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Some Personality Variables in Relation to Problem Solving Processes of College Students

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SOME PERSONALITY VARIABLES IN RELATION TO PROBLEM SOLVING PROCESSES OF COLLEGE STUDENTS

by

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VITA

Ana María Insua was born in Casilda, State of Santa Fé, Argentina, in October 28, 1931. She obtained the degree of M.A. (Profesora de Enseñanza Secundaria, Normal y Especial en Filosofía) from the University of Buenos Aires. She worked as a clinical psychologist in the John H. Jackson Institute of Buenos Aires and taught Rorschach Test in the Superior Institute of Religious Education and in The Catholic University of Buenos Aires.

In 1966, the National Counsil of Scientific and Technical Research of Argentina (Consejo Nacional de Investigaciones Científicas y Técnicas) granted her a scholarship to learn research methodology in the Psychometric Laboratory of Loyola University, Chicago.

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CHAPTER I

Introduction and Statement of the Problem

It is generally accepted that our intelligence is shaped and modified by many factors. We are under the influence of trends of which we are not aware, that is the wishes and forces of the unconscious. It has been said that we see the external world not only as it is, but also as we are. We select, modify or even alter external stimuli according to our motives and interests.

To explore these areas related to the thinking process many studies have been undertaken. This research will approach the study of the relation of personality to the thinking process by means of an inkblot test (Holtzman) and problem solving tasks.

At the beginning of this century, Alfred Binet used inkblots to study individual differences in intelligence. Since then, and mainly in the work of Hermann Rorschach, inkblots have been employed as an approach to study personality variables.

It has been assumed that some of those variables are related to the way a person perceives a situation and solves a problem. By isolating each variable, it is logical to expect a difference in the problem solving performance of subjects with high and low scores in any particular variable.

The use of a projective technique, like the Rorschach test for a research project presents many difficulties. One major problem is that the test is not easily quantifiable since it deals with many variables and attempts to describe the individual in terms of a dynamic pattern of interrelated variables. Another problem is that the number of responses

varies widely for different subjects. Subjects cannot be compared in terms of absolute incidence of a given type of response since this depends on the total number of responses.

The Holtzman Inkblot Technique is used in this study because it has been designed to overcome the psychometric limitations of the Rorschach Test. Allowing one response to each of the 45 cards, it equates the number of respones between subjects. The scoring system includes 22 variables with scores ranging from 0 to 45. Holtzman has tried to preserve the clinical sensitivity of the Rorschach while improving the objective, quantitative aspects of the method. In his book "Inkblot Perception and Personality"(1965), he reports a study by Beck, Haggard and Bock (1965) correlating both the Rorschach and the Holtzman. Correlations between the two test were all significant ranging in value from .30 to .79. Holtzman concludes that "in view of the known differences in the two systems, and the lack of information on the reliability of the Rorschach scores, these correlations are sufficiently high to justified the conclusion that variables in the Holtzman Inkblot Technique have similar meaning to their corresponding Rorschach scores" (p.254).

Several studies have tried to find out the relationship between Rorschach variables and intelligence. Since the Holtzman Inkblot Test is concerned essentially with the same variables as the Rorschach, reference to interpretative hypotheses and existing literature will take into account both tests.

In order to avoid the complications of putting many variables together, this study observes each personality variable in isolation. Important nuances such as the quality and content of the responses will not be considered here. The study of variables in isolation may really be the first

step for the understanding of variables in interaction.

The type of method used in problem solving has been previously described by Rimoldi H.J.A., Fogliatto H., Erdmann J., Donnelly M.,(1964). It was specifically applied to the evaluation of medical students making clinical diagnoses. Essentially it is an attempt to study the thinking processes of a subject by analysing the questions that he asks in order to solve a problem. The sequence of questions asked is called a tactic. Each tactic is experimentally defined by the number, type, and order of the questions asked.

In this technique, emphasis is placed on the process leading to a solution rather than on the solution itself. The interpretation of the problem and the final answer provides a clearer evaluation of the subject's thinking than the one that can be obtained from inferences made from the final answer exclusively.

In each problem the formal properties or logical structure and the language in which these structures are presented have been differentiated. The logical structure of each problem is defined by the set of relationships inherent to the problem. The varying complexity of the logical structure determines different levels of intrinsic difficulty. The word "language" is used in a very general sense and refers to the manner of presentation, i. e., words, special symbols, negative statements, pictures, etc. The language determines different levels of extrinsic difficulty.

The same structure can be presented with different "languages" or vice versa, the same "language" can be used in different structures. This flexibility allows one to distinguish the importance of each component in the thinking process of groups formed according to personality variables.

An important characteristic of these problems is the scoring system. It is dependent upon the nature of the problem itself rather than the performance of a particular group. From the logical analysis of the problem an ideal tactic is defined. The score depends on the extent to which an individual subject approaches the ideal tactic.

CHAPTER II

Review of the Related Literature

This study will consider exclusively the literature closely related with the relationship of personality variables assessed by an inkblot test, and problem solving processes. All the vast literature concerned with the Rorschach test only or with problem solving process in general is not going to be discussed here.

The relationship between some responses of the inkblot test and intelligence was detected by Rorschach (1942) himself and confirmed by many authors. It is assumed that the variables related to intelligence are: 1) Form level, that refers to the matching of the concept given to the blot area in terms of outline; 2) Movement, defined as the ability to project movement in static stimuli; 3) Whole, ability of interpret the whole area of the inkblot; 4) Organization, ability to integrate the different parts of the inkblot in a meaninful concept.

Rorschach differentiated the individual with many movement responses from the individual with many responses of color. The first one has a more individualized intelligence and a greater creative ability. The second one has a stereotyped intelligence and a reproductive ability. Therefore color is another variable to be introduced in this study.

Although the relationship between these variables and intelligence is commonly accepted, several experiments have failed to confirm it. J.E.Tuckner (1950) found that human movement (M) scores and summed animal and minor movement (FM+m) scores correlated positively with IQ's but neither correlation was high enough to indicate that moe

vement scores could be considered predictive of intelligence.

Frank Barron (1966) designed a measure of the threshold for the human movement response arranging inkblots of known M-evocative power in regularly graduated series. A group of 100 Air Force Officers with High and Low M thresholds were evalutated by the staff members through the use of a Q-sort and adjective check list techniques. In addition objective test measures of general intelligence, originality, personal stability and social attitude were obtained for all the subjects. Barron reported an important discrepancy between observers'sdescriptions and actual test measures. He says that "although subjects with greater M tendencey were described as inventive, intelligent, and broader in their interests, correlations between M threshold and actual measures of intelligence, general information and originality in problem solving were all in the neighborhood of zero"(p.511).

A study by Barrell (1953) found positive correlations between M and a combined score for the Miller analogies test and the Primary Mental Abilities word fluency subtest. This study suggests that some association between M and measures of abstraction and ideational productivity does exist.

L. Hemmendinger (1961) reported interesting findings using the Rorschach Location scores in conjunction with H. Werner's (1957) developmental theory. Applying the Rorschach to 160 children between ages of three through ten years, he found that the basic principle of development appears to be confirmed. "With increasing age there is a decrease of the undifferentiated, diffuse whole and detail responses, and an increase of the highly articulated, well integrated whole and detail responses, and an interesting shift from the early whole responses toward small details

between the ages of six to eight years, then declining in favor of the integrated whole responses later on".

D. Shapiro (1961) described a series of studies done by Weigl and Hanfmann and Kasanin stressing the significance of color under circunstances of disorganization or primitivation of thought. Patients with cerebral lesions and schizophrenic, in contrast to normal adults, have a decided tendency to make sortings first or exclusively on the basis of color. In the same line are the experiments reported by Werner (1957) and carried out by A. Descoeudres on object-sorting behavior in children. It was found that younger children matched most often on the basis of color and that with an increase in age a choice on the basis of form becomes more frequent. Shapiro points out that color seems to have increased significance for children and in conditions of pathologically impaired mental organization.

Using Rimoldi's technique, P. Robb (1966) explored the relationship of personality structure and cognitive functioning. The personality variables chosen were open and closed mindedness, defined as the openness and closedness of the individual to the evidence of reality presented in knowledge. He found that the open minded group performs significantly better when the problem solving process is evaluated, both in terms of recognizing and using the structure of the problem and in terms of reducing uncertainty.

It seems, therefore, that the present study could help to clarify some of the issues stated by the studies described above. In summary, the purpose of this investigation is to observe the relationship between some personality variables, that is personality variables of the Holtzman Inkblot Test and problem solving ability. The variables selected are the following: Movement, Color, Form and Location. Integration will not be studied because the distri-

bution of its scores was extremely skewed with a range from 0 to 20 and 43% of the subjects grouped in the interval from 0 to 4. This did not allow for differentiation of the two groups High and Low in the Integration variable.

CHAPTER III

Procedure

Subjects: The data used in this study have been taken from a research project currently being conducted at the Psychometric Laboratory of Loyola University. From 152 subjects a total of 80 male and females college students of Loyola University were selected for the study of each personality variable. The selection includes those subjects whose percentile was higher that 66 or lower than 33 in the Holtzman Scales. Thus for each variable two groups were obtained. In order to obtain two subgroups of 40 subjects each, several subjects were randomly eliminated from the original selection. In certain variables it was found that the scores had a small range, therefore taking the higher and lower thirds did not differentiate the subjects in that variable. This happened with Color, Form Appropiateness and Location. In all these cases the extreme scores were selected to form the two subgroups.

Table 1 presents the mean scores, standard deviation, and number of subjects of the two groups on each Personality Variable.

Problems: the problems used in this study have been designed by Rimoldi and described in several publications (e.g.,1967). As stated before it is possible to distinguish the structure and content in each problem. Structure refers to the formal properties of the problem expressed in terms of a basic set of logical relationships. The structures are identified by numbers. The structures designed by the numbers 31 and 35 have been selected for this study. The first one represents a rather simple and the second one a somewhat more complex type of problem (Appendix I shows the logical structure of problem 31 and 35).

Table 1

Mean, standard deviation and number of subjects of the High and Low groups in each personality variable

Holtzman Scale		Mean	S.D.	Nr. Subjects
Movement	High	52.03	12.37	40
	Low	21.05	6.04	40
Color	High	26.25	6.34	40
	Low	5.80	2.32	40
	High	25.77	5.28	30
	Low	5.71	1.92	28
Form Definiteness	High	99.17	8.73	40
	Low	71.80	6.64	40
	High	105.35	8.31	20
	Middle	87.10	1.34	20
	Low	67.30	6.54	20
Form Appropriateness	High	46.20	2.72	40
	Low	34.65	2.95	40
	High	47.68	2.84	25
	Low	33.20	2.99	25
Localization	High	59.72	6.76	40
	Low	29.65	6.29	40
	High	63.48	5.83	25
	Low	24.64	5.14	25

Each structure can be presented using different classes of content or "languages". The various contents are identified by letters. The letter "A" presents the problem in everyday terms. The letter "B" presents the problem by means of letters used as symbols for non-specified objects. The letter "C" uses symbolic negative statements. Finally the letter "K" identifies problems presented pictorially (Appendicess II through X contain all the problems and the general instructions).

Administration of the problems: Problem 31 and 35, A, B, and C were administered in group form in two different sessions. Problems 31 K and 35 K were administered individually in the same session.

The examiner read the General Instructions (see appendix) first. Each subject had also a printed page with the instructions and could follow the reading. Each problem is presented in a set of 11 cards. On the first card a statement of the problem is written. The other cards each contain a question, some of which are necessary to solve the problem. The others are irrelevant or redundant questions. On the reverse side of each card the corresponding information is written. The subject choses (asks) those questions that he thinks will help him in solving the problem. The subject himself records in an answer sheet the number and order of the cards chosen. This establishes a sequence for each individual which describes his thinking process and supplies information for the experimenter to score the answers

Scoring Procedures: Since Rimoldi's method attempts to study psychological processes rather than products, the scoring procedures has to consider the order in which the questions are chosen. Several scoring method has been designed and described (J. Erdmann,1964). In order to reduce

ambiguities and personal decisions that could be made in previous scoring methods, a new method has been developed (Rimoldi). In essence, it involves several stages:

> "1) In the "schema pulling out method" all irrelevant questions are delected from the observed tactic. In addition, the new method also deletes the redundant questions as previously defined. By this procedure, an observed tactic reduces to one of the possible basic tactics.
>
> 2) The elements remaining in the basic tactic are then analysed for order reversals. The number of more general questions determines the number of positions in which the less general questions may occur throughout all the possible levels of generality. For instance, reference to Figure 2 (Appendix II) indicates that problems built around this structure have two types of questions: A,B and C, of maximum generality and A_1, A_2,....C_3 of less generality or greater specificity.
>
> In the scoring system reversals of questions within each order of generality are not considered. Thus, for the case of Figure 2 (Appendix II) the sequences ABC, and CBA are identical and so are A_1, A_3, B_2, C_2 and A_3, B_2, C_2, A_1 and so forth. But A_3, B, C implies reversals since the order of their occurrence in terms of the specifications set forth previously should be BCA or CBA . That is, questions B and C determine three possible positions for any specific question: either before, in between, or following them. If a specific question follows a general question, it is arbitrarily assigned a positional number of 1. Other positions are assigned values related to the number of steps that they are removed from the "logical order".So question A_3 has the following values: 1 if in sequences CBA_3 or BCA_3, 2/3 if in sequences BA_3C or CA_3B, and 1/3 if in sequences A_3BC or A_3CB.
>
> The general formula to determine these positional numbers is:
>
> $$a_{pj} = 1 - \frac{j}{k}$$
>
> where a_{pj} is positional number for question p in position j, j corresponds to the number of steps

that question p is removed from its "logical" order, and k is number of possible steps. This formulation can be extended to problems with any values of k, where $0 \leq j \leq (k-1)$.

3) With the positional numbers as defined in 2) above, a matrix L is built in which the rows correspond to all the questions presented with a problem and the columns to the basic tactics as specified in 1) above. In the cells of matrix L, the corresponding positional numbers are entered, the values for the irrelevant and redundant questions being zero. An example of such matrix is given later

4) Each question in the problem is assigned a value in terms of the information it provides. Arbitrarily we assign an "information" weight of 1 to each of the class of most specific questions in the logical structure of the problem, regardless of of whether all of them actually occur as questions in the problem. More general questions are assigned an information value equal to the summation of the information values of the equivalent class of specific questions". (H.J.A.Rimoldi - Progress Report for Project 1089 on Problem Solving Processes Used by Elementary School Boys)

A row vector W gives the information weights corresponding to the elements of a given logical structure. Each element W corresponds to the information weight of each one of the n questions.

The row vector X, gives the score for all the basic tactics and is obtained by the matrix multiplication

$$X = WL$$

For instance, for problem 31 we have:

Questions

$$W = \begin{array}{c} \begin{array}{cccccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{array} \\ \begin{bmatrix} 0 & 2 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

Matrix L contains the positional numbers. For problem 31 they are:

Basic tactics

$$L = \begin{array}{c} \text{Questions} \\ \end{array} \begin{array}{c} \begin{array}{cccccccccccccccccc} 2 & 5 & 8 & 4 & 2,5 & 5,2 & 4,8 & 4,5 & 8,4 & 8,5 & 5,4 & 5,8 & 4,8,5 & 4,5,8 & 8,4,5 & 8,5,4 & 5,4,8 & 5,8,4 \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & .5 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array} \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \end{array}$$

The scores for all the basic tactics is obtained by matrix multiplication: $X = WL$

Basic tactics

$$X = \begin{array}{c} \begin{array}{cccccccccccccccccc} 2 & 5 & 8 & 4 & 2,5 & 5,2 & 4,8 & 4,5 & 8,4 & 8,5 & 5,4 & 5,8 & 4,8,5 & 4,5,8 & 8,4,5 & 8,5,4 & 5,4,8 & 5,8,4 \end{array} \\ \begin{bmatrix} 2 & 1 & 1 & 1 & 3 & 2.5 & 2 & 2 & 2 & 2 & 2 & 2 & 3 & 3 & 3 & 3 & 3 & 3 \end{bmatrix} \end{array}$$

The scores for the observed tactic is defined as:

$$s_i = \frac{x}{N} i$$

where x_i corresponds to the score for the corresponding basic tactic and N is the number of questions in the actual observed tactic before the pulling out procedure. If N is less than the amount of questions necessary to provide sufficient

information, N will take the value of the number of questions of the least parsimonious good tactic. Good tactic means a basic tactic that provides sufficient information for the solution of the problem.

Holtzman Inkblot-test: This test was administered in group sessions of about 40 subjects each. The administration was done following the recomentations given by Holtzman (1965). The scoring was carried out by three examiners. To achieve a uniform scoring criterion, they had frequent meetings between themselves discussing some aspects of the most difficult variables.

CHAPTER IV

Results

The results will be analysed using a profile analysis model described by Morrison (1967). For each personality variable a High and Low group will be distinguished and the two groups will be compared in a) perfomance in problem 31 A, B, C, K b) performance in problem 35 A, B, C, K.

The graphical representation of the mean profiles of the two groups for each variable are given in Figures 3 through 22.

