among

impulse-ridden and obsessive-compulsive neurotics, respectively, would be related to perceptual preferences for color or form as stated above. The Thurstone-Schmidt color-form test was administered to eleven women incarcerated for offenses which included physical assault on an individual. The misdemeanors varied from participation in an episode where a person was physically assaulted to second degree murder. For comparative purposes, five men and three women who were diagnosed as "obsessive-compulsive reaction" by two or more staff members (including a psychiatrist) of a mental hospital were also tested with the color-form film. The form preference mean score for the prison sample was 43.6; the obsessive-compulsive group obtained a form preference mean score of 69.1. The difference between the scores is significant at the .01 level and indicates a significantly greater preference for form among the obsessive-compulsive group than among those demonstrating impulsive tendencies. Although the results of this preliminary investigation cannot be considered final since age, sex, and intelligence factors have not been completely equated, the trends in the predicted direction suggest the fruitfulness of pursuing further research in this area.

It will be recalled that the major hypothesis set forth in this study states that form perceivers will function more efficiently than color perceivers when confronted with a restricted problem-solving task which emphasizes conceptual reasoning rather than manipulative activity. Implicit in this hypothesis are two corrolaries. One would state that if the problem-solving tasks were devised to permit the subjects freedom of choice in their mode of approach, then no difference in performance efficiency should exist between form- and color-oriented groups.

In order to obtain information regarding the validity of this corrolary

the writer carried out a preliminary experiment using the original version of the Grace Arthur Stencil Design test ( 2 ), which permits freedom of choice in approaching the tasks. The test was administered to two extreme perceptual groups consisting of six form and six color subjects (as measured by the Thurstone-Schmidt color-form test) who were matched as closely as possible for age, sex and intelligence. The test scores included not only the number of correct solutions but also the reaction time, total time, and total number of moves required for each task. No significant differences were detected between the two groups with respect to the number of correct solutions, mean reaction times, and mean total times. On the other hand, the mean number of extra moves required to complete the tasks proved to be significantly larger for the color group than for the form subjects ( $p < .02$).

Due to the possibility of a sampling error arising from the use of small comparative groups, no definite conclusions can be drawn from the results of this study. However, they do suggest some tentative inferences. Primarily, the findings appear to support the assumption that no difference exists in performance efficiency between form- and color-oriented perceptual groups when they are given the freedom to choose their preferred mode of approach in a problem-solving situation. It was also shown that the color-oriented subjects utilized more motor activity than the form-oriented persons in arriving at the correct solution of the stencil design problems. Over twice as many extra moves were recorded for the color group as for the form group. Although the results are in accord with Rosenthal's comparable data on M and C perceptual groups ( 60 ) strict comparisons between the two studies cannot be made since the experimental groups were selected by

dissimilar measures and according to slightly different perceptual criteria.

Comments offered spontaneously by some of the twelve subjects during the administration of the Stencil Design test showed that the form-oriented persons tended to think in terms of "problems" and "thinking it out" (e.g.; "I'll have to start over again and figure it out") while the color-oriented group members, using trial and error methods, were not only unaware how they had arrived at the correct solution but actually experienced difficulty in recognizing the solution after it was eventually obtained (e.g., "I don't know how I got them after I got them").

Hence, the evidence indicates that color-form preferences are important dimensions of personality and are related to characteristic response tendencies. It presumably shows that, given freedom to choose their mode of approach, two extreme perceptual groups will function with equal efficiency in solving problems. This clarifies the interpretation of the main findings and makes tenable the assumption that the variations of efficiency found among the subjects in this study were due to the restrictions imposed upon them by the nature of the experimental task. The modified presentation of the stencil design tasks precluded manipulation of the stencils in solving the problem while it apparently did not alter the requirements of the conceptual, cognitive mode of approach. The variations in performance efficiency have been attributed primarily to this limitation rather than to other possibly related factors, expecially in view of the fact that neither the form preference scores nor the stencil design scores correlated with age or intelligence for either sex in the main study.

The other corrolary implicit in the major hypothesis can be stated as follows. If a problem-solving situation were arranged so that the tasks

could be solved only by the adoption of a manipulative mode of approach, then it should follow that the efficiency of color-dominated individuals would remain high under such circumstances while that of form-dominated persons would be impaired. Such a series of tasks might prove to be difficult to construct since the solution to most problem-solving techniques involves some degree of conceptualization. One type of experimental design which might circumvent this difficulty could be one in which a subject is required, by means of manipulation, to arrive at a constantly shifting goal.

The findings reported in the study that men and women differ significantly in their performance efficiency suggests the possibility that sexual differences exist in the preferred mode of approach to problem-solving. Judging from the numerous experimental studies reported in the literature, sexual differences have been found in a large variety of psychological functions. Especially relevant to this study are the series of perception-personality experiments performed by Witkin and his colleagues ( 81 ) which show that men tend to use a more analytical approach than women in performing perceptual tasks. In view of the fact that the present study did not likewise demonstrate the existence of sexual differences with respect to perceptual preferences, conclusive interpretations concerning differences between males and females cannot be drawn from the data.

The question of a connection between form-color perception and intelligence has received much attention in the literature. Among Rorschach theorists, especially, this debate has assumed lively proportions and inconsistent findings have emerged from investigations of this problem. In this respect the present study fails to show any significant relationship

between form-color preferences and intelligence for males or females. It is difficult to evaluate the extent to which this finding contributes toward a resolution of the controversy, for the experimental situations are not strictly comparable. It may be that the form and color determinants on the Rorschach test measure a different cluster of behavioral traits than do form and color preferences on the Thurstone-Schmidt color-form test.

