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# Relationship of the Global-Analytical and Open-Closed Dimensions Within and between the Sexes in Cognitive Activity

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RELATIONSHIP OF THE GLOBAL-ANALYTICAL AND OPEN-CLOSED DIMENSIONS  
WITHIN AND BETWEEN THE SEXES IN COGNITIVE ACTIVITY

by

Sister Mary Austin Doherty, OSF

A Dissertation Submitted to the Faculty of the Graduate  
School of Loyola University in Partial Fulfillment  
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## CHAPTER I

### INTRODUCTION

The attempt by psychologists to understand the unique approach to reality of the individual while at the same time exploring similarities among individuals has resulted in several extensive research programs designed to explore relationships between perceptual and cognitive functioning and personality.

One of the most systematically investigated areas is the one explored by Witkin, Faterson, Goodenough and Karp (1962) whose theory of psychological differentiation hypothesizes a more differentiated or less differentiated level in many areas of psychological activity, making for self consistency in emotional, social, perceptual, and intellectual activity. The construct of psychological differentiation serves to conceptualize the particular communality observable in a person's functioning in different psychological areas. Basing his theory originally upon extensive research in perceptual functioning, Witkin discovered through evidence from studies on intellectual activity, the nature of the body concept, the self, and personality controls and defenses that perceptual field dependence-independence was related in a meaningful and coherent manner to broad and highly diverse aspects of personal

functioning. The term field-dependence-independence, used to describe the dimension in its perceptual aspects, was replaced by the term global-analytical dimension as descriptive of this broader mode of personal functioning.

The two poles of the global-analytical dimension are described by Witkin as follows: "At one extreme there is a consistent tendency for experience to be global and diffuse; the organization of the field as a whole dictates the manner in which its parts are experienced. At the other extreme there is a tendency for experience to be delineated and structured; parts of a field are experienced as discrete and the field as a whole organized" (Witkin, 1965).

It is not the purpose of this study to discuss nor to explore the theory of differentiation proposed by Witkin. Nor do I believe it necessary to accept or to reject the theory in order to investigate the cognitive style dimension upon whose identification the theory is partially based. The present research, proposed to explore the cognitive aspect of the global-analytical dimension and its relationship to other aspects of personal functioning with the view to gaining greater insight into the global-analytical dimension itself as a fundamental characteristic of personal functioning. The theory of differentiation is not under direct investigation although it is evident that greater understanding of the global-analytical dimension in the cognitive area will affect theorizing regarding

the meaning and relationship of this dimension to personality functioning in general.

The present investigation attempts to investigate the global-analytical dimension as an aspect of personality by studying it in relationship to another such dimension, dogmatism, which has also been quite thoroughly investigated. The high-low dogmatic dimension has been chosen for study not only because it is a well documented aspect of personal functioning but primarily because a comparison of the theoretical formulations of these two dimensions of personal functioning lead us to believe that they bear some relationship to one another even though studies attempting to correlate the dimensions have not been successful. It is believed that an empirical study of individuals possessing both characteristics will provide evidence not only on the relationship of these dimensions to each other within different subgroups but also on the relatively pervasive influence of each dimension on personal functioning.

Although the personality dimensions of global-analytical and high-low dogmatism constitute the main focus of investigation in this study, related to both are the questions of sex differences and anxiety.

Although high-low dogmatism does not seem to differentiate the sexes, the consistent findings of sex differences in the global-

analytical dimension necessitate an exploration of differences. Also, since Witkin has focused primarily upon male subjects, an investigation of the validity of the global-analytical construct for females is greatly needed as Maccoby has indicated in her recent summary of research in The Development of Sex Differences (1966).

A related argument also accounts for the inclusion of an investigation of the level of anxiety in the subjects under study. Because of its demonstrated relationship to high dogmatism and globalness and its ambiguous relationship to other psychological phenomena in studies of sex differences, anxiety, although peripheral to this study, is a factor of some significance.

Measures of masculinity-femininity and anxiety, therefore, will be analyzed for possible interaction with the two major personality dimensions under discussion.

The attempt to relate the areas researched by Witkin and Rokeach requires ascertaining as clearly as possible the aspect of psychological functioning being defined or described by the terms global-analytical and high-low dogmatism.