In all cases the three hypotheses to be tested will refer to 1) parallelism of the profiles 2) in the case of parallelism, whether level of performance of the two groups High and Low are significantly different 3) within each structure whether the performance in each different language is different.

In the case that the profiles are not parallel, the analysis to test the other two hypothesis cannot be continued. In that case a 2X4 analysis of variance with repeated measures in the first factor will be performed.

According to Morrison, this method assumes that the responses are described by a p-dimensional multinormal random variable X

For the two groups, High and Low, the respective mean vectors of X will be $\mu_1' = [\mu_{11}, \ldots\ldots, \mu_{1p}]$ and $\mu_2' = [\mu_{21}, \ldots\ldots, \mu_{2p}]$ Both population will have the common though unknown covariance matrix Σ .

The parallelism hypothesis states that the slopes of the population profile segments are the same for both groups.

$$H : \begin{bmatrix} \mu_{11} - \mu_{12} \\ \mu_{12} - \mu_{13} \\ \mu_{13} - \mu_{14} \end{bmatrix} = \begin{bmatrix} \mu_{21} - \mu_{22} \\ \mu_{22} - \mu_{23} \\ \mu_{23} - \mu_{24} \end{bmatrix}$$

The first subscript indicates the group, and the second subscript indicates the language.

The statistic for testing the parallelism hypothesis is the two-sample T^2 computed as follows:

$$T^2 = \frac{N_1 \; N_2}{N_1 + N_2} \; (\bar{X}_1 - \bar{X}_2)' \; C' \; (CSC')^{-1} \; C(\bar{X}_1 - \bar{X}_2)$$

where N_1 and N_2 are the number of subjects in each group.

$\bar{X}_1$ and $\bar{X}_2$ are the sample mean vectors for the two groups, such that:

$$\bar{X}_1' = \left(\bar{x}_{11} \; \ldots\ldots \bar{x}_{1P}\right) \quad \text{and} \quad \bar{X}_2' = \left(\bar{x}_{21} \; \ldots\ldots \bar{x}_{2P}\right)$$

S is the variance covariance matrix for both groups

C is the $(k-1) \times k$ patterned matrix with 1, -1 and 0 entries

$$C = \begin{pmatrix} 1 & -1 & \ldots\ldots & 0 & 0 \\ 0 & 1 & -1 & \ldots\ldots & 0 \\ \ldots & \ldots & \ldots & \ldots & \ldots \\ 0 & 0 & 0 & \ldots\ldots & 1 \; -1 \end{pmatrix}$$

The value of F is given by:

$$F = \frac{N_1 + N_2 - p}{N_1 + N_2 - 2) \quad (p-1)} \; T^2$$

This is referred to a table of F distribution with degrees of freedom p-1 and $N_1 + N_2 - p$ and the hypothesis of parallelism is rejected at the chosen level if the observed F exceeds the critical value F_{α} ; $p-1, N_1 + N_2 - p$.

If the hypothesis of parallel profiles is tenable the second hypothesis of equality of levels can be tested by the usual two-sample t statistic from the sums of the observations on all responses in each sampling unit.

The statistic in matrix notation is:

$$t = \frac{j'(\bar{X}_1 - \bar{X}_2)}{\sqrt{j'Sj\left(\frac{1+1}{N_1 N_2}\right)}}$$

where $j' = \{1, \ldots\ldots 1\}$ is the p component vector with unity in each position

$\bar{X}_1$ and $\bar{X}_2$ the column vector of means for the different languages of group 1 and 2 respectively:

$$\bar{X}_1 = \begin{Bmatrix} \bar{X}_{11} \\ \bar{X}_{12} \\ \bar{X}_{13} \\ \bar{X}_{14} \end{Bmatrix} \quad \text{and} \quad \bar{X}_2 = \begin{Bmatrix} \bar{X}_{21} \\ \bar{X}_{22} \\ \bar{X}_{23} \\ \bar{X}_{24} \end{Bmatrix}$$

Finally the 3rd hypothesis of equal language means for both groups is tested using a single sample T^2 statistic.

$$T^2 = (N_1 + N_2)\, \bar{X}'C' (CSC')^{-1} C\bar{X}$$

where $\bar{X}$ is the grand mean vector obtained averaging the mean vectors of each group. The computation is:

$$\bar{X} = \frac{N_1}{N_1 + N_2} \bar{X}_1 + \frac{N_2}{N_1 + N_2} \bar{X}_2$$

The value of F is given by:

$$F = \frac{N_1 + N_2 - p}{(N_1 + N_2 - 2)(p-1)} T^2$$

The notion of equal language means is rejected at the $\alpha = .05$ level if the observed F exceeds the upper critical value $F_{\alpha}; p-1, N_1 + N_2 - p$.

If F is significant Scheffé method will be used to make comparisons among sample means. When the confidence interval fails to cover zero, the comparison is said to be

significant.

MOVEMENT

E.G.Schachtel (1966) defines Movement as responses in the perception of which kinesthetic factors play a co-determining role, together with form, color or shading, or a combination of these.

Traditionally, Movement responses have been linked to the capacity for inner creation and have given cues to the basic character attitudes of the subject. A great number of interpretative interlocking hypotheses have been put forth concerning this variable. In turn, these hypotheses have been qualified by other considerations. This resulted in an elaborate superstructure of hypotheses.

Among these hypotheses, there is one relating Movement respones with a high intellectual level. This was already detected empirically by Rorschach (1942) himself, and confirmed by other authors. According to Klopfer (1954), a large number of M responses of good quality is a sign of high intellectual capacity. He also stated that the individual with a large number of M responses is free to use his imaginal process to enrich his perception of the world.

Holtzman defines Movement in terms of energy level or dynamic quality rather than in terms of the particular content. Therefore, his Movement Scale includes actions performed by human beings, animals or inanimate objects. His 5-point scale is described as follows:

0 - No movement nor static potential for movement.

1 - Static potential for movement as indicated by such participles as sitting, looking, resting, lying.

2 - Casual movement, such as walking, talking, climbing, reaching.

3 - Dynamic movement, such as lifting, dancing,

running, weeping.

4 - Violent movement, such as whirling, exploding.

A graphical representation of the performance of the groups High and Low in the Movement variable is given in Figure 3 and 4. The F and t ratios for parallelism and equality of levels respectively and the Scheffé Analysis of equality of languages is also indicated. The letters refers to pairs of languages that are significantly different at the .05 level.

Table 2 presents a summary of the results. In Table 2 a plus sign indicates acceptance of parallelism ($\alpha = .05$), rejection of equality of levels ($\alpha = .05$), and rejection of equality of languages ($\alpha = .05$).

By inspecting Figures 3 and 4 and Table 2 it can be seen that the curves are parallel. Therefore there is no interaction between M, the personality variable, and the language in which the problem is presented. In other words, the amount of imagination does not make any difference in the use of the different languages.

The High Movement group, as a whole, is more efficient in solving problem than the Low Movement group. This happens in both structures, 31 and 35. Table 3 gives a summary of the results.

In establishing the significance of the differences, a one-tailed test was used because of the specific hypothesis that the High M group would perform significantly better than the Low M group.

According to this, the subjects endowed with a vivid imagination are better for solving problems than the subjects more restricted in imagination.

With reference to the equality of languages, the F test shows a significant difference between languages. The results for problem 31 and 35 are given in Table 4.

Figure 3

Problem 31 - M High and Low Profiles

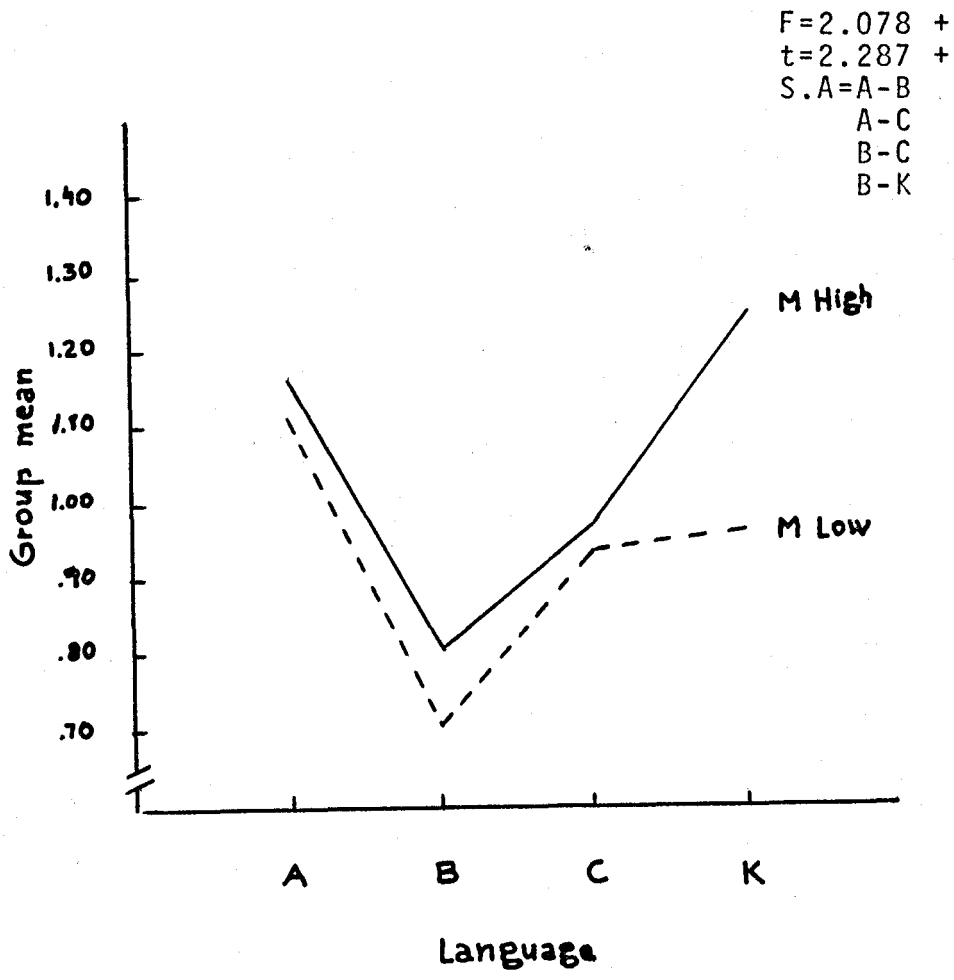


Figure 4

Problem 35 - M High and Low Profiles

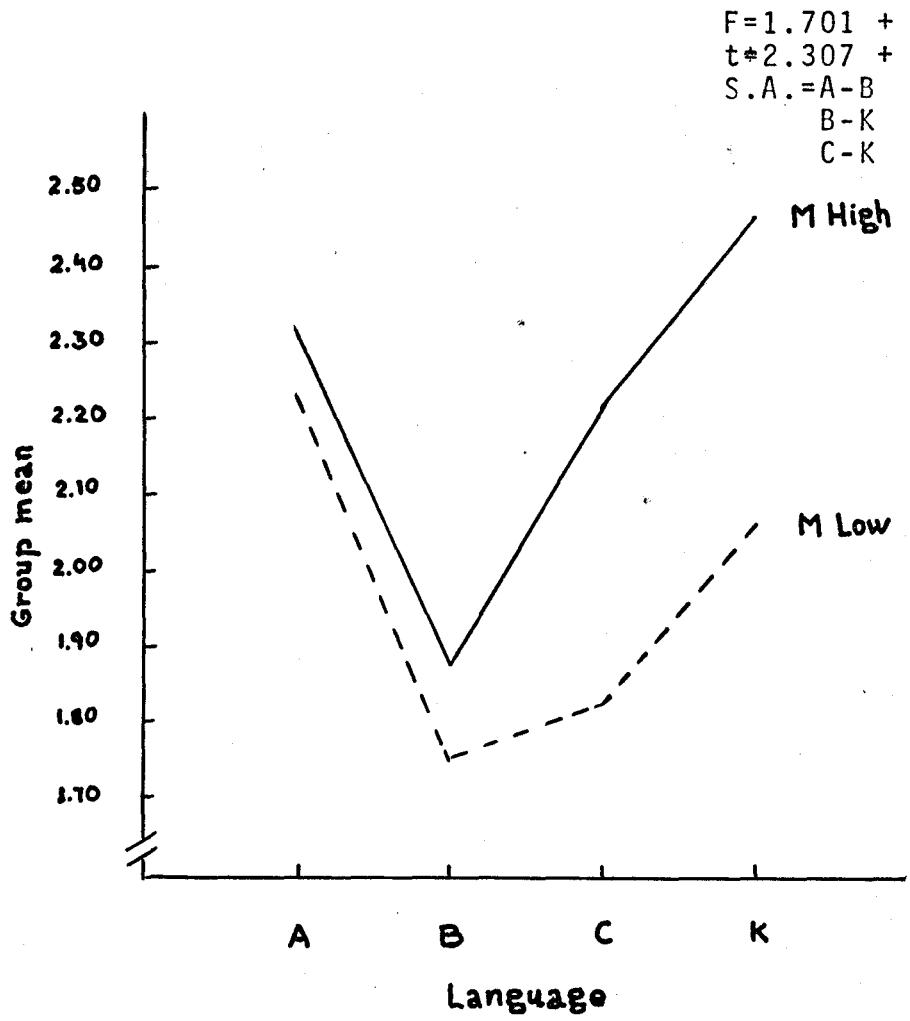


Table 2

Movement - Summary of Results

	Parallelism	M. Levels	F (Languages)	Scheffé Analysis
Problem 31	+	+	+	A-B A-C B-C B-K
Problem 35	+	+	+	A-B B-K C-K

Table 3

Movement

t - values for group differences in problem solving

Groups	Problem 31	Problem 35
High versus Low M	2.287*	2.307

$P < .05$

Table 4

Movement
Scheffé confidence intervals for differences between languages

	F	Confidence intervals
Problem 31	21.2254**	A-B: $.5674 \leq \mu_1 - \mu_2 \leq .8694$*
		A-C: $.0200 \leq \mu_1 - \mu_3 \leq .3592$*
		A-K: $-.1204 \leq \mu_1 - \mu_4 \leq .1986$
		B-C: $-.3211 \leq \mu_2 - \mu_3 \leq -.0545$*
		B-K: $-.5036 \leq \mu_2 - \mu_4 \leq -.2249$*
		C-K: $-.1505 \leq \mu_3 - \mu_4 \leq .0241$
Problem 35	9.8990**	A-B: $.1987 \leq \mu_1 - \mu_2 \leq .7189$*
		A-C: $-.0289 \leq \mu_1 - \mu_3 \leq .5321$
		A-K: $-.2236 \leq \mu_1 - \mu_4 \leq .2524$
		B-C: $-.4877 \leq \mu_2 - \mu_3 \leq .0733$
		B-K: $-.7173 \leq \mu_2 - \mu_4 \leq .1715$*
		C-K: $-.3460 \leq \mu_3 - \mu_4 \leq -.1284$*

** $P < .01$ * $P < .05$

Table 4 shows that in problem 31 and 35 both groups perform significantly better using the A language rather than B language. It should be remembered that the A language presents the problem in everyday terms while the B language presents the problem using symbols. The difference could be explained by the difficulty of passing from an everyday language to an abstract one. For the same reason the performance is better using the A language rather than the C language in problem 31. In problem 35 the difference is not significant. Language C is also symbolic (negative symbols) but the subjects having performed already in the B language, have some training in it and their performance is improved using C language. This is accomplished faster if the subjects realize that the negative language can be dealt with as a positive language. The improvement is so noticeable that there is a significative difference between the values obtained when using the B language and the values obtained when using the C language in problem 31. Again this does not happen in problem 35.

The K language uses pictures of geometric objects. Here the practice effect and the concreteness of the language determine a good performance. The results in problem 31 and 35 were significantly better when using the K language rather than the B language. In problem 35 the results were also significantly different when the K language was compared with the C language.

COLOR

Color refers to those responses in which the subject utilizes the chromatic elements of the colored cards in the formation of his concept. Many authors have tried to clarify the nature of color experience and the color response.

Especially important are the contributions of Schachtel (1966) and Shapiro (1961).

Schachtel underlines the quality of passiveness in color perception. The perception of colors requires little activity on the part of the perceiver. He says "in color perception the subject need not pay active attention, the color impresses itself on him, it strikes him, it penetrates his consciousness, it is like a sound penetrating quiet" (E.Schachtel, 1960).

David Shapiro (1961) also stresses the perceptual passivity in connection with color experience. By perceptual passivity he means a condition of relative absence of active perceptual organizing capacities. The perceptual experience is dominated by the most immediately manifest and most vivid aspects of the visual surroundings.

Shapiro examines several experimental studies of color perception. He concludes that Color does appear to have increased significance for children, in conditions of pathologically impaired mental organization, and in conditions of primitive and undeveloped visual capacity, as compared with normal adults. This fact seems consistent with the assumption that color experience involves more passive and immediate processes.

The second characteristic is described by Schachtel (1960) as the "immediacy" of the relation between subject and object-color. This characteristic represents the absence of controlling or reflecting thought. It is logical then to expect a poor performance in problem solving from the group high in the Color Scale.