The subjects' comments concerning the difficulty of determining the direction of movement in the color-form test indicate that unconscious factors for the most part prompted their choice of color or form. Out of 99 subjects who expressed an opinion pertaining to difficulty on the color-form film, 43 found the task easy, and another 38 experienced moderate difficulty on some of the 144 presentations. Only 18 persons felt that they were unsure of the direction of the apparent movement throughout the test. The vast majority had no doubt that the stimulus figures were moving in the direction which they reported on the scoring sheet. Since the movement is only apparent, the subjects theoretically have an equal opportunity to "see" the band move either way. Hence, their perception of the tasks as easy or only moderately difficult can be interpreted in terms of their inability to see the alternate choice in most of the presentations. Further, an informal experiment was conducted with a small group of persons who had formerly taken the color-form test. They were asked in a retest to try to shift their set to attend to the alternate choices inherent in the colored bands. Most found this task difficult even when they were aware that an alternate way of perceiving the moving band existed. When two persons saw the same band moving in opposite directions each appeared convinced that his perception of this phenomenon was the correct one. Thus,

the color-form test seems to be a good device for measuring color-form variables since conscious attitudes are apparently kept at a minimum.

It remains a matter of speculation and theorizing as to why form perception should relate behaviorally to conceptual activity while color perception is affiliated with a preference for manipulative activity. Shachtel's thesis ( 62 ) is that color, like affect, demands action; that there is a directness and immediacy in the relationship between color and the responses it evokes. Although the perceiver experiences this process passively, he finds himself drawn into responding when the color is present. On the other hand, the form perceiver actively imposes meaning onto the form elements; he is deliberate and detached and approaches the situation rationally and objectively. Likewise, Witkin et al. ( 81 ), as a result of their extensive studies on the effect of perception in altered visual fields, suggest that the capacity for analytical dealing with a visual configuration (i.e.; the ability to "break up" the configuration) is closely related to the tendency toward active coping with (vs. passive submission to) environmental situations. Rickers-Ovsiankina ( 57 ) goes even further and attributes the perceptual-personality relationship to the extent of separation between the person's ego and the outside world. In her theoretical formulation, she proposes that a weak boundary between the inner and outer world allows for a rather free interplay of forces between the reacting person and his immediate environment. Colors, she feels, lend themselves readily to this interplay and hence serve as a good screening device for the degree of permeability of a person's outside boundary.

These explanations, while stressing the similarity between form-color perception and the activity-passivity roles of the perceiver, fail to take

into account the origins of this linkage. Phillips ( 51 ) believes, for example, that an evaluation of responses to color and form can be made only in terms of the genetic development of perceptual and social behavior.

A possible genetic approach proposed by the author, regarding the perceptual-personality affiliation, involves a consideration of the ways in which the developing child learns to control and direct his affective discharge in a manner acceptable to society. In order to conform to societal pressures, the child has to begin to deliberate and ponder his course of action. At this point "logical" and "purposive" thinking enters as a way of securing the continued existence of this mode of behavior. Form perception is most closely related to this type of formal and logical reasoning which is unimpaired by emotional considerations. Form elements in the environment come to be apperceived primarily in terms of their formal characteristics rather than in terms of their affective impact. If the child's efforts at social conformity are only partially effective he is forced to rely instead on repressive measures to handle his affects. In such a case, subjective, emotional elements often break through precipitously and influence his characteristic ways of behaving. Color perception appears to be related to this kind of affective expression and impulsive motor behavior. Thus, it would appear that the child tends to select more consistently that mode of perception which conforms most closely to his recently acquired behavioral preferences. As the child grows into maturity these perceptual personality patterns become solidified and constitute a characteristic way of responding under normal circumstances. Murphy describes this relationship in terms of the individual's constant search for form.

> "We know that the need for form and the manner of seeking it differ widely from one child to another. Some children move rapidly forward to sharp and clear organization; other children take in global masses of meaning and talk in geyser-fashion . . . . . (certain problems) are handled by some children through incisive piecemeal analysis and synthesis; others attack them globally, making many small acts simultaneously on many aspects of the total. The adult's quest for form is in part a continuation of, or transfer from, the form seeking tendencies of early infancy. Form perception and the capacity to respond to and use form appear to develop in a direction determined by individual idiosyncrasy". ( 47, p. 359 ).

The above theoretical formulation suggests that further research should be extended to include studies of genetic perceptual development and related behavioral traits. In accordance with this theory, a prediction might be stated that those children who manifest marked shifts in perception from color to form preference as they grow older will concurrently demonstrate an increasing preference for a rational, conceptual mode of approach in solving daily problems. On the other hand, others who show only slight movement from color to form preference will be more emotional and physically active in their mode of approach in coping with their environment.

# CHAPTER V

# SUMMARY AND CONCLUSIONS

## I. SUMMARY

Although assumptions regarding form and color on the Rorschach test constitute one of the main bulwarks of Rorschach personality theory, they have not been subjected to close experimental scrutiny. Several investigators have attempted in recent years to relate form and color determinants on the Rorschach test to selected measures of personality and behavior. However, the propriety of using the Rorschach test as the instrument to validate one or more of its own determinants is open to question.

The purpose of this study was to provide an experimental examination of performance efficiency in a problem-solving situation as a function of the preference for form or color perception.

A review of the literature with respect to color-form perception indicated a general agreement that form preference is closely associated with mental activity whereas preference for color is related to emotional and conative modes of behavior. From the nature of these relationships it was hypothesized that a person's perceptual preferences will indicate his mode of approach in a problem-solving situation.

Hypothesis: The hypothesis was made that perceptual preference for form reflects a tendency to emphasize a conceptual, cognitive mode of approach; a preference for color reflects a tendency to emphasize a manipulative, conative mode of approach.

Prediction: A behavioral prediction was derived from this assumption: Individuals who prefer form perception will perform more efficiently than color perceivers in solving problems which are constructed in such a manner as to emphasize conceptualized reasoning rather than manipulation and trial and error methods.

Experimental design: The prediction was tested in an experiment designed to establish the relationship of subjects' scores in an experimentally restricted problem-solving situation to form and color scores obtained on a perceptual task.