As mentioned above, the term global-analytical is used both to describe a cognitive style and also to express a more or less developed psychological complexity within the individual. The global-analytical cognitive style, according to Witkin, is the cognitive component of the dimension of psychological differentiation,



a broader and pervasive dimension of personal functioning.

By employing the term cognitive style Witkin intends to convey that the tendency to function in a consistent manner pervades both perceptual and intellectual activity. His original investigations in the field of perception in which he discovered that individuals differ in the way they orient themselves in space, led to his investigation of preferred modes of perceiving which he classified field-dependence-independence. In a field dependent approach, perception is dominated by the overall organization of the field and the parts of the field are experienced as "fused." In the field independent approach parts of the field are experienced as discrete from organized background. The instruments used to assess the individual's preferred orientation were primarily the rod-and-frame test (RFT), the body-adjustment test (BAT), and the embedded-figures test (EFT). The RFT evaluates the individual's perception of the position in relation to the upright of an item within a limited visual field. The BAT is a part of the tilting-room-tilting-chair test which evaluates the individual's perception of the position of his body and of the surrounding field in relation to the upright. The EFT is a test requiring the individual to separate an item from the field in which it is incorporated, but involves neither orientation toward an upright nor perception of body position.

In intellectual functioning, Witkin identified the counter-

parts to the field-dependence-independence approach of perceptual activity through factor analytic studies of standard intelligence tests (WISC and WAIS), investigations of Guilford's adaptive-flexibility factor, and extensive study of insight and set problems. According to these studies a tendency toward a global or analytical way of experiencing characterized the subject's problem-solving activities as it had characterized his perceptual activity. The person described as analytical manifested the ability to overcome embedding contexts and to experience items as discrete from the field. The global person was more greatly influenced by the dominant organization of the field and manifested an inability to solve problems which required that contexts be overcome. Whether the field is immediately present in preception or represented only symbolically, these two styles represent contrasting ways of approaching the field.

In both perceptual and intellectual functioning, however, Witkin maintains that the global-analytical dimension is continuous. An individual's approach is determined relative to the mean of his group on the dimension. Therefore, the two approaches do not constitute distinct "types."

It is difficult to ascertain the precise meaning Witkin attaches to "approach." His caution not to consider them personality "types" is difficult to adhere to in view of his additional evidence from research on the sense of separate identity, body concept, nature

of control and defenses, adjustment and pathology. What constitutes a personality "type" as distinct from a fundamental "approach" to reality may be only an exercise in semantics dependent upon whether the theorist's main focus is the study of personality itself or the psychological activities of perception and cognition. However, it seems that Witkin's use of "approach" rather than "type" conveys the element of activity which characterizes his belief regarding psychological phenomena. For Witkin the person is actively involved in his perceptual and cognitive experience and has developed characteristic ways of responding to reality. Developmental studies of the global-analytical dimension have enabled Witkin to formulate hypotheses regarding early emotional, intellectual and social experiences which are related to the dominant global-analytical "approach" of the individual. Empirical support for the pervasive character of the global-analytical dimension has come from various other areas as well. Research has indicated that a more global or more analytical quality is a stable characteristic of an individual's psychological functioning over time.

If a global-analytical approach is a stable characteristic of the individual's psychological functioning then it would seem that it might be fruitful to investigate its relationship to other aspects of psychological activity within the individual which also have received empirical support for their stability of functioning.

For this reason another fundamental "approach" or "type"

was selected for study, the high-low dogmatic dimension formulated by Rokeach. Only in a very limited way have Witkin and Rokeach discussed their own research in relation to each other. Although indicating that his work has "made contact with" the field-dependence-independence dimension of Witkin and his associates, Rokeach (1960) distinguishes between the analytic ability being assessed by Witkin and the building up or synthesizing ability measured in studies of high-low dogmatism.

The high-low dogmatic dimension described by Rokeach (1960) is based on the belief-disbelief system of the individual. According to Rokeach an individual's belief system has a pervasive influence in all areas of his perceptual, cognitive and aesthetic activity. Rokeach stresses that it is the structure rather than the content of belief systems which is indicative of personality functioning. For example, the degree of isolation and differentiation among individual beliefs helps to determine the organization of the belief system. But the essence of this dimension is found in the "capacity to distinguish information from source of information and to evaluate each on its own merits" (p. 396). For Rokeach this variable is the cornerstone of any attempt to understand whatever relationships exist among personality, ideology, and cognitive functioning.