Holtzman rated the color variable on a 4-point scale as follows

0 - color not used as determinant.

1- color used but only in a secondary manner as an

elaboration of the percept reported (similar to FC in the Rorschach).

2 - color used as a primary determinant but with some form (though indefinite) implied in the response (similar to CF in the Rorschach).

3 - color used as a primary determinant but with no form present (similar to CF in the Rorschach).

The results were analysed selecting randomly 40 subjects among those whose percentile were higher than 66 and 40 subjects among those whose percentile were lower than 33 in the Color Scale. These subjects form the High and Low group, respectively.

A graphical representation of the performance of both groups in problem 31 and 35 is given in Figures 5 and 6. The F and t ratios for parallelism and equality of levels respectively and the Scheffé Analysis of equality of languages is also indicated. The letters refer to pairs of languages that are significantly different at the .05 level.

Table 5 presents a summary of the results. In table 5 a plus sign indicate acceptance of parallelism (α=.05), rejection of equality of levels (α=.05), rejection of equality of languages (α=.05).

Looking at Table 5 it can be seen that the performances curves of Problem 31 are not parallel. Therefore it is not possible to continue the profile analysis to test the other hypothesis of equal group levels and equality of language effect.

The performance curves of Problem 35 are parallel but there are no differences between the levels of performance. The Color variable apparently does not differentiate between good and poor problem solvers in this problem.

A careful look at the data revealed that the Low Color group has 12 subjects also low in Movement and that the High

Figure 5

Problem 31 - C High and Low Profiles

F=5.240 -

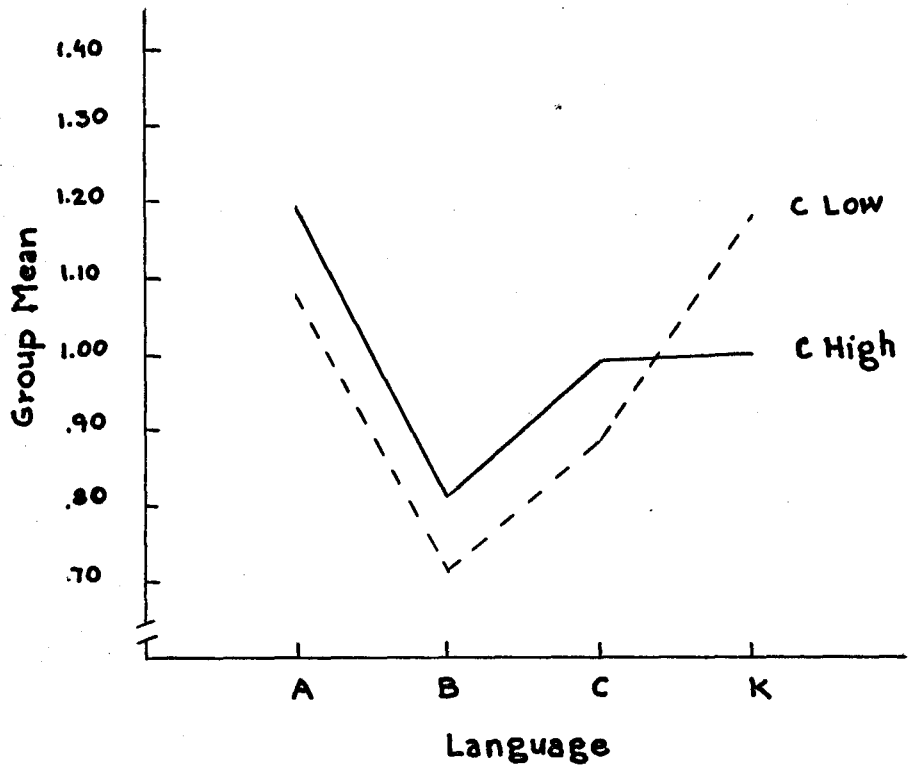


Figure 6
Problem 35 - C High and Low Profiles

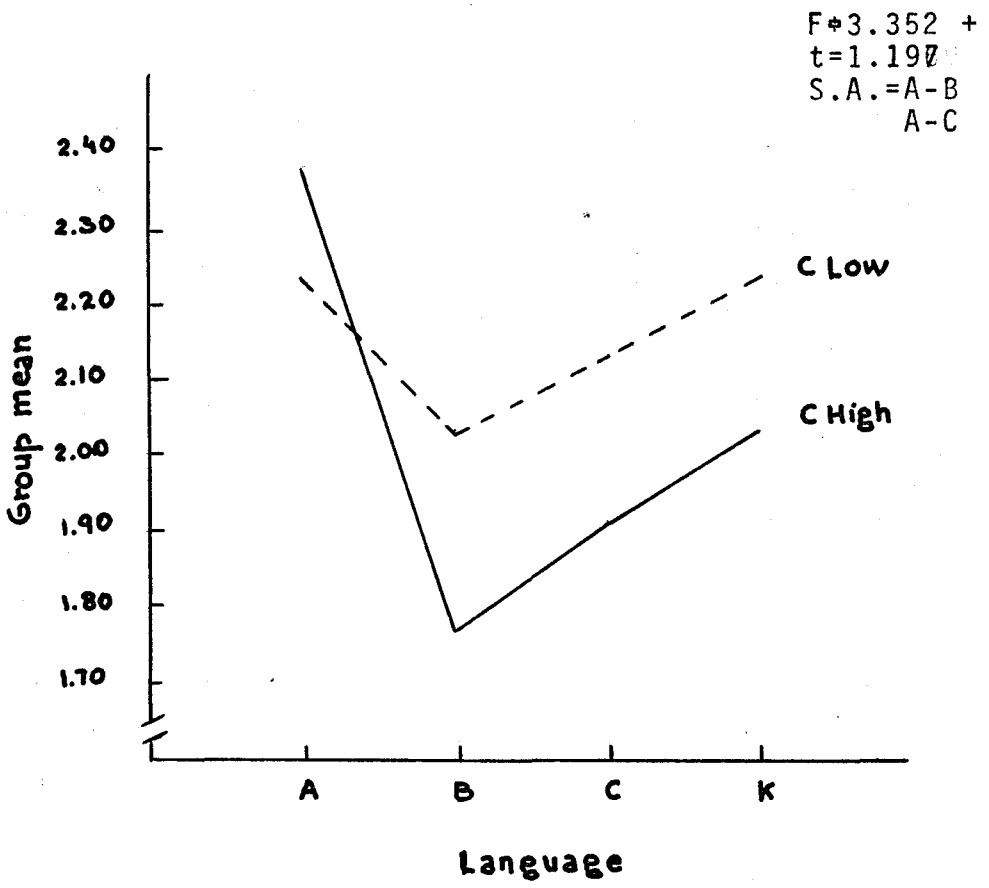


Table 5

Color - Summary of Results

	Parallelism	C.Level	F (languages)	Scheffé analysis
Problem 31	-			
Problem 35	+	-	+	A-B B-C

Color group has 10 subjects high in Movement. It should be remembered that the High Movement Group were better problem solver than the Low Movement Group. Is it possible then that these extreme subjects in the Movement Scale are affecting the problem solving performance of the Color Groups?

The 12 subjects that were included before in the Low Movement Group and the 10 subjects included in the High Movement Group were eliminated from the Color Low and Color High groups, respectively. There remained 28 subjects in the Low Color Group and 30 subjects in the High Color Group. With these subjects a new profile analysis was tried.

The results are shown in Figures 7 and 8 and in Table 6.

It can be seen that the profiles of figures 7 and 8 do not change very much as compared with Figures 5 and 6.

The curves of performance for problem 31 continue being not parallel and the group Color High is slightly above the Color Low group for all languages except for the K language.

To test the interaction an analysis of variance was performed using a 2×4 model for repeated measures in the second factor, described by Winer (1962). The results are summarized in Table 7.

There is no difference due to color in the problem solving ability. The F of the language effect is significant showing that there is variation in performance due to the way the problem is presented. There is also interaction between the Color variable and the languages. The language effect is different for the two groups. It seems that the K language has a different effect as compared with the other three languages. The Color Low Group performs the best using the K language.

Figure 7
Problem 31 - C High and Low Profiles,
Having eliminated those subjects that
belonged to the High and Low Movement Groups

F=5.046 -

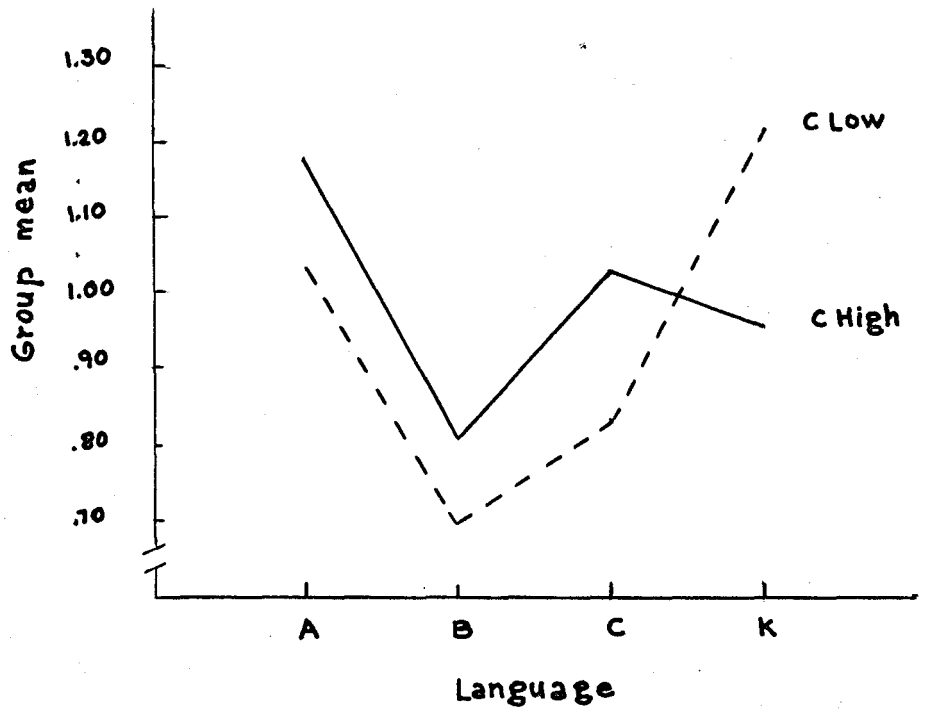


Figure 8
Problem 35 - C High and Low Profiles,
Having eliminated those subjects that
belonged to the High and Low Movement Groups

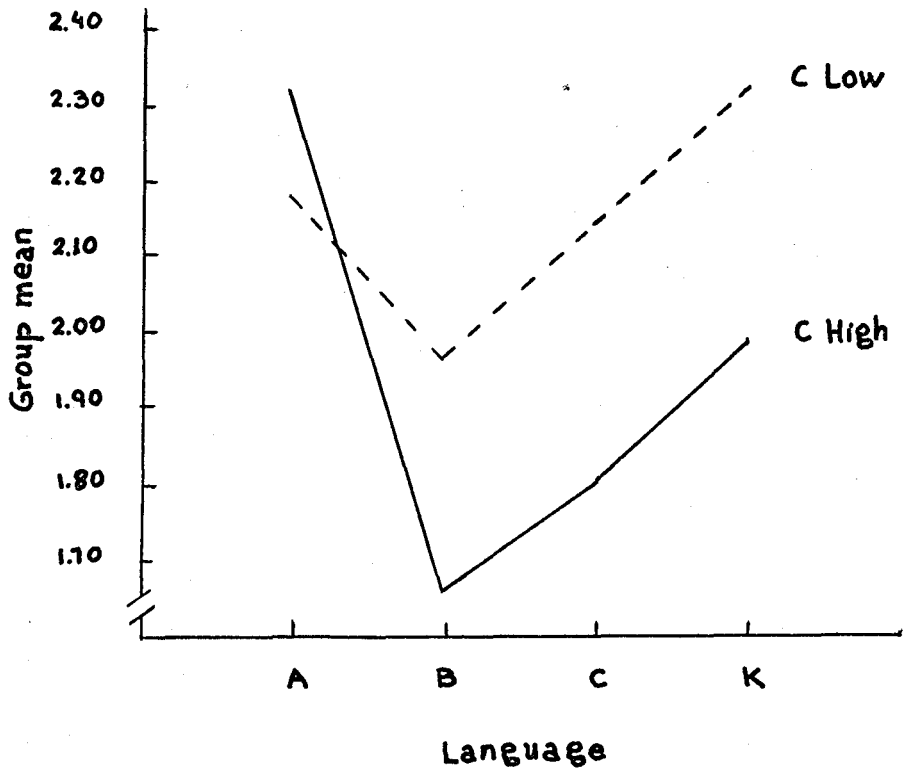


Table 6

Color, having eliminated those subjects that belonged to the High and Low Movement groups- Summary of Results

	Parallelism	C.Level	F (languages)	Scheffé analysis
Problem 31	-			
Problem 35	+	+	+	A-B

Table 7

Problem 31 - Analysis of Variance of Problem solving ability for the groups High and Low in Color

Source	Sum of Squares	D.F.	Mean Square	F
Between Subjects	7.4330	55		
Groups (high-low C)	.0300	1	.0300	.2188
Subj.within Groups	7.4051	54	.1371	
Within Subjects	29.9698	168		
Language	4.3803	3	1.4601	9.9938**
GroupxLanguage	1.9036	3	.6345	4.3429**
Languagexsubjects	23.6809	162	.1461	

** P <.01

Problem 35 maintains the same outline of the profile in spite of the elimination of the subjects High and Low in movement from the High and Low Color groups, respectively. The curves continue being parallel but the distance between the two curves is increased. The group Color Low performed significantly better ($\alpha = .05$) than the Color High Group. It should be recalled that the logical structure of Problem 35 is more difficult than the logical structure of problem 31. The results seems to indicate that with an increased difficulty in logical structure, the difference between the two groups becomes apparent.

It is interesting to notice that Problem 31 K follows the same trend manifested in Problem 35, that is the Low Color Group performing better than the High Color Group. It seems that the K language is the best among the 4 languages to show any difference that might exist in the performance of the two groups.

The results of the analysis of the Color Variable are in agreement with the hypothesis that this variable is related with different levels of problem solving ability. The hypothesis stated above said that a great susceptibility to the color experience is connected with absence of reflecting thought. This could explain that the group High in the Color Variable is poor in problem solving when compared with the group Low in the same variable.

The third hypothesis tested is the equality of languages for problems 31 and 35. The four languages are compared using Scheffé simoultaneous confidence interval. In problem 35 the curves are parallel and the analysis was performed collapsing in one group the High and Low groups. The non-parallelism of the curves of problem 31 requires a separate analysis for each one of the groups. An analysis of variance was carried out separately for each one of the groups

of problem 31 and the error term was used to estimate the population standard deviation of differences between means required for the Scheffé analysis. The two analyses of variance are summarized in Table 8 and 9.

The results of the Scheffé simoultaneous confidence interval are shown in Table 10 where a star indicates which languages are significantly different at $\alpha = .05$

In the two problems the A language is significantly different from the B language. This is a common finding since to solve a problem in everyday language ("A") is much easier than to solve the same problem in a symbolic language ("B").

The Low Color group of Problem 31 shows also a significant difference in the use of the K language versus the B and C languages. That is, the symbolic positive and symbolic negative languages are more difficult to deal with than the pictorial language. These results are consistent with other findings in which the best problem solvers perform very well when using the K language rather than the others.

COLOR AND MOVEMENT

The results obtained with the separate analysis of Movement and Color, point out the importance of an analysis of the two variables together. Since the beginning of the interpretation of reactions to inkblot stimulus, it has been observed that a specific type of response, human movement or color, seems to measure important personal characteristics. The concept of experience type, defined by Rorschach (1942) in the Psychodiagnostic, is essentially a ratio between Human Movement and Color responses. The characteristics of the experience type, summarized in the Psychodiagnostic, are as follows:

Table 8

Problem 31 - Analysis of Variance of language effect for the Low color group

Source	Sum of Squares	D.F.	Mean Square	F
Between people	4.6909	27		
Within people	14.8251	84		
Languages	4.1931	3	1.3977	10.6532**
Residual	10.6320	81	.1312	
Total	19.5160	111		

** $p < .01$

Table 9

Problem 31 - Analysis of Variance of language effect for the High color group

Source	Sum of Squares	D.F.	Mean Square	F
Between people	6.9144	27		
Within people	10.9514	84		
Language	2.0996	3	.6998	6.4084**
Residual	8.8518	81	.1092	
Total	17.8628	111		

** $p < .01$

Table 10

Color
Scheffé confidence intervals for differences between languages

		F	Confidence intervals
Problem 31	High Group	6.4084**	A-B: .1233 ≤ μ_1 − μ_2 ≤ .6315* A-C: -.0931 ≤ μ_1 − μ_3 ≤ .4151 A-K: -.0089 ≤ μ_1 − μ_4 ≤ .4993 B-C: -.4705 ≤ μ_2 − μ_3 ≤ .0377 B-K: -.3863 ≤ μ_2 − μ_4 ≤ .1219 C-K: -.1699 ≤ μ_3 − μ_4 ≤ .3383
	Low Group	10.6532**	A-B: .0500 ≤ μ_1 − μ_2 ≤ .6082* A-C: -.0898 ≤ μ_1 − μ_3 ≤ .4684 A-K: -.4625 ≤ μ_1 − μ_4 ≤ .0957 B-C: -.4189 ≤ μ_2 − μ_3 ≤ .1393 B-K: -.7916 ≤ μ_2 − μ_4 ≤ -.2330* C-K: -.6518 ≤ μ_3 − μ_4 ≤ -.0934*
Problem 35	Both groups	6.8774**	A-B: .1569 ≤ μ_1 − μ_2 ≤ .7223* A-C: -.0225 ≤ μ_1 − μ_3 ≤ .5805 A-K: -.1703 ≤ μ_1 − μ_4 ≤ .4719 B-C: -.1606 ≤ μ_2 − μ_3 ≤ .0527 B-K: -.6342 ≤ μ_2 − μ_4 ≤ .0566 C-K: -.4517 ≤ μ_3 − μ_4 ≤ .1953

Kinesthesis Predominant	Color Predominant
- More individualized intelligence	- Stereotyped intelligence.
- Greater creative ability	- More reproductive ability.
- More "inner" life	- More "outward" life.
- Stable affective reactions	- Labile affective reactions.
- More intensive than extensive rapports.	- More extensive than intensive rapports.
- Measured, stable motility	- Restless, labile, motility.
- Awkwardness, clumsiness	- Skill and adroitness.