An independent perceptual test (the Thurstone-Schmidt color-form ratio test) was chosen as the most suitable instrument to ascertain preferences for form or color. By means of this instrument individuals could be ranked along a continuum ranging from predominantly color responses to predominantly form responses.

A modified version of the Grace Arthur Stencil Design test was employed as the measure of efficiency of performance in a problem-solving situation. The original task required the subjects to assemble a number of stencils in order to reproduce a design displayed before them. In the altered version employed in the study the stencils and designs were enlarged threefold and were administered in a group setting. The new requirements prevented the subjects from handling the stencils. Instead they were forced toward a conceptual determination of the stencil combination needed to achieve a correct solution. Eighteen stencil design problems were used. They were arranged in an ascending order of difficulty as determined by the author of the test. Except for the last two stencil designs, the correct number of stencils required for each task was made known to the subjects. A scoring system was

devised to afford partial credit for incomplete solutions. The total score earned on the eighteen stencil design tasks served as the measure of performance efficiency.

Operational prediction: The behavioral prediction deduced from the assumption above was restated in operational terms. Form preference ( F% ) scores on the color-form film will correlate positively with efficiency scores obtained on the Stencil Design test.

A total of one hundred twelve men and women were used in the study. They were drawn from three evening classes in Human Relations and one evening psychology class conducted at a nearby university. The age range was limited to eighteen to forty-nine years and the range of intelligence varied from an I.Q. of 90 to an I.Q. of 135. No subject with visual difficulties or previous knowledge of the tests was used.

The subjects were tested in two separate group sessions. In the first session the color-form film was administered to obtain a frequency distribution of form preference scores. A self-administering measure of intellectual functioning, the Shipley Hartford Conceptual Quotient Scale, completed the remainder of this session. The group administration of the Stencil Design test constituted the second session.

Statistical hypothesis: The operational prediction was translated into the following statistical hypothesis: the population value of the correlation between form preference scores and stencil design scores is zero.

Before this hypothesis was examined the frequency distributions of the total form preference, stencil design, and intelligence scores were tested for normalcy and were found to approximate the normal curve. When the total scores were separated according to sex and compared statistically, it was

found that the male and female groups came from the same population with respect to age, intelligence, and form preference scores but differed significantly in their stencil design mean scores. The mean stencil design score for the females was significantly lower than that determined for the male group. Hence, the data for both groups were analyzed separately.

Pearson's product-moment correlation was used to measure the degree of relationship between color-form preferences and behavioral efficiency of performance. It was found that the major hypothesis was confirmed for both the male and female groups. For the male group the obtained value of r was .54, for the female group, r was .63. Both correlations met the requirements of significance at the .01 level. Additional statistical analysis showed that neither age nor intelligence was significantly correlated with form preference scores or stencil design scores. This held true for both sexes. Support was therefore indicated for the behavioral prediction that people who prefer form function more efficiently in a problem-solving task which places the emphasis on conceptualization and mental activity than do people who prefer color.

There is evidence in the literature to support the contention that, age and intelligence held constant, both perceptual groups would function with the same degree of efficiency in an unrestricted problem-solving situation. In addition, an exploratory study was conducted by the examiner which lent added support to this assumption. When the original version of the Stencil Design test was administered to two small ( N = 12 ) extreme form and color perceptual groups, similar stencil design mean scores were obtained by both. Thus, it was concluded that the appearance of a positive

relationship which was found to exist in this study between color-form perception and efficiency of performance could be attributed to the altered nature of the problem-solving task which precluded the use of the manipulative, conative mode of approach.

## II. CONCLUSIONS

A relationship has been shown to exist between an individual's preference for form and efficient performance in a problem-solving situation where deliberation, mental activity, and conceptualization are emphasized. On the other hand, people displaying a preference for color will suffer in performance efficiency when confronted with such a task presumably because they prefer the application of a manipulative, trial and error mode of approach in solving problems.

This study has lent support to some of the commonly held assumptions pertaining to form and color perception. Most of these assumptions are well rooted in empirical observation and clinical intuition but there has been a noticeable lack of concise experimental studies in this area. It is the author's hope that these positive findings will serve to focus more attention on color-form and related perceptual problems.

## III. IMPLICATIONS FOR FURTHER RESEARCH

Questions which have arisen during the course of the study suggest further research pertaining to color-form perception and related behavioral variables.

1. The results of the present study offer indirect evidence that confirms propositions derived empirically from the Rorschach C and

F determinants. Support for the validity of these propositions would be greatly strengthened if associations could be shown to exist between color and form on the Thurstone-Schmidt color-form test and C and F determinants on the Rorschach. An important question that needs to be answered in this respect is whether color and form tendencies on the Rorschach test are equivalent to color and form as perceived in independent perceptual situations.

2. Further research with the Thurstone-Schmidt color-form film may be profitably extended to the study of genetic perceptual development and related behavioral traits. There is evidence in the literature to indicate that preference for color decreases with increasing age among children. This inverse relationship, if confirmed by the color-form test, could serve as a basis for a longitudinal study of development changes in preferred modes of behavior. The findings of the present study suggest the expectation that those children who manifest marked shifts from the color to the form end of the perceptual continuum will tend to prefer a rational, conceptual mode of approach to problems in maturity, whereas others who show only slight shifts from color to form preference, will demonstrate a more emotional, conative mode of approach.

3. Finally, exaggerated behavior patterns as observed in deviant segments of the population may serve to illustrate contrasts in color-form preferences. Pathological groups with syndromes implying opposite behavioral characteristics, such as obsessive-compulsive

and impulse-ridden neurotics, could be used to extend the validity of the behavioral correlates of color-form preferences to neurotic groups. An exploratory investigation of this nature was conducted by the writer using an obsessive-compulsive neurotic group and a group of prison inmates incarcerated for inflicting physical violence on another person. The tentative findings revealed significant perceptual differences among the two groups as predicted. These findings could be extended to other pathological groups and serve as a starting point for a clearer understanding of the nature of perceptual-personality relationships.