An individual's belief-disbelief system is characterized primarily by openness or closedness, that is, by the extent to which

the person can "receive, evaluate, and act on relevant information received from the outside on its own intrinsic merits, unencumbered by irrelevant factors in the situation arising from within the person or from the outside" (p. 57). This description of the individual seems to imply a person actively structuring his own environment.

In his phenomenological analysis of the dogmatism theory, however, Robb (1966) revealed Rokeach's concept of person as passive and subject to the influences of affectivity rather than as actively structuring his own environment. Since Robb agrees with the phenomena of openness and closedness as described by Rokeach, but considers the individual's active structuring to be the essential component in cognitive activity, his reformulation of the dogmatism theory ascribes characteristics of openness and closedness to individuals rather than to beliefs or belief systems and specifies that the determinant of openness or closedness in the individual is his judgment about reality rather than the content of his absolute beliefs. To the degree that the value orientations of an individual aid or prevent him from structuring reality according to the demands of reality itself can that individual be described as open or closed. The expectation is that the closed-minded individual would tend to impose structure upon reality whereas the open-minded individual would tend to be receptive to reality as it presents itself.

The question in this study concerns the relationship

between these two aspects of personality functioning. Since the global-analytical and the high-low dogmatic dimensions have not been found to be significantly correlated with each other, individuals may be global and high or low dogmatic or they may be analytical and high or low dogmatic. The question arises, then, for example, regarding an experience of reality which is clearly articulated, that is, perceived according to the elements or aspects comprising it, which Witkin describes as analytical or articulated, in the person who imposes a structure on reality, the high dogmatic person in Rokeach's formulation. How is such a person's experience different from the low dogmatic individual who receives the reality as given, that is, as able to be distinguished in the elements which comprise it. The experience of the global person evokes a similar question. The global individual who experiences reality in a diffuse, hazy, and ill-defined manner but also tends to impose some structure upon it in the manner of the high dogmatic person may be expected to approach that reality differently from the low dogmatic person who accepts the structure as given.

It is difficult to understand the lack of correlation between these two dimensions. The explanation offered by Rokeach that Witkin's global-analytical dimension reflects analytical ability in the individual whereas the open-closed dimension reflects both analysis and synthesis, rather than settling the issue, seems

only to invite further investigation in view of the admission that analysis is central to both dimensions. It should be possible to study these two dimensions within the same subjects and thereby explore the relationships which, from the theoretical discussion above and empirical work to be discussed in the next chapter, seem to exist between them. This study, therefore, is designed to compare individuals who are similar on one dimension under investigation and who differ on the other dimension. It is expected that analytical individuals will perform better than global individuals on the task selected and that openness will contribute to performance whereas closedness will constitute a difficulty for the individual in his assessment of the most efficient manner of proceeding.

Since the process of psychological functioning is under investigation, it was necessary to select problem-solving tasks for study which would allow an assessment of the process in addition to an assessment of the product. The work of Rimoldi and his associates in analyzing the problem-solving processes of individuals lends itself to this type of investigation. They devised problems with a set structure which made it possible to score individuals according to their understanding of the structure, the reality as it is. Scoring methods were devised which facilitated "the analysis of the dynamic aspects of thinking which are ignored when the final answer is considered alone" (Rimoldi, et al., 1964). Both factors

of analysis and synthesis are involved in the solution of the problems devised by Rimoldi and can be assessed by the scoring procedures employed.

At the level of personal functioning being investigated it is assumed that the fundamental processes of intellection are the same for all persons irrespective of sex. The use individuals make of these processes, however, differs and in the present study these differences are attributed to differences in approaches to reality. Differences will be related to the more articulated approach to reality described by Witkin and to the receptiveness of reality or structure of the low-dogmatic individual. No differences between the sexes, therefore, are expected.

Specifically the following hypotheses are under investigation.