Accordingly, the problem solving performance of a group with a high number of Movement responses and a group with a High number of Color responses should be significantly different.

The results for Problem 31 and 35 are shown graphically in Figures 9 and 10, and are summarized in Table 11.

It has been found that the curves of problem 31 (Figure 9) are not parallel therefore the profile analysis to test equality of group levels and equality of language effect cannot be used.

Problem 35 shows parallelism of the performance curves, significant differences between group levels and significant differences between languages.

The t-test for group differences gives a value of 1.891. This is significant at the .05 level using a one tailed test, because of the prediction in a specific direction. The group in which the kinesthses are predominant performed significantly better compared with the group in which color is predominant.

With reference to the equality of language, the

Figure 9
Problem 31 - C High and M High Profiles, having eliminated those subjects that belonged to both groups

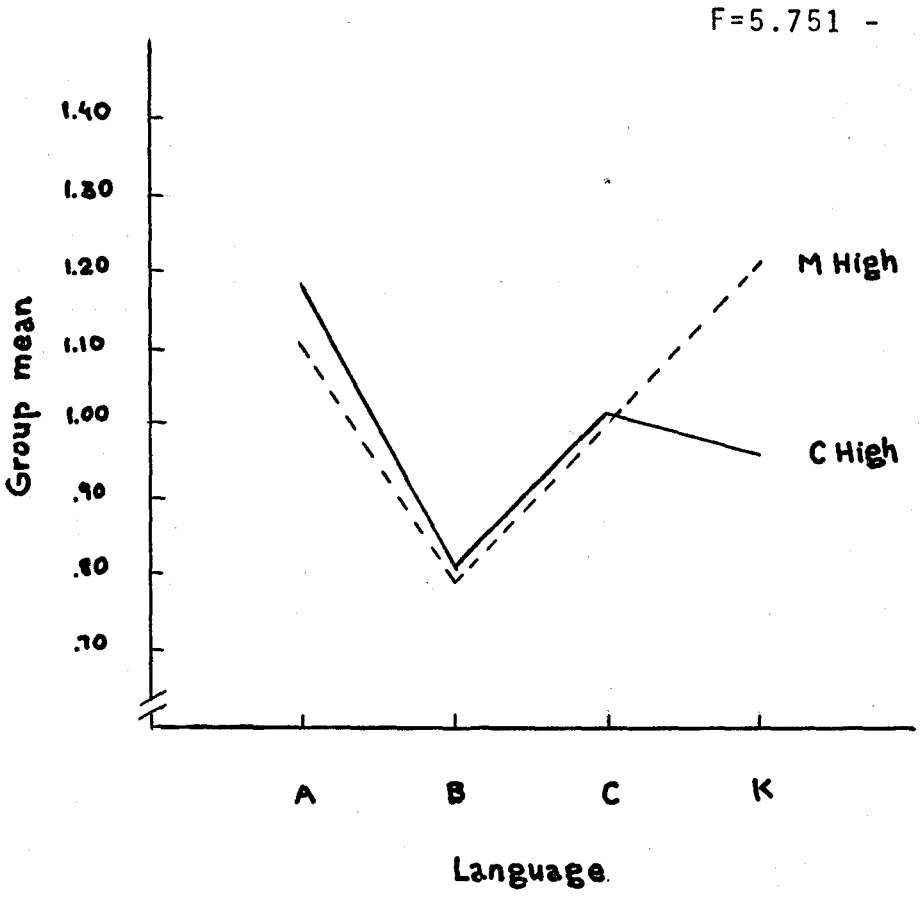


Figure 10
Problem 35 - C High and M High Profiles, having eliminated those subjects that belonged to both groups

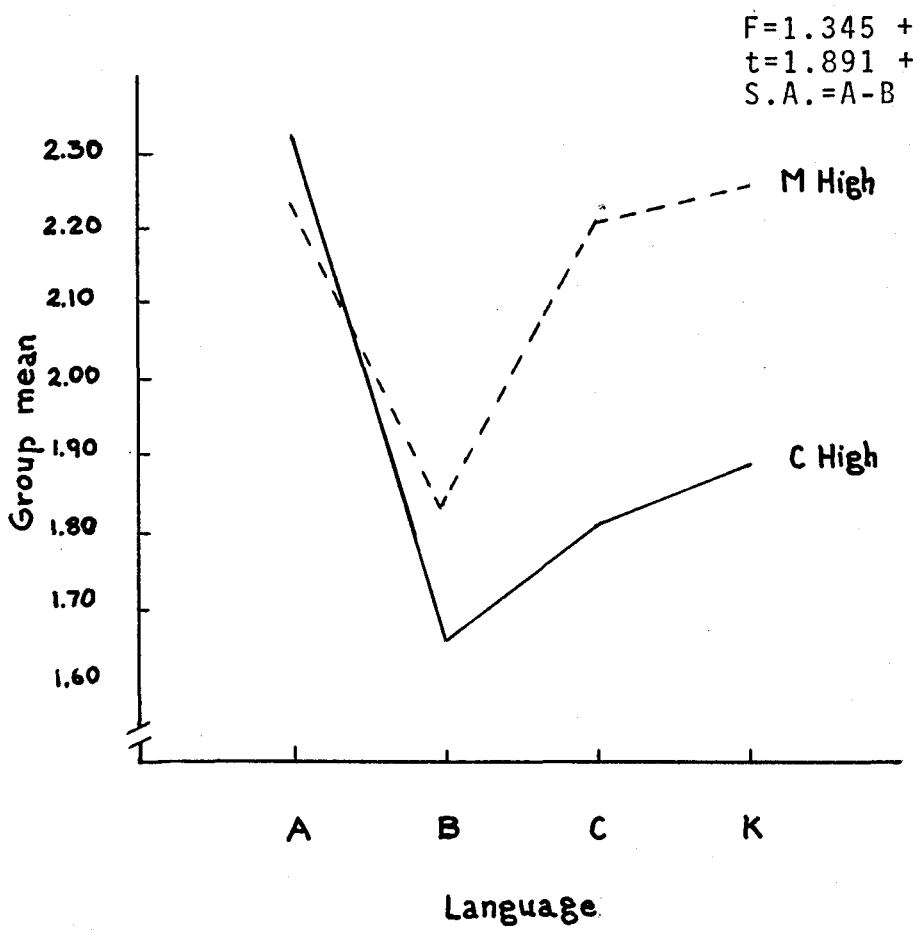


Table 11

Color and Movement - Summary of Results

Parallelism	Group Level	F (languages)	Scheffé analysis
Problem 31 -			
Problem 35 +	+	+	A-B

F test shows a significant difference between languages. The results of the Scheffé confidence intervals are presented in Table 12 where a star indicates which languages are significantly different at $\alpha = .05$.

In problem 35, both groups perform significantly better using the A language rather than the B language. This is the usual finding as a result of passing from an everyday language to an abstract one. The other languages are not significantly different between themselves. This is probably due to the influence of the Color High group, whose performance curve has a soft slope in the interval from B to K.

FORM APPROPRIATENESS

Form is considered the most important of the determinants. It gives understructure to diffuse and unfamiliar inkblots.

Horltzman distinguishes between Form Appropriateness and Form Definiteness. Form Appropriateness deals with the goodness of fit of the concept to the form of the inkblot.

According to Rorschach the goodness of form depends on : 1rst) the ability to concentrate 2nd) the availability of clear memory images 3rd) the ability to bring such memory images into consciousness 4th) the ability to select from among these the most fitting for the stimulus. For all these reasons, the goodness of form is associated with intelligence. We are assuming then a relationship between this determinant and the problem solving process.

Holtzman stablishes a 3-point scale to judge Form Appropriateness.

Table 12

Color and Movement
Scheffé confidence intervals for
differences between languages

	F		Confidence intervals		
Problem 35	11.3964**	A-B: .2379	$\leq \mu_1 -$	$\mu_2 \leq$	.8121*
		A-C:-.0546	$\leq \mu_1 -$	$\mu_3 \leq$	.5818
		A-K:-.1226	$\leq \mu_1 -$	$\mu_4 \leq$	.5272
		B-C:-.9294	$\leq \mu_2 -$	$\mu_3 \leq$	.4066
		B-K:-.6540	$\leq \mu_2 -$	$\mu_4 \leq$	.0086
		C-K:-.3642	$\leq \mu_3 -$	$\mu_4 \leq$	.2416

0 - poor form

1 - fair form

2 - good form

How are we going to judge that the given response fits the inkblot? This is a difficult question. It is true that Holtzman gives many examples to guide the examiner's judgement, but in the last instance the accuracy of a response depends on the empathic judgement of the examiner. Accurate is what another individual judges as an adequate solution to the problem. The scoring procedures present then a basic difficulty for experimental work.

The subjects were divided in two groups High and Low in Form Appropiateness, as was stated before in the design of the experiment. The result of these two groups in problem 31 and 35 are shown graphically in Figures 11 and 12, and are summarized in Table 13.

In both problem it can be seen that the curves of performance are parallel and that there is not significant difference between the High and Low group. I should be notice also that in Problem 31 the low group seems to perform better than the High group using the B and C languages and in problem 35 the low group performs better than the High group using all the languages except the K language. There is a trend that does not agree with the expectations.

Since the difference between the two groups is not statistically significant it was thought to choose extreme subjects in Form Appropriateness to increase the differences, if there are any.

The 25 subjects located in the High end of the Form Appropriateness scale were selected for the High Group and the 25 subjects located in the lower end formed the Low Group.

Figure 11
Problem 31 - Form Appropriateness
High and Low Profiles

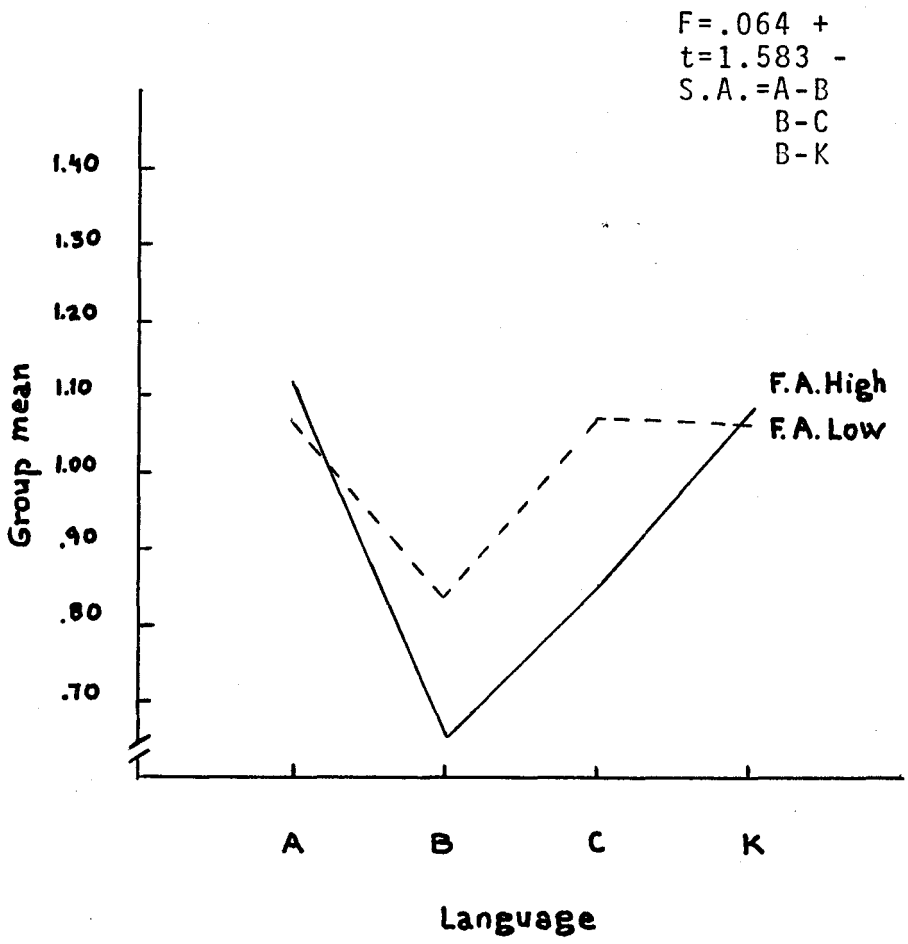


Figure 12
Problem 35 - Form Appropriateness
High and Low Profiles

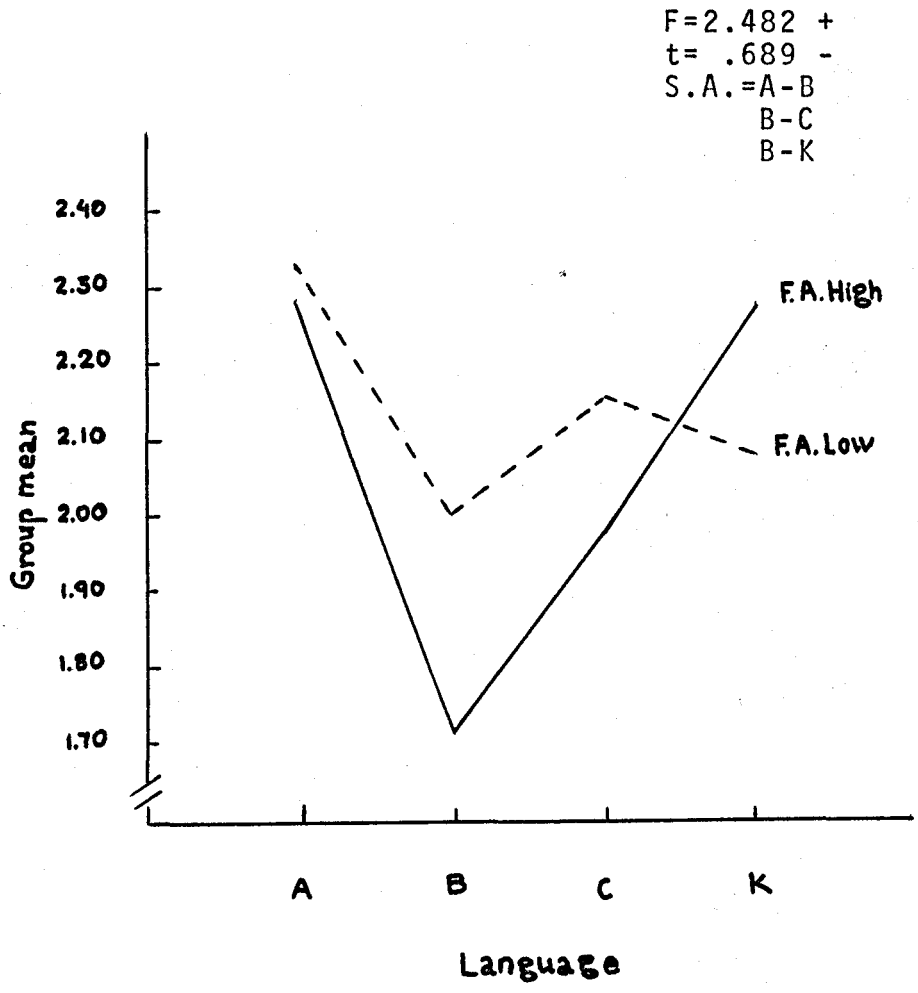


Table 13

Form Appropriateness - Summary of Results

	Parallelism	F.A. Level	F (languages)	Scheffé analysis
Problem 31	+	-	+	A-B A-C A-K
Problem 35	+	–	+	A-B B-C B-K

The results are presented graphically in Figures 13 and 14, and are summarized in Table 14.