# APPENDIX A

## TEST SCORING SHEETS

## AND TEST REPRODUCTIONS

Directions: You are to list in their proper order (from top to bottom) the stencils which are needed to reproduce each design correctly. The stencils are numbered consecutively from 1 through 18. You can tell how many stencils it will take to solve a specific design by counting the number of blank lines marked under that problem. For example, No. 1 has two blank lines, indicating that two stencils are all that are needed to correctly reproduce the design. On the other hand, No. 10 with four blank lines, signifies that four stencils will be needed to solve this problem. The number of the stencil that should be on top is to be listed on the first blank line. List on the line below the number of the stencil which you believe goes next. This procedure is repeated so that the stencil that goes on the bottom is the last one to be numbered. If you are not sure of the correct order, guess! At least try to put down the numbers of the stencils that make up the design even if you don't know the order in which they go. Try to do every one.

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
|---|---|---|---|---|---|---|---|---|---|
| top | top | top | top | top | top | top | top | top | top |
| ____ | ____ | ____ | ____ | ____ | ____ | ____ | ____ | ____ | ____ |
| | | | | | | | ____ | | ____ |
| | | | ____ | ____ | ____ | ____ | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ | ____ | ____ | ____ | ____ | ____ | ____ |
| Bottom | bottom | bottom | bottom | bottom | bottom | bottom | bottom | bottom | bottom |

| 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. |
|---|---|---|---|---|---|---|---|
| top | top | top | top | top | top | top | top |
| ____ | | ____ | ____ | ____ | ____ | | |
| ____ | ____ | ____ | | ____ | ____ | | |
| ____ | ____ | ____ | ____ | ____ | ____ | | |
| ____ | | ____ | ____ | ____ | ____ | | |
| ____ | ____ | ____ | ____ | ____ | ____ | | |
| bottom | bottom | bottom | bottom | bottom | bottom | | |

Figure 2. The Grace Arthur Stencil

Design Scoring Sheet

NAME

In the test below, the first word in each line is printed in capital letters. Opposite it are four other words. DRAW A LINE under the ONE WORD which means the SAME THING, or most nearly the same thing, as the first word. A sample has been worked out for you. If you don't know, GUESS. Be sure to underling the ONE WORD in each line that means the same thing as the first word.

sample

| | | | | | |
|---|---|---|---|---|---|
| LARGE | | red | big | silent | wet |

begin here

| | | | | | |
|---|---|---|---|---|---|
| (1) | TALK | draw | eat | speak | sleep |
| (2) | PERMIT | allow | sew | cut | drive |
| (3) | PARDON | forgive | pound | divide | tell |
| (4) | COUCH | pin | eraser | sofa | glass |
| (5) | REMEMBER | swim | recall | number | defy |
| (6) | TUMBLE | drink | dress | fall | think |
| (7) | HIDEOUS | silvery | tilted | young | dreadful |
| (8) | CORDIAL | swift | muddy | leafy | hearty |
| (9) | EVIDENT | green | obvious | skeptical | afraid |
| (10) | IMPOSTER | conductor | officer | book | pretender |
| (11) | MERIT | deserve | distrust | fight | separate |
| (12) | FASCINATE | welcome | fix | stir | enchant |
| (13) | INDICATE | defy | excite | signify | bicker |
| (14) | IGNORANT | red | sharp | uninformed | precise |
| (15) | FORTIFY | submerge | strengthen | vent | deaden |
| (16) | REKNOWN | length | head | fame | loyalty |
| (17) | NARRATE | yield | buy | associate | tell |
| (18) | MASSIVE | bright | large | speedy | low |
| (19) | HILARITY | laughter | speed | grace | malice |
| (20) | SMIRCHED | stolen | pointed | remade | soiled |
| (21) | SQUANDER | tease | belittle | cut | waste |
| (22) | CAPTION | drum | ballast | heading | ape |
| (23) | FACILITATE | help | turn | strip | bewilder |
| (24) | JOCOSE | humorous | paltry | fervid | plain |
| (25) | APPRISE | reduce | strew | inform | delight |
| (26) | RUE | eat | lament | dominate | cure |
| (27) | DENIZEN | senator | inhabitant | fish | atom |
| (28) | DIVEST | dispossess | intrude | rally | pledge |
| (29) | AMULET | charm | orphan | dingo | pond |
| (30) | INEXORABLE | untidy | involatile | rigid | sparse |
| (31) | SERRATED | dried | notched | armed | blunt |
| (32) | LISSOM | moldy | loose | supple | convex |
| (33) | MOLLIFY | mitigate | direct | pertain | abuse |
| (34) | PLAGIARIZE | appropriate | intend | revoke | maintain |
| (35) | ORIFICE | brush | hole | building | lute |
| (36) | QUERULOUS | maniacal | curious | devout | complaining |
| (37) | PARIAH | outcast | priest | lentil | locker |
| (38) | ABET | waken | ensue | incite | placate |
| (39) | TEMERITY | rashness | timidity | desire | kindness |
| (40) | PRISTINE | vain | sound | first | level |



Figure 3. The Shipley-Hartford Conceptual Quotient Scale.

SHIPLEY - HARTFORD C. Q. SCALE
ABSTRACTION TEST

E_____

Complete the following. Each dash (-) calls for either a number or a letter to be filled in. Every line is a separate item. Take the items in order, but don't spend too much time on any one.

start here

1 2 3 4 5 -

white black short long down --

AB BC CD D -

Z Y X W V U -

1 2 3 2 1 2 3 4 3 2 3 4 5 4 3 4 5 6 - -

NE/SW SE/NW E/W N/-

escape scape cape ---

oh ho rat tar mood ----

A Z B Y C X D -

) tot tot bard drab 537 ---

) mist is wasp as pint in tone --

) 57326 73265 32657 26573 -----

) knit in spud up both to stay --

) Scotland landscape scapegoat ----ee

) surgeon 1234567 snore 17635 rogue -----

) tam tan rib rid rat raw hip ---

) tar pitch throw saloon bar rod fee tip end plank ----- meals

) 3124 82 73 154 46 13-

) lag leg pen pin big bog rob ---

) two w four r one o three --



Figure 3. (cont.) The Shipley-Hartford Conceptual Quotient Scale.