It can be observed that the results have changed. The curves of problem 31 are not parallel, therefore the profile analysis could not be continued to test the other two hypotheses.

The curves of problem 35 are parallel but now the High group seems to perform better than the Low group in all languages except the B language, although the difference between both groups is not statistically significant. It is interested to notice how flat is the curve of the Low group in both problems, 31 and 35. Its slope is very small as compared with the High group. This result suggests that the scoring procedure of Form Appropriateness makes the difference. To score F.A. the examiner has to compare the concept given with the shape of the inkblot and judge its adequacy. Some poor forms could have been scored as good ones, it the subject did not point exactly to the area of the inkblot selected, and the examiner was unable to find it. It should be remembered that the Holtzman was administered to a group and the subject has to make an outline of each concept. If the subject forgot to do that or if his drawings were poor, it was quite difficult to locate the area to which he was referring in his answer. It could have happened then that many answers were scored as poor form when they were good, and subjects selected for the Low F.A. group do not belong to it in fact.

Holtzman gives an average inter-scorer correlation of .73 for For Appropriateness between four scorers and a correlation of .91 between two scorers. Even if this last correlation is high, it is lower than similar correlations for the other variables. A failure in the subtle scoring criteria that the examiner needs to score accurately for Form Appropriateness might be an important factor in the results

Figure 13
Problem 31 - Form Appropriateness High and
Low Profiles with 25 subjects in each group

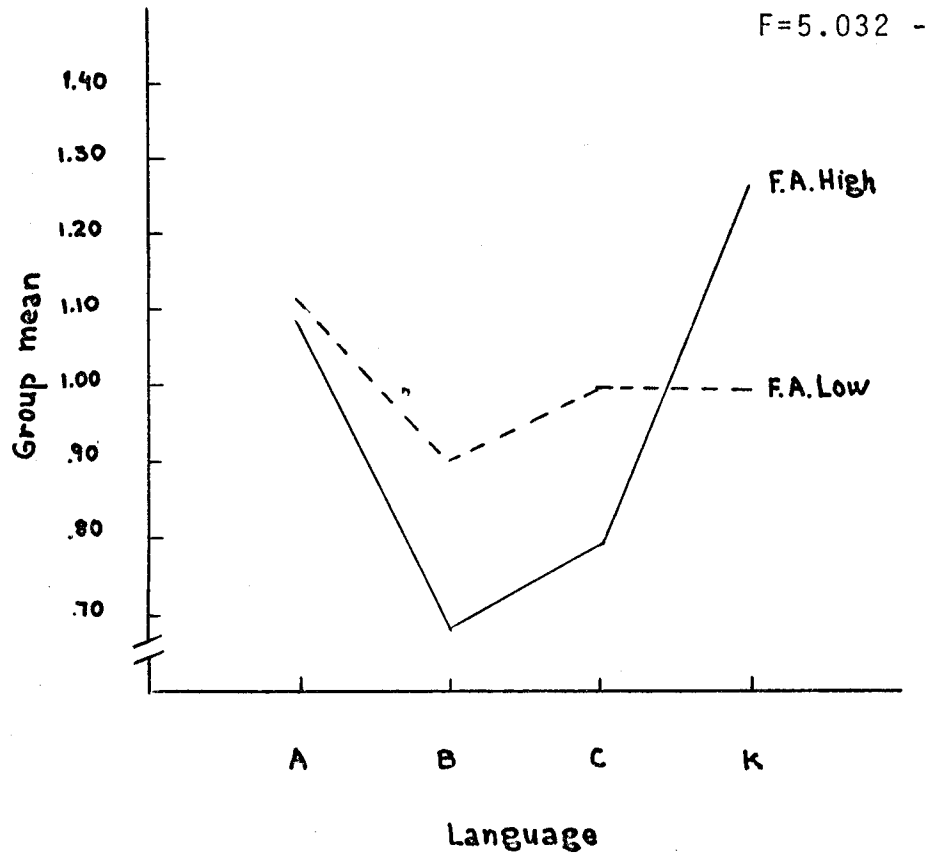


Figure 14

Problem 35 - Form Appropriateness High and Low Profiles with 25 subjects in each group

F=1.318 +
t=1.174 -
S.A.=B-K

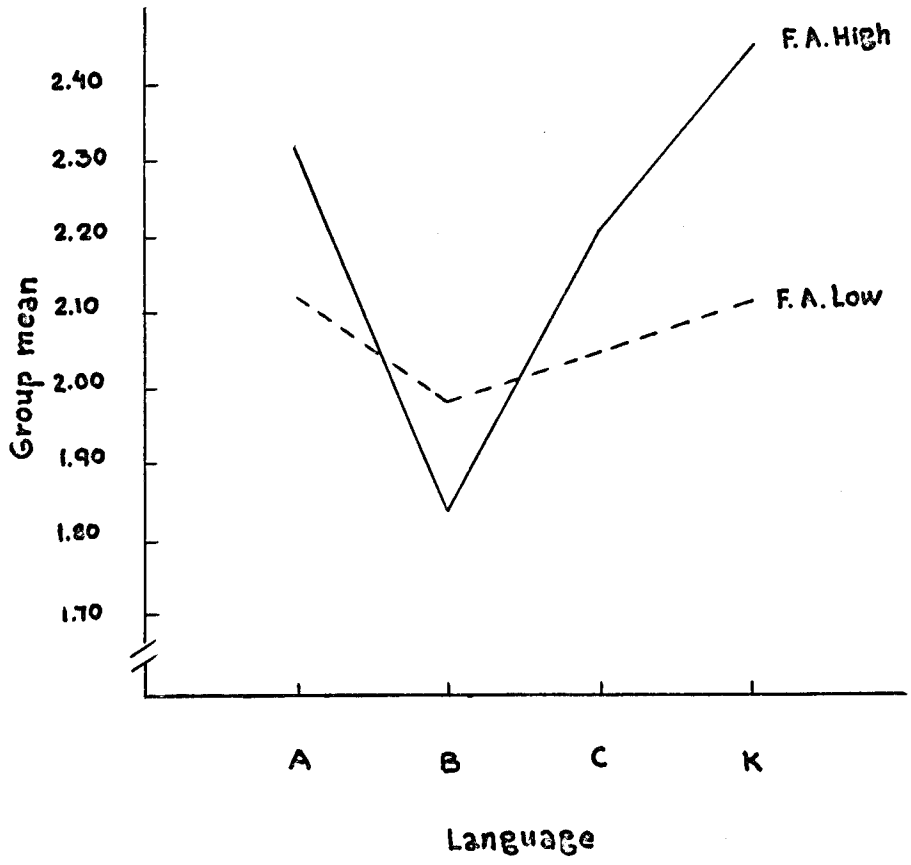


Table 14

Form Appropriateness, 25 subjects
in each group - Summary of Results

	Parallelism	F.A.Levels	F (language)	Scheffé analysis
Problem 31	-			
Problem 35	+	-	+	B-K

obtained.

As the performance curves of Problem 31 were not parallel a 2×4 Analysis of Variance using repeated measures in the second factor was performed. The results are given in Table 15.

It can be observed in Table 15 that there is a significant difference in the problem solving performance of the two groups and a significant difference between languages. The interaction between the Form Appropriateness Scale and the languages, seems to point out that the difference between both groups are not independent of the language used. Since the Analysis of Variance gives an overall significant difference between groups a t-test between the means of the Groups High and Low in Form Appropriateness was performed for each language. The results are summarized in Table 16.

In establishing the significance of the differences, a one-tailed test was used because of the specific hypothesis that the High F.A. group would perform significantly better than the Low F.A. group. The differences are significant between the two groups when using the B, the C language and the K language, but in the first and second case the Low group performed better than the High group and in the third case the result is inversed, the High group performed better than the Low group. According to the theory, the expectation was for a better performance of the High Group. The results are difficult to interpret since the B and C language, using abstract symbols, are usually quite difficult to handle. A possible explanation is the scoring procedure of F.A., as was suggested above. A group of subjects was included in the Low group due to the impossibility to locate and understand its answers, when in fact the forms were good. This raised the problem solving score of the Low group, specially in those languages that are more difficult.

Table 15

Problem 31 - Analysis of Variance of problem solving ability for the Groups High and Low in For Appropiateness

Source	Sum of Squares	D.F.	Mean Square	F
Between Subjects	7.7205	49		
Groups (high-Low F.A.)	1.1211	1	1.1211	8.1593**
Subjects within groups	6.5994	48	.1374	
Within Subjects	22.3901	150	.1492	
Language	4.0647	3	1.3549	11.2533**
GroupxLanguage	.9805	3	.3268	2.7142*
Languagexsubjects	17.3449	144	.1204	

** P < .01 *P<.05

Table 16

t-values for the differences in problem solving between the groups High and Low in Form Appropriateness - Problem 31

High versus Low F.A.	t-value
A language	.2920
B language	-2.277*
C language	-2.059*
K language	2.642*

* $P < .05$

The third hypothesis tested is the equality of languages for problem 31 and 35. The four languages are compared using Scheffé simoultaneous confidence interval. A separate test for equality of languages was performed for each group of problem 31, since the performance curves are not parallel. An analysis of variance was carried out separately for each one of the groups of problem 31. The error term thus obtained was used to estimate the population standard deviation of differences between means required for the Scheffé analysis. A summary of the two analyses of variance are shown in Table 17 and 18.

The results of the Scheffé simultaneous confidence interval are shown in Table 19 where a star indicates which languages are significantly different at $\alpha = .05$.

The Low Group of problem 31 does not present any significant difference between languages. This unusual result strongly suggests some kind of error in the selection of the Low group. On the contrary, the High group presents noticeable differences. The performance is better using the A language than using the B or C language. It is easier to solve problems using the everyday language as compared with symbolic languages. The performance is also significantly better using the K language than either the B or C language. Here the pictorial presentation of the problem and the practice effect determine a good performance.

Problem 35 presents only a significant difference between the B and K language, that is the performance using a symbolic language was poor as compared with the performance using a pictorial language. It can be observed in the graph of Figure 14 that the High Form Appropriateness curve presents a sharp slope, while the Low Form Appropriateness curve is much more flat. As the test for equality of languages is done collapsing the two groups, the lack of significant differences

Table 17

Problem 31 - Analysis of Variance of language effect for the Low Form Appropriateness Group

Source	Sum of Squares	D.F.	Mean Square	F
Between people	4.8796	24		
Within people	9.1112	75		
Languages	.5874	3	.1958	1.6551
Residual	8.5238	72	.1183	
Total	13.9908	99		

Table 18

Problem 31 - Analysis of Variance of language effect for the High Form Appropriateness Group

Source	Sum of Squares	D.F.	Mean Square	F
Between people	2.7228	24		
Within people	13.2772	75		
Languages	5.4604	3	1.8201	18.6868**
Residual	7.0163	72	.0974	
Total	16.0000	99		

** $P < .01$

Table 19

Form Appropriateness, 25 subjects in each group
Scheffé confidence intervals for
differences between languages

		F	Confidence Intervals
Problem 31	High Group	18.6868**	A-B: .1606 $\leq \mu_1 - \mu_2 \leq$ .6652* A-C: .0576 $\leq \mu_1 - \mu_3 \leq$ .5622* A-K: -.4211 $\leq \mu_1 - \mu_4 \leq$ .0835 B-C: -.3553 $\leq \mu_2 - \mu_3 \leq$ .1493 B-K: -.8340 $\leq \mu_2 - \mu_4 \leq$ -.3294* C-K: -.7310 $\leq \mu_3 - \mu_4 \leq$ -.2264*
	Low Group	1.6551	
Problem 35	Both Groups	3.3956*	A-B: -.0175 $\leq \mu_1 - \mu_2 \leq$ .6277 A-C: -.1972 $\leq \mu_1 - \mu_3 \leq$ .3746 A-K: -.3741 $\leq \mu_1 - \mu_4 \leq$ .3033 B-C: -.4603 $\leq \mu_2 - \mu_3 \leq$ .0275 B-K: -.6723 $\leq \mu_2 - \mu_4 \leq$ -.0087* C-K: -.4267 $\leq \mu_3 - \mu_4 \leq$ .1785

between languages can be attributed to the unusual performance of the low group.

FORM DEFINITENESS

Form Definiteness refers to the complexity of the concept regardless of the goodness of fit to the inkblot. It is an entirely concept-centered variable.

Form Definiteness is scored on a 5-point scale, ranging from o (concepts that are formless or lacking in specificity) to 4 (concepts that are highly definite in form).

Holtzman gives a list of concepts that belong to each category. The list provides a set of reference points for the scoring of Form Definiteness. But even with the help of this list, the scoring depends to a great extent on the subjective judgment of the examiner.

Form Definiteness is included in this study because of its importance in connection with Form Appropriateness. Both variables are not entirely independent. The higher the Form Definiteness of an answer, the more difficult it is for a person to find an appropriate area within the inkblot that fits the concept given. It seems to require a good intellectual capacity to be able to give concepts with a high score on Form Appropriateness and on Form Definiteness.

As was done with other variables, Form Definiteness will be studied separately. The important qualifications of Form Appropriateness are not going to be included. The analysis of Form Appropriateness did not yield very clear results and to use this variable to qualify another might introduce more error.

Figure 15 and 16 presents graphically the results in problem solving of the group High and Low in Form Appropriateness.

Figure 15
Problem 31 - F.D. High and Low Profiles

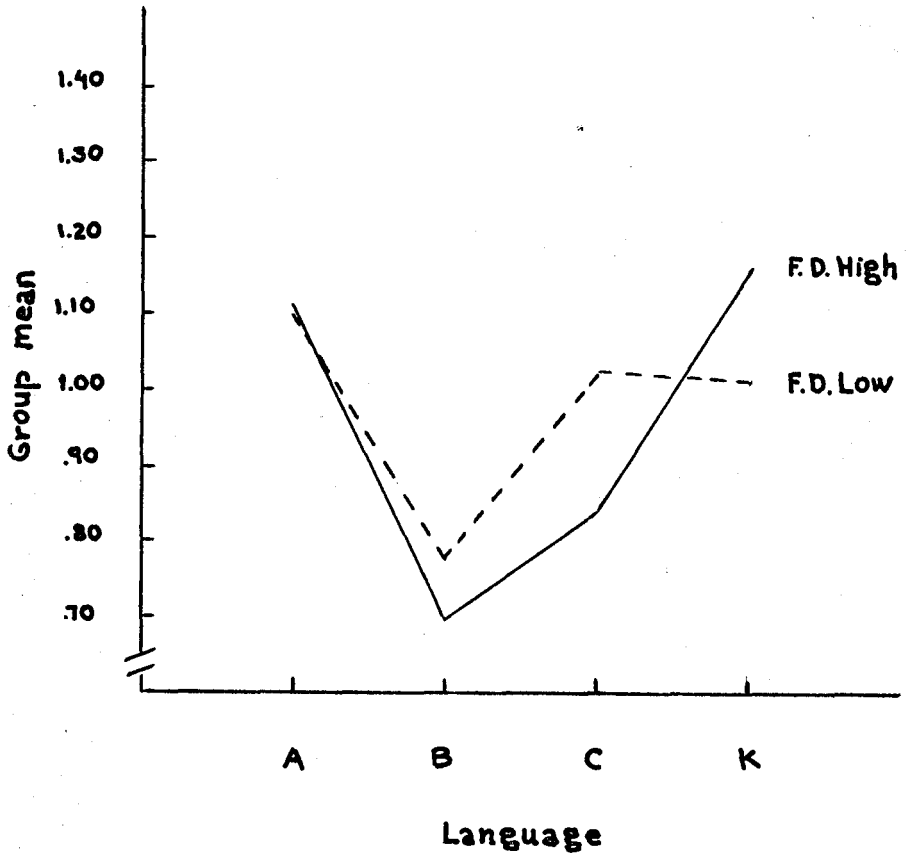
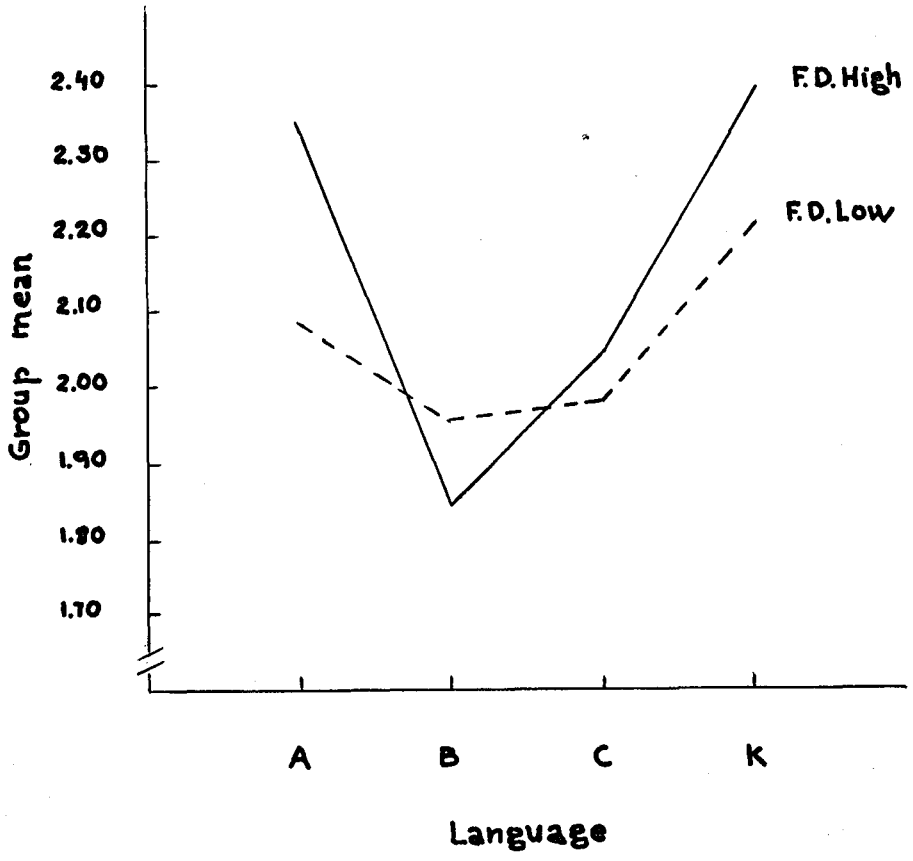


Figure 16
Problem 35 - F.D. High and Low Profiles



It can be observed that in problem 31 the Low group seems to perform better than the High group using the B and C language and worst using the A and K languages. With respect to problem 35, although the High group seems to perform better than the Low group in all languages except the B, the curves are quite close one to another. It was suspected that not statistically defined difference exists between both groups.