# Manual of Directions
# for the
# STENCIL DESIGN TEST I
# by
# Grace Arthur, Ph.D.

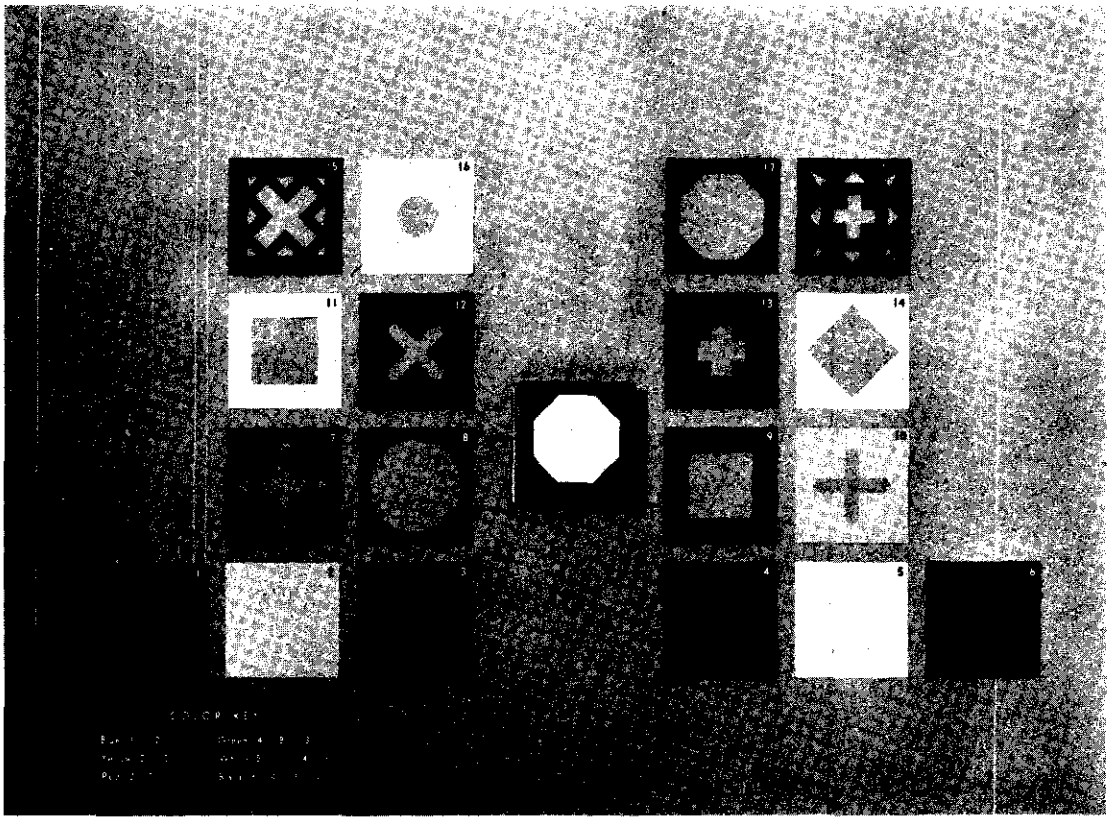

**Figure 4. Manual for the Grace Arthur Stencil Design Test I**



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## DESCRIPTION

The Stencil Design Test I consists of twenty designs, each three inches square, and eighteen colored cards, also three inches square, to be used to reproduce the designs. Six of these colored cards are solid and twelve are stencils. All the color cards and stencils are reversible, so that no time is lost if a card is laid face down on the table.

The designs and stencils are symmetrical so that there is no possibility of difficulty with up-down or right-left reversals. The colors have been selected so that even patients known to be handicapped by a considerable degree of color blindness will have no difficulty in distinguishing them.

The designs are arranged and numbered by order of difficulty. This order must be followed in presenting the designs since the degree of difficulty is affected by the position in the series. The cards for reproducing the designs are numbered to facilitate placing them on the table in the correct order. If the table is either black or white, a cover of some neutral color should be provided so that the stencils may be easily seen.

A stop watch is needed for timing the work on each design. The time needed to complete each design should be recorded on the record sheet as well as whether it is correctly reproduced.

## PROCEDURE

Place the stack of designs before the subject, about ten inches from the edge of the table. Lay down the eighteen colored cards in numerical order as shown in the picture on the cover.

Say: "You can make all these designs (pointing to the stack) with these cards." Point to the Sample Design which is on top of the stack and say: "Pick out the cards you need and make this one." Allow time for the subject to comprehend that he is to copy the design both in form and color. Encourage him to build in the space between the stack of designs and the edge of the table, but do not insist if he clings to some other method. Give him any help that is needed to complete the Sample Design, but do not give any verbal explanations.

When the design is completed, say: "Get the edges even, so that you can see whether the design is right or not. Always take a good look to make sure the design is the way you want it before you tell me it is finished." When the subject signifies that he is satisfied, say: "Put the cards that you used back where they were, so that you can find them when you need them again." Do not insist that cards be replaced in their original positions, but make sure after each design is either completed or failed that all the cards are placed on the table without overlapping, so that they can be readily seen. As soon as the used cards have been placed back on the table, turn the completed design face down between the stack of design cards and the examiner, exposing the next design. Tell the subject to reproduce the new design and start the stop watch. The time limit is four minutes for each design.

If Design I is not completed within the time limit, record as failed. Then give whatever help is necessary for the patient to complete it. Do the same for Designs II, III, IV, or V, unless Designs I, II and III are all failed, in which case the test is discontinued. Do not allow extra time for the completion of the designs after Design V, or give any hints as to their solution, as these may affect the work on subsequent designs.

As soon as the subject indicates that he has completed a design, stop the watch. Record the time in seconds (as 20") or in minutes and seconds (as 2' 15") and if the design is correct, put a check in the correct-items column. Record any fraction of a second as a whole second. If the subject shows his reproduction of the design to the examiner asking "Is this right?" the watch is stopped and the solution recorded. He should then be warned that he, and not the examiner, is the one to decide when he has completed the task to his own satisfaction.

When Design IV is presented, say: "Use as many as you need to make this one."

Design VIII offers the only exception to the rule stated above that no hint as to the correct solution shall be given after Design V. For Design VIII there is a frequent tendency to omit the white border. When this occurs, the failure is recorded, and then the examiner points to the white border and says: "The whole card is the design, not just the center. You forgot this part, didn't you?"

Continue testing until three designs in succession have been failed. However, Design XIX is given only to those who have completed Design XVIII within the four-minute time limit. Similarly, Design XX is given only to those who have completed Design XIX within the time limit.

## SCORING

The score is the number of designs successfully completed within the time limit. Eventually, extra point values will be allowed for the completion of a design in less than average time, if this is shown to increase the discriminative value of the test.

## NORMS

On the basis of 300 cases from the same district used in establishing norms for Form I of the Point Scale of Performance Tests, tentative norms for the Stencil Design Test I were accumulated. The addition of cases (bringing the total to 968) in the course of standardizing Revised Form II of the Point Scale of Performance Tests, confirmed these norms in detail.

| C. A. in years* | Number of Designs | C. A. in years* | Number of Designs |
|---|---|---|---|
| 4 | 0 | 10 | 10 |
| 5 | 1 | 11 | 11 |
| 6 | 3 | 12 | 12 |
| 7 | 5 | 13 | 13 |
| 8 | 7 | 14 | 14 |
| 9 | 9 | 15 | 15 |

* A year's range is from one birthday to the next. For example, six-year-olds include all those who are between their sixth and seventh birthdays.

Although the average four-year-old does not succeed in completing even one design, he finds the top card for at least one of the first three designs.

## USE

The Stencil Design Test I is one of the five tests standardized as the Revised Form II of the Point Scale of Performance Tests. The manual for this Point Scale (2) contains a more complete discussion of the test, including instructions for pantomime administration to deaf or non-English-speaking subjects, and a few case illustrations of its apparent validity for prediction of success in mechanical drawing or drafting and other high school courses, in addition to its usefulness in helping to determine a subject's general mental age level.

Eighteen pupils tested in an Indian school before the procedure for this test had been standardized received much less help than did the standardization group. In spite of this, they earned a median IQ of 96 calculated from the above norms.

The Stencil Design Test I offers an opportunity for observing the behavior of psychopathic cases in dealing with spatial relations. One child, in whom an early encephalitis had been suspected, showed reactions so different from those of normal or simply retarded children as to suggest that there had been some injury to the central nervous system.

Later, it is planned to produce the material in a form suitable for use with spastics.

## HISTORY (1), (3)

The Stencil Design Test I had its beginning when the retest norms for Form II of the Point Scale of Performance Tests indicated that the Kohs Block Design Test was showing too high a degree of practice effect, especially at the upper age levels. It was then that the search began for an equally useful test to replace the Kohs Block Design Test in an alternate form of the scale. This Stencil Design Test I was constructed for this.

The order of difficulty of the designs was determined by giving them to individuals at the Children's Preventorium of Ramsey County, increasing or decreasing the difficulty of designs at strategic points, and trying out the revised series on other children at the Preventorium. The test was then given to eighteen pupils, ranging in age from six to nineteen, at the school at the Pine Ridge Indian Agency. On the basis of this experience, the procedure and instructions were standardized for use with the normative group.

Pupils of three Saint Paul schools were used for the standardization group: the Wilder Day Nursery for the lower levels, the Woodrow Wilson High School for the higher levels, and the Galtier School for the intermediate levels.

## ACKNOWLEDGMENTS

The revision and standardization of Form II of the Point Scale of Performance Tests are being made possible by a grant from the Amherst H. Wilder Charity of Saint Paul. The Stencil Design Test I was standardized as a part of that scale, but can be used independently.

Margaret Weikert, Superintendent, and the staff of the Children's Preventorium of Ramsey County sent in the children as they were needed for the original work on the level of difficulty of the designs.

The Pine Ridge Indian Agency, South Dakota, supplied the pupils for the standardization of procedure.

Meryl Walker, Superintendent of the Wilder Day Nursery and her staff were most helpful in obtaining children from the younger age group as they were needed for testing.

Paul S. Amidon, Superintendent of Schools, Saint Paul; Russell Petersen, Principal of the Woodrow Wilson High School; William C. Davini, Principal of the Galtier School; and their respective staffs have made possible the collection of the tentative norms.

The children themselves, from the four-year olds of the Day Nursery to the fifteen-year-olds in high school have by their enthusiastic cooperation turned a routine chore into a delightful experience. The pupils of the Pine Ridge Indian School gave of their free time in order to help get the Revised Form II of the Point Scale of Performance Tests into its final form and the procedure for the Stencil Design Test I determined so that the standardization could be begun.

The Psychological Corporation would appreciate receiving test scores and any additional information that would be helpful in the final standardization.