In order to maximize the differences, if there are any, the subjects were divided into three groups: High, Middle and Low, with 20 subjects each. The High and Low group were formed with those subjects whose scores were located in the High and Low extremes of the Scale. The middle group was formed by those subjects who fell in the middle interval. There were 17 5-points intervals, therefore the interval selected was the 9th, with scores ranging between 84.5 and 89.5

The results are shown graphically in Figures 17 and 18. In problem 31 it seems that there is no difference between the performance curves, although the High group maintains a little higher score than the other two groups, except when using the C language. Problem 35 shows quite parallel looking curves for the High and Middle group, and a considerable separation between both. The low group presents the same phenomenon observed in the analysis of F. Appropriateness. The curve does not have any slope. Looking back at the data it was observed that 6 subjects of the Low group had an excellent problem solving performance using the 4 languages, raising the means of Languages B and C that are usually the most difficult. This explains the flatness of the curve. But the interesting fact was that the same examiner scored these six subjects in Form Definiteness. The author remembers long discussions about Form Definiteness and Form

Figure 17
Problem 31 - F.D. High, Middle and Low Profiles

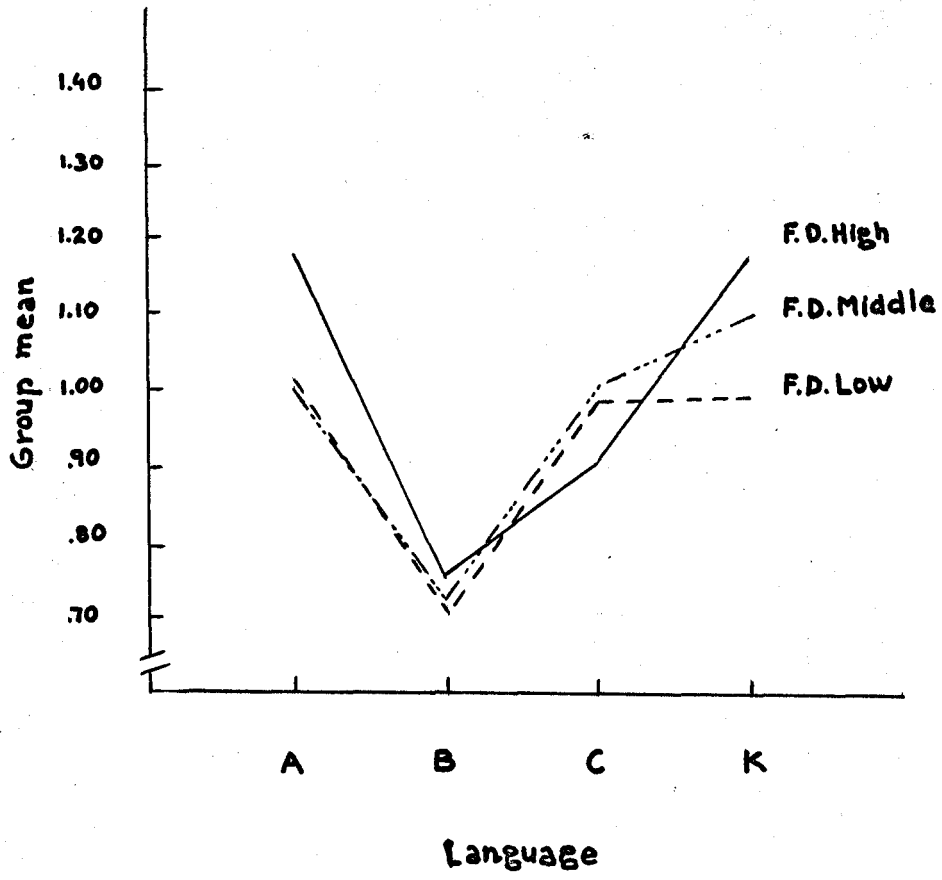
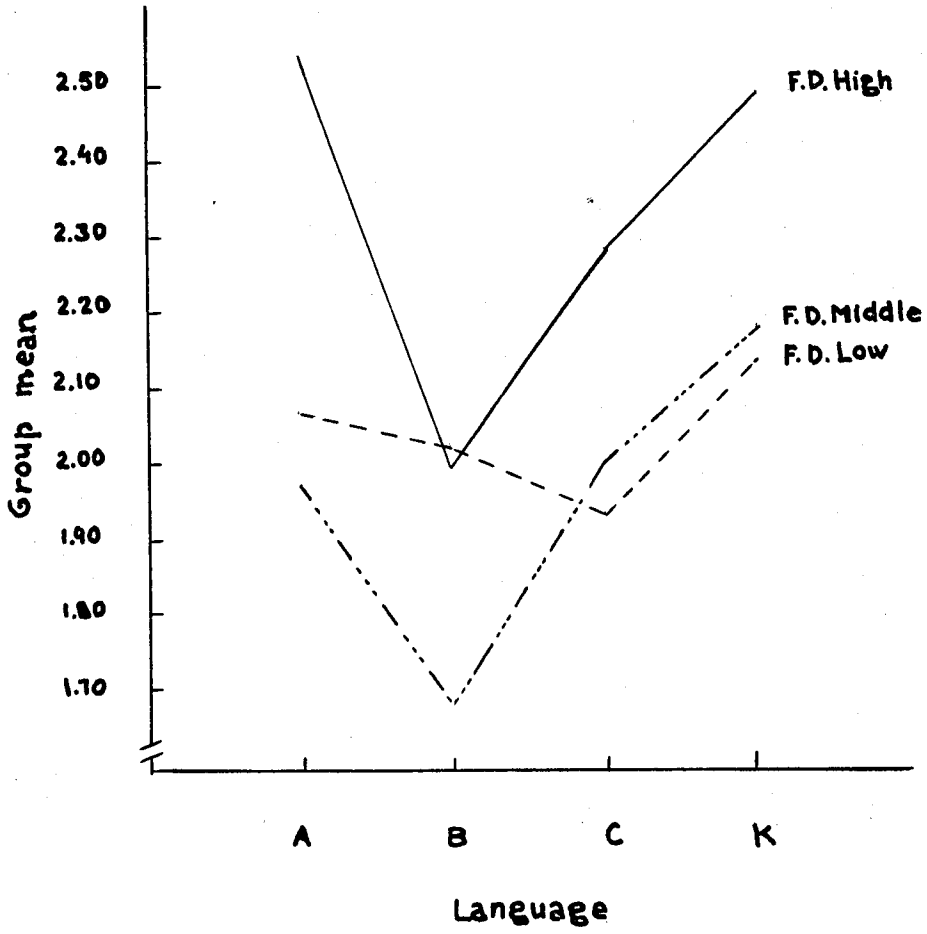


Figure 18
Problem 35 - F.D. High, Middle and Low Profiles



Appropriateness between the three examiners that scored the inkblot test. It could have happened that the scoring criteria of this particular examiner determined the inclusion on the Low Form Definiteness group of subjects that would be included in higher groups by the other two examiners.

A profile analysis was performed between the High and Middle group. The Low group was eliminated because the results given by this group do not seem to be consistent. The results of the profile analysis are summarized in Table 20.

As is shown in Table 20 and in Figures 17 and 18 the curves of the High and Middle group for Problems 31 and 35 are parallel. The performance in problem 31 is not significantly different for groups High and Middle in the Form Definiteness Scale. In problem 35, however. the performance curves are significantly different. The t-values are given in Table 21. A one-tailed test was chosen because it was predicted that the High group would performed better than the Middle group.

Why are the two groups different in Problem 35 and are not in Problem 31? Problem 35 is more difficult than problem 31, since it has a more complex structure. Differences between group are apparent when the difficulty of the problem increases. When the problem is easy, both groups perform equally well.

The results obtained in problem 35 seems to support the hypothesis that individuals that use complex, elaborate or uncommon concepts in their answers to an inkblot test, are better problem solvers than individuals that use plain and popular concepts.

Table 20

Form Definiteness, High and Middle groups-Summary of Results

	Parallelism	C.Level	F (languages)	Scheffé analysis
Problem 31	+	-	+	A-B B-K
Problem 35	+	+	+	A-B B-C B-K

Table 21

Form Definiteness, High and Middle groups
t-values for group differences in problem solving

GROUP	Problem 31	Problem 35
High versus Middle	.987	2.729*

* $P < .025$

Table 22

Form Definiteness, High and Middle groups
Scheffé confidence intervals for differences between languages

	F	Confidence interval
Problem 31	11.0905**	A-B: .1188 $\leq \mu_1 - \mu_2 \leq$ .5860* A-C: -.5123 $\leq \mu_1 - \mu_3 \leq$ .0613 A-K: -.3005 $\leq \mu_1 - \mu_4 \leq$ .2013 B-C: .6584 $\leq \mu_2 - \mu_3 \leq$ .0309 B-K: -.6334 $\leq \mu_2 - \mu_4 \leq$ -.1706* C-K: -.4061 $\leq \mu_3 - \mu_4 \leq$ .0531
Problem 35	5.2100**	A-B: .0148 $\leq \mu_1 - \mu_2 \leq$ .7864* A-C: -.3132 $\leq \mu_1 - \mu_3 \leq$ .5112 A-K: -.4564 $\leq \mu_1 - \mu_4 \leq$ .3224 B-C: -.5992 $\leq \mu_2 - \mu_3 \leq$ -.0040* B-K: -.8865 $\leq \mu_2 - \mu_4 \leq$ -.0487* C-K: -.5420 $\leq \mu_3 - \mu_4 \leq$ .2100

In table 22 the F and Scheffé confidence interval for equality of languages are given. There is a significant differences between languages in both problems.

Table 22 shows that in Problem 31 and 35 both groups perform significantly better using the A language rather than the B language. This is the usual effect of passing from an everyday language to an abstract one. The performance is significantly better also using the K language than the B language. The K language uses pictures of geometric objects. The concreteness of the language and the practice effect determine a good performance.

In problem 35, both groups perform significantly better using the C language rather than the B language. The B language uses negative symbols but the subjects having performed first with positive symbols have some practice with it. Besides, when they realize that the negative symbols can be dealt with as positives ones, their performance improves notably.

LOCATION

The location Scale refers to the area of the blot chosen for answer. It could be all the inkblot or only parts.

Holtzman uses a 3 point scale for scoring Location.

0- use of the whole blot, or at least all except minors portions of the blot.

1- use of a large area of the blot, such as one entire side or the entire center of the blot.

2- use of smaller areas of the blot.

Traditionally, the use of the whole blot for interpretation has been related with intelligence. But it is important to remember that the whole may be achieved by integrating parts that have been differentiated out of the blot or the whole may be seen as global and undifferentiated.

The first kind only is related with a high level of intelligence.

It was stated before that the present study observes each variable in isolation. Integration and goodness of form that are very important in qualifying a whole response as predictor of intelligence are not taken into account.

As usual, the subjects were divided in two groups of 40 subjects each, high and low in the Location Scale.

The results of the profile analysis are presented graphically in Figures 19 and 20 and are summarized in Table 23.

It can be observed that the performance curves are parallel in Problem 31 and 35. There is not a significant difference in problem solving ability between the groups High and Low in the Location Scale. The t-test for group differences is given in Table 24.

It seems that the way the individual perceives, the whole stimuli or only a part, does not make any differences in problem solving ability as measured by Location on Holtzman.

The F test shows a significant difference between languages. The result for Problem 31 and 35 are given in Table 25.

In problem 31 and 35, both groups perform significantly better using the A language rather than the B language. This effect has been explained before by the difficulty of passing from an everyday language to an abstract one. There is also a significant difference between the values obtained when using the B language and the values obtained when using the C language. Both are symbolic languages, the first is positive, the second negative. Using the C language after the B, the subject has some training in it. Besides, if he realize that the negative language can be

Figure 19

Problem 31 - Loc. High and Low Profiles

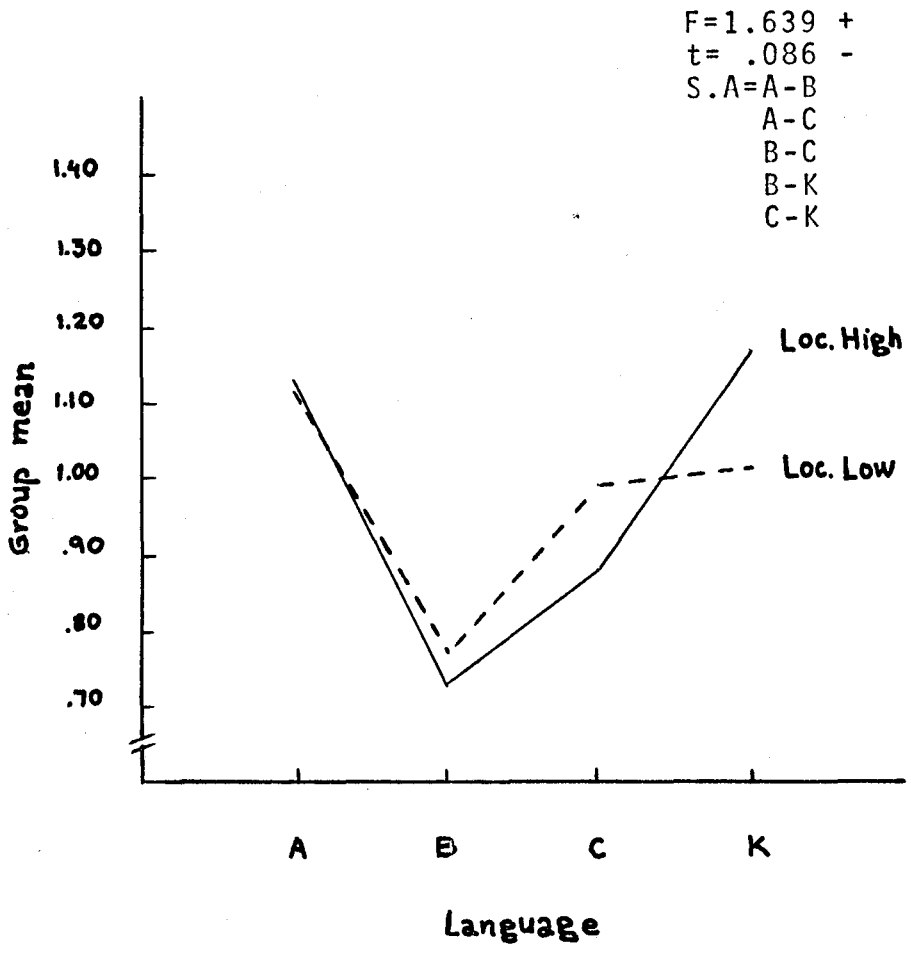


Figure 20

Problem 35 - Loc. High and Low Profiles

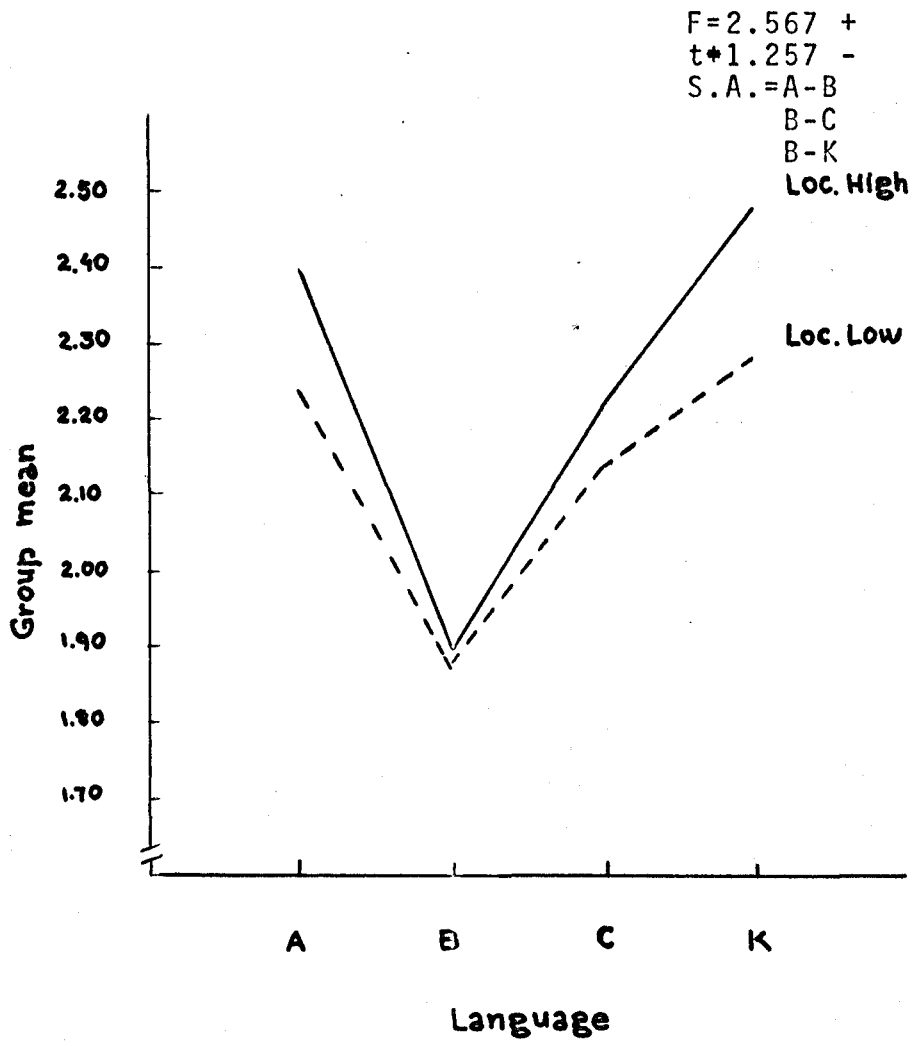


Table 23

Location-Summary of Results

	Parallelism	Loc.Level.	F (languages)	Scheffé Analysis
Problem 31	+	-	+	A-B A-C B-C B-K C-K
Problem 35	+	-	+	A-C B-C B-K