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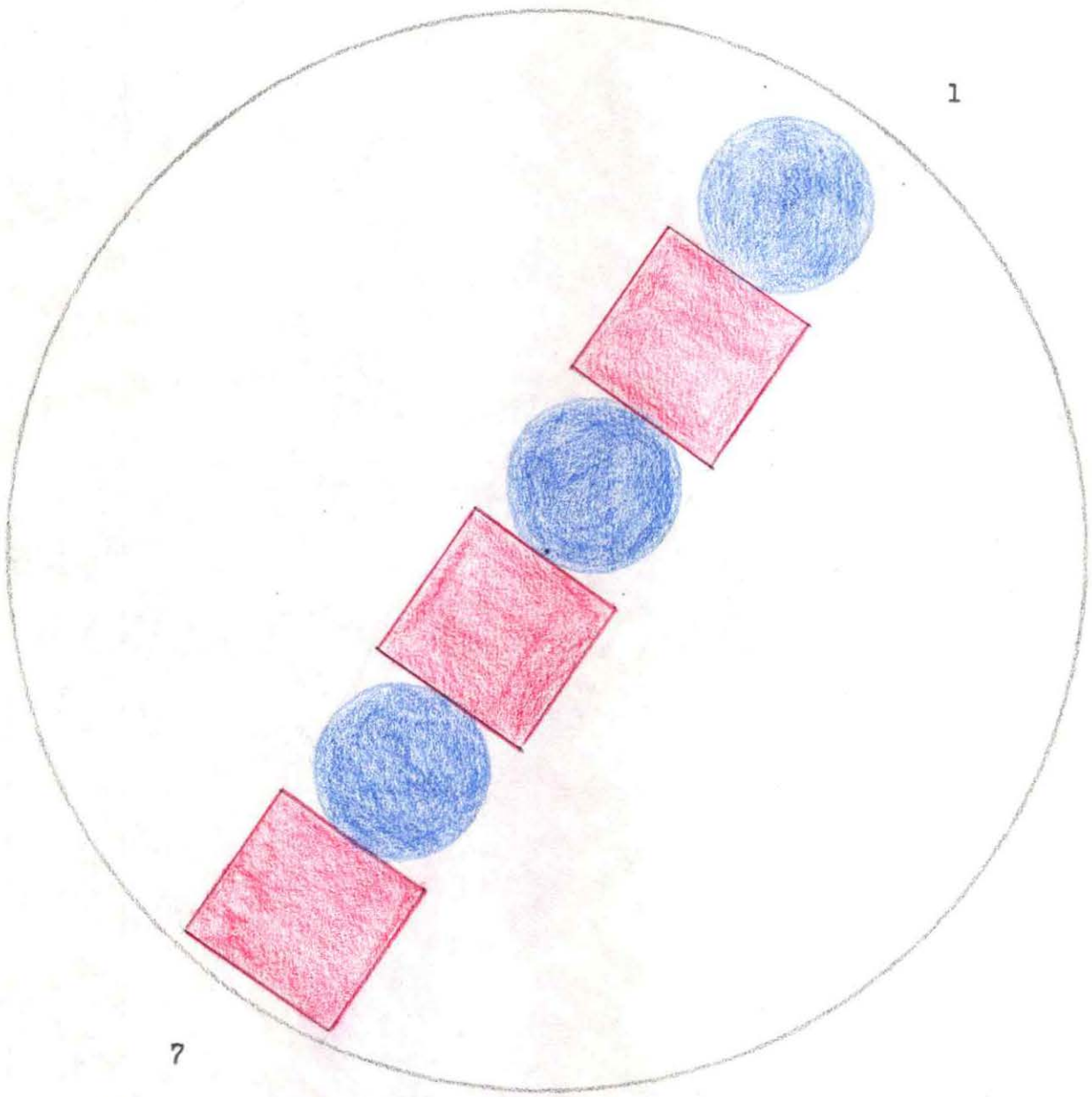


Figure 5. Replica of Thurstone-Schmidt Color-Form Design.

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# COLOR-FORM PREFERENCES AND EFFICIENCY IN PROBLEM-SOLVING

Abstract of a Dissertation

Submitted in partial fulfilment of the requirements

for the degree of Doctor of Philosophy

BOSTON UNIVERSITY GRADUATE SCHOOL

by

Gershen Rosenblum

A.B., Harvard College, 1947

A.M., Boston University, 1949

Department: Psychology

Field of Specialization: Clinical Psychology

Major Instructor: Professor Chester C. Bennett

1955

## ABSTRACT

Although assumptions regarding form and color on the Rorschach test constitute one of the main bulwarks of Rorschach personality theory, they have not been subjected to close experimental scrutiny. Several investigators have attempted in recent years to relate form and color determinants on the Rorschach test to selected measures of personality and behavior. However, the propriety of using the Rorschach test as the instrument to validate one or more of its own determinants is open to question.

The purpose of this study was to provide an experimental examination of performance efficiency in a problem-solving situation as a function of the preference for form or color perception.

A review of the literature with respect to color-form perception indicated a general agreement that form preference is closely associated with mental activity whereas preference for color is related to emotional and conative modes of behavior. From the nature of these relationships it was hypothesized that a person's perceptual preferences will indicate his mode of approach in a problem-solving situation.

Hypothesis. The hypothesis was made that perceptual preference for form reflects a tendency to emphasize a conceptual, cognitive mode of approach; whereas a preference for color reflects a tendency to emphasize a manipulative, conative mode of approach.

Prediction. A behavioral prediction was derived from this assumption. Individuals who prefer form perception will perform more efficiently

than color perceivers in solving problems which are constructed in such a manner as to emphasize conceptualized reasoning rather than manipulation and trial and error methods.

Experimental design. The prediction was tested in an experiment designed to establish the relationship of subjects' scores in an experimentally restricted problem-solving situation to form and color scores obtained on a perceptual task.

An independent perceptual test (the Thurstone-Schmidt color-form ratio test) was chosen as the most suitable instrument to ascertain preferences for form and color. By means of this measure individuals could be ranked along a continuum ranging from predominantly color responses to predominantly form responses.