Table 24

Location- t-values for Group differences in problen solving

GROUP	Problem 31	Problem 35
High versus Low Loc.	.0858	1.2574

Table 25

Location-Scheffé confidence intervals for differences between languages

	F	Confidence interval
Problem 31	20.1030**	A-B: $.5151 \geq \mu_1 - \mu_2 \geq .2231$* A-C: $.3586 \geq \mu_1 - \mu_3 \geq .0270$* A-K: $.2073 \geq \mu_1 - \mu_4 \geq -.1425$ B-C: $-.0458 \geq \mu_2 - \mu_3 \geq -.3068$* B-K: $-.2316 \geq \mu_2 - \mu_4 \geq -.4418$* C-K: $-.1592 \geq \mu_3 - \mu_4 \geq -.5142$*
Problem 35	9.4941**	A-B: $.6951 \geq \mu_1 - \mu_2 \geq .1795$* A-C: $.3879 \geq \mu_1 - \mu_3 \geq -.0973$ A-K: $.2056 \geq \mu_1 - \mu_4 \geq -.3128$ B-C: $-.0374 \geq \mu_2 - \mu_3 \geq -.5466$* B-K: $-.1831 \geq \mu_3 - \mu_4 \geq -.7987$* C-K: $.0300 \geq \mu_3 - \mu_4 \geq -.4287$

dealt with as a positive one, the problem becomes easier and a significant difference appears between both languages.

The B and C languages are significantly different from the K language, showing the difficulty of solving a problem in symbolic terms as compared with concrete pictures.

It was thought that by selecting extreme subjects on the Location Scale any difference that might exist between the two groups, would be apparent. Two groups were formed by taking the 25 subjects located in the upper end and the 25 subjects located in the lower end of the Location Scale. These are the High and Low group, respectively. A Profile Analysis was tried in these two groups. The results are presented graphically in Figures 21 and 22.

Problem 31 changes almost nothing with respect to the analysis performed with 40 subjects in each group. But problem 35 changes markedly. The two curves continue being parallel but their slopes are less deep than before showing no differences between languages. The difference in problem solving ability is quite noticeable. The High Localization group performes significantly better than the Low Location. That is, the group that perceives details and small details seems to be better problem solver than the group that perceives the whole inkblot. The results of the t-test for problem 31 and 35 are given in Table 26. In establishing the significance of the differences a two-tailed test was used because the direction of the difference was not predicted.

To understand the difference in performance between the two groups it will be useful to refer again to Hemmendiger's (1961) studies in this area. It should be remembered that Hemmendiger studied Location using the implications of Heinz Werner's developmental theory. Heinz Werner's approach states that "when development occurs, it proceeds form a state of relative globality and lack of

Figure 21
Problem 31 - Loc. High and Low Profiles
with 25 subjects in each group

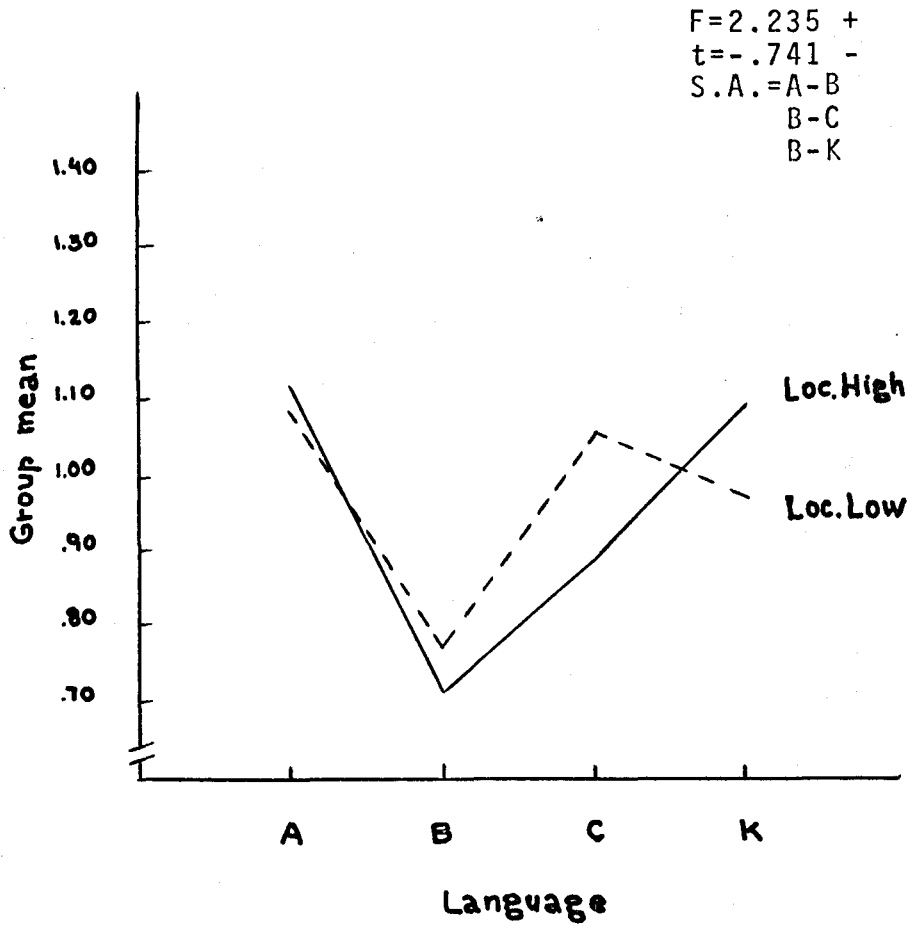
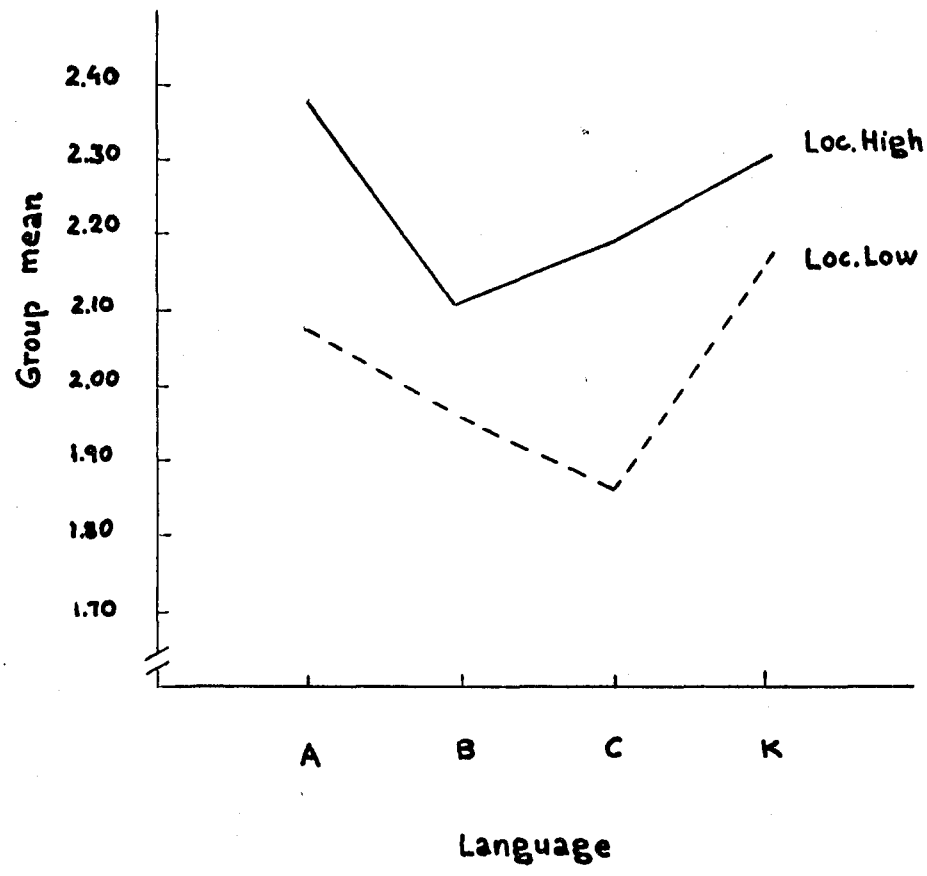


Figure 22
Problem 35 - Loc. High and Low Profiles
with 25 subjects in each group

F= .920 +
t=2.702 +



differentiation to a state of increasing differentiation, articulation and hierarchic integration" (1957). Hemminger found that with increasing age there is decrease of the undifferentiated, diffuse whole and detail responses and an increase of the highly articulated, well integrated whole responses. Between these two extremes there is a shift from the early whole responses toward small details.

Applying Hemmendinger findings to the results of this study with the Location Scale, it is possible that the High Group, that is the group with many details and small detail responses, is functioning in a stage of differentiation previous to the achievement of integrated global responses. For this reason the High Location group has a better problem solving performance as compared with the Low Location group that is in a stage of undifferentiated wholes. The fact that the Holtzman test was administered in group and with a limit in the exposition time of each card could have affected the results. The subjects did not have enough time to integrate the detail responses in a well integrated global response.

The second important question to be asked about the result obtained is why there is not difference between languages. It is the usual finding that languages A and K are much easier to deal with than the C and B languages. Looking at the data it was found that among the High group there were 8 subjects with the highest score in all four languages and in the Low group there were 6 subjects in the same condition. Reducing the number of subjects of each group from 40 to 25, the influence of the excelent performance of these subjects is noticeable producing a softer slope of the performance curve. Another study controlling for integration and goodness of form should be planned in order to explain the inclusion of almost equal number of excellent

problem solvers in the High and Low Group.

CHAPTER IV

Discussion and conclusions

The results of the present study seem to present evidence that some personality variables assessed by the Holtzman Inkblot test, are directly related to good and poor problem solving.

The results obtained with the Movement variable, showed that the High group performed significantly better as compared with the Low group. With the color variable the results were inversed, the Low group performing significantly better than the High group. Applying the interpretative hypothesis that lies behing these variables, it seems that subjects endowed with a vivid imagination are better for solving problems than the subjects more restricted in imagination while subjects whose perception is easily dominated by the most immediately manifest and sensorially most vivid aspects of the visual surroundings, such as color, are poor problem solvers.

This fact has been known empirically in the clinical area, even to the point of relating these two variables with characteristics psychological defenses and intellectual endowment. Thus, Movement gives presumptive evidence of defenses of an ideational type, like intellectualizations, doubts and ruminations and projections. Color suggests the presence of repressive defenses. The relationship with the intellectual functions is stated by Roy Schafer (1954) saying: "As a rule, repression seems to be favored for defensive purposes by those who are intellectually mediocre or relatively limited, just as the obsessive-compulsive defenses seem to be the defenses of choice among those who

are intellectually precocious. We do not seem to be dealing with an either-or proposition. More or less limited endowement seems to favor turning away from mastery of reality and conflict through intellect and tends to foster repressive solutions to problems; in turn, these repressive solutions may lead to neglect and even devaluation of such intellectual assets or potentialities as are present" (p.202). The current study employed normal subjects, but the analysis of Movement and Color seems to agree with the clinical interpretation. It is possible that the group High in Movement, formed by good problem solvers, is prone to an ideational type of defense while the group High in Color, formed by poor problem solvers, is prone to a repressive type of defense.

The analysis of Form Appropriateness did not give clear results. There were not significant differences in problem solving performance between the High and Low Form Appropriateness groups, when these groups were formed with 40 subjects each. A profile analysis performed using the 25 subjects located in the furtherst extremes of the Form Appropriateness Scale did not give significant differences between groups in problem 35. Problem 31 gave contradictory results. The High group performed significantly better as compared with the Low group when using the K language, but the result was inversed with the B and C language, the Low group performing significantly better than the High group.

The interpretative hypothesis underlying Form Appropriateness stresses ability to concentrate, form clear memory images, ability to make adequate use of such images selecting among them the most fitting for the stimuli. Therefore, the fact that the Low group was superior to the High group when using the B and C languages is very

disconcerting. Since the scoring of this variable is quite subjective, depending on the empathic judgement of the examiner, it was thought that the result was in part due to a failure in following the scoring criteria.

Form Appropriateness has been used to distinguish psychotic records from neurotic or normal ones and intelligent records from mediocre or defective records. Its importance is stressed by Schachtel (1966) saying: "Form is the most important of the determinants as it is the most important aspects of the visible world. Out of Chaos form creates Kosmos. From Aristotle and Plato to Thomas Aquinos, Leonardo and Goethe form has been recognized as the ordering, structuring principle of the universe perceived by man" (p.87). Considering the results obtained and the importance of Form Appropriateness for psychological assessment it would be very convenient in another study similar to this one, to test the subjects individually to avoid possible errors due to group testing. It would be also desirable to use another scale with more specific scoring criteria, in order to reduce to a minimum subjective judgements.

The results obtained with Form Definiteness were more cpnsistent than those obtained with Form Appropriateness. The High group performed significantly better as compared with the Middle group. There is some evidence then to sustain the hypothesis that individuals answering with complex or uncommon concepts in an inkblot test, are better problem solvers than individuals that use popular or ordinary concepts.

Finally, it was found that the group High in the Location Scale, performed significantly better than the group Low in the same Scale. That is, the subjects that perceives details are better problem solvers than the subjects that perceives the totality. This result seems contrary to the hypothesis that considers the perception of well integrated

wholes of good quality as a sign of superior intellectual ability. But this study took each variable in isolation, therefore the Low Location group, the one with many Whole responses, has integrated Whole's as well as indifinite and vague ones. On the contrary the Low Location group fulfils one of the presuppositions of the hypothesis, namely, the ability to differentiate as a step previous to integration in a totality

Previous experimentation with this problem solving technique by Rimoldi and al. (1964) and Rimoldi and Vander Woude (1969) has shown that in the thinking processes there is an interplay between the logical structure of the problem and the mode (language) of presentation. One of the aims of this study is to detectany personality differences in the handling of the logical structure and in the use of the languages. It was observed that differences in performance between the High and Low group was obtained always with Problem 35 and only twice with problem 31. It should be remembered that problem 35 has a more complex structure than problem 31, and therefore is somewhat more difficult. A relatively easy problem is solved by everybody, the mediocre as well as the bright. But a more complex problem will be solved only by the intellectually superior. The sensitivity of Rimoldi's Technique to subtle degrees of difficulty permits one to differentiate the performance of the two groups in each personality variable. The failure of previous studies to find intellectual differences between groups formed according with personality variables could be attributed to the intellectual measure used.

In general it was observed that the performance curves were parallel. This means that, with exception of the Form Appropriateness analysis, the personality variables have a constant effect. The two groups High and Low in each variable performed at different levels but without interacting with the

languages.

The comparison between languages in problem 31 and 35 gave a similar result for all the personalities variables. A summary is given in Appendix 11.