A modified version of the Grace Arthur Stencil Design test was employed as the measure of efficiency of performance in a problem-solving situation. The original task required the subjects to assemble a number of stencils in order to reproduce a design displayed before them. In the altered version employed in this study the stencils and designs were enlarged threefold and were administered in a group setting. The new requirements prevented the subjects from handling the stencils. Instead they were forced toward a conceptual determination of the stencil combination needed to achieve a correct solution. Eighteen stencil design problems were used. They were arranged in an ascending order of difficulty as determined by the author of the test. Except for the last two stencil designs, the correct number of stencils required for each task was made known to the subjects. A scoring system was devised to afford partial credit for incomplete solutions. The total score earned on the

eighteen stencil design tasks served as the measure of performance efficiency.

A total of one hundred twelve men and women were used in the study. They were drawn from three evening classes in Human Relations and one evening psychology class conducted at a nearby university. The age range was limited to eighteen to forty-nine years and the range of intelligence varied from an I.Q. of 90 to an I.Q. of 135. No subject with visual difficulties or previous knowledge of the tests was used.

The subjects were tested in two separate group sessions. In the first session the color-form film was administered to obtain a frequency distribution of form preference scores. A self-administering measure of intellectual functioning, the Shipley Hartford Conceptual Quotient Scale, completed the remainder of this session. The group administration of the Stencil Design test constituted the second session.

Operational Prediction. The behavioral prediction deduced from the assumption above was restated in operational terms. Form preference ( F % ) scores on the color-form test will correlate positively with efficiency scores obtained on the Stencil Design test.

Statistical hypothesis. The statistical hypothesis tested states that the population value of the correlation between form preference ( F % ) scores and stencil design scores is zero.

Before this hypothesis was examined the frequency distributions of the total form preference, stencil design, and intelligence scores were tested for normality and were found to approximate the normal curve. When the total scores were separated according to sex and compared statistically

it was found that the male and female groups came from the same population with respect to age, intelligence, and form preference scores but differed significantly in their stencil design mean scores. The mean stencil design score for the females was significantly lower than that determined for the male group. Hence, the data for both groups were analyzed separately.

Pearson's product-moment correlation was used to measure the degree of relationship between color-form preferences and behavioral efficiency of performance. It was found that the major hypothesis was confirmed for both the male and female groups. For the male group the obtained value of r was .54, for the female group, r was .63. Both correlations met the requirements of significance at the .01 level. Additional statistical analysis showed that neither age nor intelligence was significantly correlated with form preference scores or stencil design scores. This held true for both sexes. Support was therefore indicated for the behavioral prediction that people who prefer form function more efficiently in a problem-solving task which places the emphasis on conceptualization and mental activity than do people who prefer color.

There is evidence in the literature to support the assumption that, age and intelligence held constant, both perceptual groups would function with the same degree of efficiency in a free choice problem-solving situation. In addition, an exploratory study was conducted by the experimenter which lent added support to this assumption. When the original version of the Stencil Design test was administered to two small ( N = 12 ) extreme form and color perceptual groups, similar stencil design mean scores were

obtained by both. Thus, it was concluded that the appearance of a positive relationship which was found to exist in this study between color-form perception and efficiency of performance, could be attributed to the altered nature of the problem-solving task which precluded the use of the manipulative, conative mode of approach.

This study has lent support to some of the commonly held assumptions pertaining to form and color perception. Most of these assumptions are well rooted in empirical observation and clinical intuition but there has been a noticeable lack of concise experimental studies in this area.

Questions which have arisen during the course of the study suggest further research pertaining to color-form perception and related behavioral variables.

1. The results of the present study offer indirect evidence that confirms propositions derived empirically from the Rorschach C and F determinants. Support for the validity of these propositions would be greatly strengthened if associations could be shown to exist between color and form on the Thurstone-Schmidt color-form test and C and F determinants on the Rorschach.
2. Further research with the Thurstone-Schmidt color-form film may be profitably extended to the study of genetic perceptual development and related behavioral traits. There is evidence in the literature to indicate that preference for color decreases with increasing age among children. This inverse relationship, if confirmed by the color-form test, could serve as a basis for a longitudinal study of development changes in preferred modes of behavior.

3. Finally, exaggerated behavior patterns as observed in deviant segments of the population may serve to illustrate contrasts in color-form preferences. Pathological groups with syndromes implying opposite behavioral characteristics, such as obsessive-compulsive and impulse-ridden neurotics, could be used to extend the validity of the behavioral correlates of color-form preferences to neurotic groups. An exploratory investigation of this nature was conducted by the writer using an obsessive-compulsive neurotic group and a group of prison inmates incarcerated for inflicting physical violence on another person. The tentative findings revealed significant perceptual differences among the two groups as predicted. These findings could be extended to other pathological groups and serve as a starting point for a clearer understanding of the nature of perceptual-personality relationships.

Conclusion. A relationship has been shown to exist between an individual's preference for form and efficient performance in a problem-solving situation where deliberation, mental activity, and conceptualization are emphasized. On the other hand, people displaying a preference for color suffer in performance efficiency when confronted with such tasks presumably because they prefer the application of a manipulative, trial and error mode of approach in solving problems.

AUTOBIOGRAPHY

I was born in Boston, Massachusetts on January 23, 1924, the twin son of Benjamin and Rose Rosenblum. I was educated in the Boston public schools and entered Harvard College in 1941. Two years later I entered the U. S. Army and served at home and abroad for three years. In 1946 I returned to Harvard and received my A. B. degree in the fall of 1947. I then enrolled in the Boston University Graduate School and earned my Master's degree in Psychology in 1949.

While interning at the Judge Baker Guidance Center as a U. S. Public Health Fellow in Clinical Psychology I met my wife, Eleanor Slimp, who was then employed on the staff as a Social Worker. We were married at Cincinnati, Ohio on August 30, 1951. At present we have one child, Bruce Edward, born November 1, 1953.

I am currently employed part time at the James Jackson Putnam Children's Center in Roxbury, Mass. as a Research Psychologist and at the Massachusetts General Hospital as a Research Fellow in Psychiatry. In addition, I serve as Clinical Psychologist for the Barnstable County Mental Health Clinic, Hyannis, Mass.