Looking at Table 27 in Appendix 11 it can be observed that in all cases the performance with the A language is superior than The performance with the B language. The difference has been explained by the difficulty of passing from an everyday language to an abstract one,

The A language is also superior to the C language in several instances. This happens in problem 31, with the Movement groups, the Form Appropriateness High Group, the Location groups and in problem 35 with the Color groups. Language C is symbolic negative, therefore the difference could also be explained by the difficulty of solving the problem presented in negative symbols as compared with the everyday language. A signficant difference did not occur in every case, becasuse the subjects, having performed already in the B language, have some training in the use of symbolic languages. Besides, when they realized that the negative language can be dealt with as a positive one, their performance improves notably. Significant differences between the C language and the B language, showing the improvement ocurred in problem 31 with the Movement groups, the Form Appropriateness groups and the Location Groups. In problem 35 it happened with the Form Appropriateness Groups and the Location Groups.

The K language uses pictures of geometric objects. Here the practice effect and the visual quality of this language determine a good performance. The results were significantly better when using the K language rather than the B language in problem 31 for the Movement groups, the Low

Color Group, the Form Appropriateness Groups, the Form Definiteness Groups and the Location Groups. In problem 35 the differences were significant for the Movement groups, the Form Appropriateness groups, the Form Definiteness groups and the Location groups.

For the same reason, that is the difficulty of performing with a symbolic negative language as compared with a pictorial one, the performance with the K language is significantly better than the performance with the C language. In problem 31 this happened with the Color groups, the Form Appropriateness groups, and the Location Groups. In problem 35 it happened solely with the Movement Groups.

Observing the graphs of the profiles (Figures 3 through 22) one phenomenon appears constantly. The good problem solvers are always excellent using the K language. Even when problem 31 does not show differences between groups, the K language follows the same trend of differences detected by problem 35.

The good problem solvers were characterized in this study by a vivid imagination (M), detachment in frontof the overhelming effects of the external stimuli (C), adequacy between the perceived area and the concept given (F.A., elaborated concepts (F.D.) and capacity of discrimination and differentiation (L). They seem to performed the best with the K language.

The preference of a certain language by subjects with definite characteristics, may have practical application in the educational process and in the understanding and communication with some psychological characters. This was observed by Rimoldi (1967) saying:"THere are, no doubt, individual differences in the use and acquisition of a language. This implies that in the educational process it may be worthwhile to fit the language or languages used to the

characteristics of the individual, rather than force the use of a preferred language indiscriminately to all individuals" (p.574).

What are the attributes of the K language that facilitate the solution of the problem to a certain type of individuals? The K language presents the problem pictorially. One explanation could be that facility with visual imagery is involved here. It is commonly ssumed that a special kind of abstraction is required by some geometrical and spatial test. The first factor extracted by Thurstone (1968) in his factorial study of Primary Mental Abilities was a spatial factor.

Another explanation could also be possible. The author noticed that certain subjects guessed immediately the correct answer in the pictorial problem even without asking any question. Apparently this happens because the experience with previous problems showed them that to find the solution they have to subtract from a given total, certain amount of information obtained by the questions asked. The problem presented in the K language requires similar type of reasoning but does not require the knowledge of a fixed quantity. The simple presence of the questions is telling the subject that the question corresponding to the correct solution is missing. For instance, problem 31 K says that "among a set of objects there are small green squares, large green squares, small blue squares and large blue squares". The subject's task is to find out which type of squares has been selected. Taught by previous experience, when the subject sees the "questions" presented by the drawings of a large and small blue square and large green square, he guesses that the missing drawing of a small green square is the correct answer. The asking of questions confirmed his expectation.

If this tentative explanation agrees with the facts, the K language would seem to facilitate the solution of the

problem to those subjects that are able to grasp immediately the structure of the problem and anticipate a solution. The solution anticipated guides them to choose the logical steps to confirm it.

The results obtained in this study with the K language suggests that a number of interesting factors could be involved. Further studies are necessary to clarify which mental functions are operating in the solution of this type of pictorial problems.

CHAPTER VI

Summary

This study investigated the relationship between some personality variables assessed by the Holtzman Inkblot test and problem solving ability. The variables selected were Movement, Color, Form and Location. The criteria for the selection was derived from empirical findings with inkblot tests.

Rimoldi's method was used to evaluate the thinking process. This method has three main advantages: 1) the tactic an individual is using to solve a problem may be observed; 2) each problem has a well defined logical structure; 3) each problem allows for different modes of presentation, verbal, symbolic or pictorial. In addition the scoring system of the problems has been carefully elaborated and it is very sensitive to the performance of each subject.

The analysis of each variable was done selecting from a total of 152 subjects, a High and Low Group. Three hypothesis were tested: 1) whether the performance of the high and low group were parallel 2) in the case of parallelism whether the level of performance were significantly different 3) within each structure whether the performance in each different language was different.

The results sustantiated the empirical findings. The subjects High in Movement, Form Definiteness, Location and Low in Color were better problem solvers as compared with subjects Low in Movement, Form Definiteness, Location and High in Color. Form Appropriateness gave contradictory

results and it was thought that the scoring procedure of this variable could have introduced some error in the selection of the groups.

The performance curves were parallel, with the exception of the performance of the Color groups and the Form Appropriateness groups in problem 31. This seemed to show no interaction between the personality variables and the mode of presentation of the problem. But a trend was observed for the good problem solvers to perform the best when using the K language. This phenomenon deserves further study.

With respect to differences between languages, it was found that the performance is better when the problem is presented in everyday terms as compared with symbolic languages. Also a better performance using pictures of geometric objects than using symbolic statements was found. On several instances the performance with a symbolic negative language was significantly better than the performance with a symbolic positive language. This seems to show the effect of training that helped the subjects to discover that the symbolic negative language could be dealt with as a positive language.

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APPENDIX I

General Instructions to the problems

You are going to be given a series of problems to solve. The problems should be approached in the following manner:

First read over carefully the instructions given for each problem. Secondly, read over all the questions. Next decide which questions you would like to ask in order to solve the problem. That is, decide which question you would like to ask first. The asnwer is obtained for each question by turning the card over. After you have obtained the answer for the first question, decide what question you would like to ask next, and so forth. You may ask as many questions as you want. But do not ask more questions than you think you need to solve the problem. Every time you ask a question, mark the question number on the answer sheet. For example, if the first question you ask is question #3, then you would put 3 next to "1st" on the answer sheet, and so forth. Be sure to put your name on the answer sheet, the time started and the time completed the problem, and at the top of each column, the problem number. Finally, when you have solved the problem, put your answer at the bottom of the column in the space provided.

APPENDIX II

Figure 1

Logical Structure for Problem 31

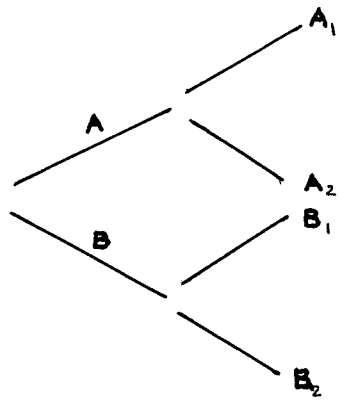
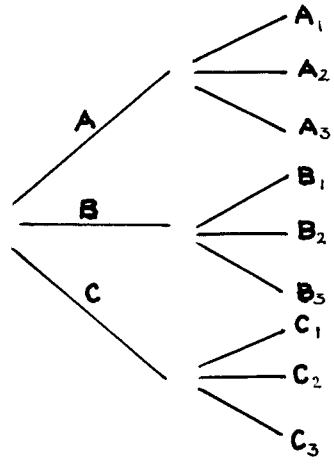


Figure 2

Logical Structure for Problem 35



APPENDIX III

Problem 31 A

Instructions and Corresponding Questions and Answers

At Spencer High School, the annual fall dance is about to be held. A dance committe has been selected to make the necessary arrangement. A total of 20 boys and girls are on the committee. A part of the committe is to take care of the refreshments for the evening and another part will look after the sale of the tickets for the dance. The list of the girls on the dance committee involved in the sale of tickets has been lost. From the other information available, which you will find in the questions, your object will be discover the number of girls involved in the sale of tickets.

Questions	Answers
1. How many students are in Spencer high School?	1.200
2. How many students are in charge of refreshments?	7
3. Is Spencer High School the only coeducational school in the city?	No
4. How many boys are in charge of the refreshments?	5
5. How many boys are in charge of the sale of tickets?	5

Questions	Answers
6. How many boys attend Spencer High School?	240
7. Are there more girls than boys at this school?	Yes
8. How many girls are in charge of refreshments?	2
9. How much time does the committee as a whole spend in preparation for the dance?	275 hours
10. How much time would the average committee member contribute?	11 hours.

Solution: 8

APPENDIX IV

Problem 31 B
Instructions and Corresponding Questions and Answers

We have a certain number of objects, M, 50 of which, for lack of a better name, will be called C's. The C's are composed of B's and G's. No B is G and Vice versa. Any B can be either an R or a T, and any G can be either an R or a T. No R can be a T and vice versa. Your task is to discover how many of the G objects are also called T?

Questions	Answers
1) Are there C's that are not B's and G's?	No
2) Are there more M's than C's?	Yes
3) How many R objects are also called G?	15
4) How many T objects are also called B?	10
5) How many B's are M's?	120
6) How much is K times C?	550
7) Are there more C's than B's?	No
8) How many R objects are there?	35
9) How many R objects are also called B?	20
10) Are there more T objects than R objects?	Yes

Solution: 5

APPENDIX V

Problem 31 C

Instructions and Corresponding Questions and Answers

Assume that X,A,D,P and S represent properties among F objects. Not-X, Not-A, Not-D and so on represent lack of these properties. There are 40 Not-X's. These are composed of Not-A's and Not-D's. Each of these latter is divided into Not-P's and Not-S's. From the other information available which you will find in the questions, your object will be to discover the number of Not-D's that are also Not-S's.

Questions	Answers
1) Are there Not-X's that are A's and D's?	No
2) How many Not-A's are Not-X's?	14
3) How many Not-A's are F's?	100
4) How many Not A's are Not-P's ?	8
5) How many Not-D's are Not-P's?	20
6) Are there more Not-D's than Not-A's among the F's?	Yes
7) How many Not-A's are also Not-S's?	6
8) What is the value of I times the Not-X's?	440
9) How many Not-D's that are Not-X's are also P's?	None
10) How many Not-X's are S's?	None

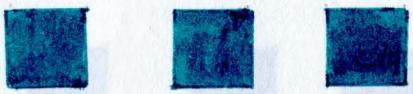
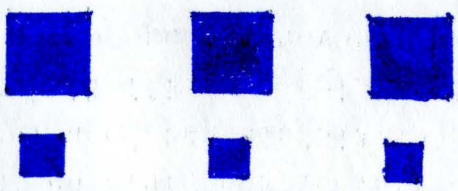
Solution: 6

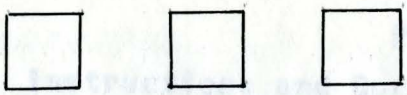
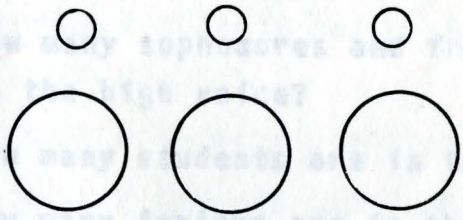
APPENDIX VI

Problem 31 K

Instructions and Corresponding Questions and Answers

Among a set of objects there are small green squares, large green squares, small blue squares and large blue squares. One of these types of squares has been selected. Your task is to discover which type of square has been selected. You may do this by picking up a card and "asking" if the boxes on this card are one of the selected type of objects. The answer to this question is given on the reverse side of the card.

Questions	Answers
1. 	No
2. 	No
3. 	No
4. 	NO
5. 	NO

Questions	Answers
6. 	No
7. 	No
8. 	No
9. 	No
10. 	No

Solution: small green squares

APPENDIX VII

Problem 35 A

Instructions and Corresponding Questions and Answers

A college choral group is composed of freshmen, sophomores and juniors. The group has 45 members. The chorus has three voices or parts which are high, medium and low. From the questions given on the following cards you are to find out how many juniors sing de medium part.

Questions	Answers
1) How many juniors and freshmen are in the low voice?	10
2) How old are the chorus members?	At least 18
3) How many sophomores are in the low voice?	5
4) How many girls are in the chorus?	20
5) How many sophomores and freshmen are in the high voice?	10
6) How many students are in the low voice?	15
7) How many juniors are in the high voice?	5
8) How many students are in the high voice?	15
9) How many sophomores and freshmen are in the medium voice?	10
10) How many freshmen are in this college?	1057

Solution: 5

APPENDIX VIII

Problem 35 B

Instructions and Corresponding Questions and Answers

50 T objects are composed of M, N and P types. Each of these 3 types is divided into Q's, R's and S's. From the questions and answers given you can discover the various relationships between these objects. Make use of this available information to determine how many of the T objects are N's and also S's.

Questions	Answers
1) How many N objects are also called R?	9
2) How many M objects and N objects are also called Q?	12
3) How many S's are also A's?	250
4) How many R objects are there?	15
5) How many M objects and P objects are also called S?	5
6) How many Q objects are there?	25
7) How many M objects and P objects are also called R?	6
8) How many Q objects are called P?	13
9) Are there more Q objects than R objects?	Yes
10) Are there more S objects than Q objects?	Np

SOLUTION: 5

APPENDIX IX

Problem 35 C

Instructions and Corresponding Questions and Answers

A class of objects is distinguished by calling B's and some others not-B's depending upon the possession or non-possession of a certain property. The total number of not-B's are 45. These not-B's are divided into no-X's, not-Y's and not-Z's. Each of these types can be further divided into not-D's, not-E's and not-F's

From the accompanying questions and answers you can discover the relationship that exist between these objects. Make use of the information available to determine how many not-Y's are also not F's.

Questions	Answers
1) How many not-E's are there?	15
2) How many not-X's and not-Z's a are also not-E's?	10
3) How many not-X's and not-Y's are also not-D's?	10
4) How many not-Y's are also not-E's?	5
5) How many not-Z's are also not-D's?	5
6) Are there more not-Z's than not-X's?	No
7) How many not-D's are not A's?	150
8) How many not-X's and not-Z's are also not-F's?	10

Questions	Answers
9) How many not-G's are among the not-B's?	30
10) How many not-D's are there?	15

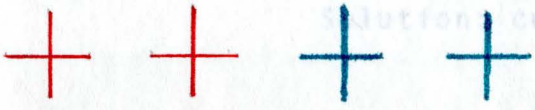
Solution: 5

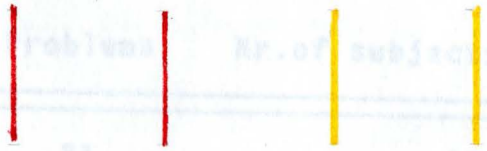
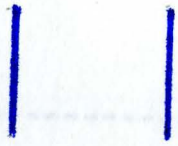
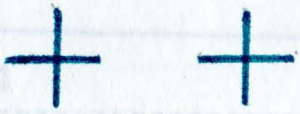
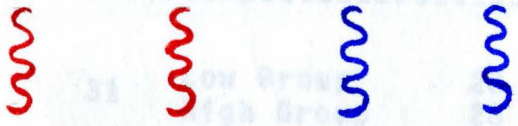
APPENDIX X

Problem 35 K

Instructions and Corresponding Questions and Answers

Among a set of objects, there are straight lines, curved lines, and wavey lines. Each of these types of lines can be either red, blue, or yellow. From these lines of different shapes and color, one type has been selected. Your task is to discover which one of these has been selected. You may do this by picking up a card and "asking" if the selected type is among the objects on the card. The answer to the question is given on the reverse side of the card.

Questions	Answers
1. 	No
2. 	No
3. 	No
4. 	No
5. 	No

Questions	Answers
6. 	No
7. 	No
8. 	NO
9. 	No
10. 	No

Solution: curved yellow

APPENDIX 12

Table 26

Summary of language differences for all the personality variables

Variables	Problems	Nr.of subjects in each group		Languages
Movement	31		40	A-B A-C B-C B-K
	35		40	A-B B-K C-K
Color	31		40	not parallel
	35		40	A-B A-C
	31	Low Group High Group	28 28	A-B B-K C-K A-B
	35	Low Group High Group	28 30	A-B
Color High versus Movement High	31 35		30 30	not parallel A-B
Form	31		40	A-B B-C B-K
	35		40	A-B B-C B-K

Variables	Problems	Nr. of subjects in each group		Languages
Appropriateness	32	Low Group	25	no differences
		High Group	25	A-B A-C
	35		25	C-K B-K
Form	31		20	A-B B-K
Definiteness	35		20	A-B B-C B-K
Location	31		40	A-B A-C B-C B-K C-K
	35		40	A-B B-C B-K
	31		25	A-B B-C B-K
	35		25	no differences

APPROVAL SHEET

The dissertation submitted by Ana Maria Insua, has been read and approved by members of the Department of Psychology.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Jan 12/70
Date

Signature of Advisor