1. When the pulling out method is employed, which is sensitive to structure, the performance of the groups will be as follows, highest to lowest scores: analytical-low dogmatic; analytical-high dogmatic; global-low dogmatic; global-high dogmatic.
2. This same order is expected to hold when the method of uncertainty reduction is employed.
3. There will be no difference between the groups on number of problems correct.



4. Anxiety will be related to both high dogmatism and globalness but will not differentiate the sexes.
5. There will be no sex differences in problem solving activity.

## CHAPTER II

### REVIEW OF THE LITERATURE

The major area of interest, the global-analytical personality dimension, has been studied most thoroughly by Witkin and his associates and Gardner and his colleagues. Witkin's recent summary of his research, Psychological Differentiation (1962), spans a dozen years and surveys several areas of psychological functioning in support of this dimension as a fundamental aspect of personality. Although Witkin has drawn evidence from such broad areas as sense of separate identity, body concept, adjustment and pathology, and nature of controls and defenses, research findings will be discussed only in the areas of perceptual and intellectual functioning, the two areas relevant to the present study.

#### Perceptual Functioning

Perceptual activity was the first investigated by Witkin and the findings became the basis for his thesis of perceptual differentiation which he called field-dependence-independence. These results were drawn from his own experiments with the instruments already mentioned, Rod and Frame Test, Body Adjustment

Test and Embedded Figures Test, as well as from experiments and studies with tests assessing the effects of distracting contexts, flexibility of closure, perceptual constancies and perception of reversible figures (Haronian and Sugerman, 1966; Pressey, 1967; Witkin, 1962, 1965).

Strongest evidence that field-dependence-independence defines the ability to separate an item from its context and is not reflective of a general ability to resist distraction comes from the work of Karp (1963). Among the 18 tests administered to his 150 male college subjects, Karp included the three which require separating items from an embedding context, EFT, BAT, RFT, and four tests designed to require separation of items from distracting contexts. He also included subtests from the WAIS battery, the results of which will be discussed below in the section on cognitive differentiation.

Karp's factor analyses of the 18 tests revealed a factor which received significant loadings from the EFT, RFT, BAT, WAIS Object Assembly, Block Design, Match Problems, Form-Recognition and Insight Problems and was thus considered by Karp to define analytic ability. This factor implied a high degree of overlap among measures of adaptive flexibility. The factor defining the distraction tests, however, did not receive significant loadings on the embeddedness tests. It was Karp's conclusion that his

results favored Witkin's position that measures of field dependence involve ability to overcome the effects of embedding contexts and that other kinds of cognitive tasks involving this ability load the same factor. Although some correlation exists between the ability to overcome embeddedness and the ability to resist distraction, the results indicate that these abilities are factorially different and that overcoming embeddedness seems to be related to analytic ability.

Karp's finding that field-dependence-independence is also related to flexibility of closure has been supported a number of times. Flexibility of closure was first described by Thurstone (1944) as "the ability to shake off one set in order to take a new one" and bears a distinct similarity to Witkin's field dependence concept of which the latter is very aware. High correlations between Thurstone's Gottschaldt Test and Witkin's Embedded Figures Test have been well established (Goodman, 1960 quoted in Witkin, 1962; Podell and Phillips, 1959).

One of the most comprehensive studies of field articulation and its relationship to other cognitive abilities was undertaken by Gardner and his colleagues (1959, 1960) who investigated relationships between "cognitive control principles" and intellectual abilities. Cognitive control principles, defined as "ego structures" which are essential attributes of personality organization, are alleged to control certain aspects of adaptive behavior.

Of the five major control principles, the one which is relevant to this study is the principle of field articulation.

Gardner's field dependent subjects tended to organize fields containing stimulus incongruities along the simplest possible lines and, therefore, did not seem to cope effectively with tasks in which they had to respond selectively to relevant cues in fields containing contradictory and interfering cues. The field independent subjects, however, were capable of differential attention to relevant vs. irrelevant cues regardless of which was item and which was field (Gardner, 1960). These findings were drawn from the subjects' performance in the following tests: Concealed Figures, Spatial Orientation, Letter Grouping. Although field articulation was significantly correlated ( $r = .32$ ) to vocabulary tests, it was not correlated with tests of general reasoning nor ideational fluency and thus did not seem to represent a factor of general intelligence.

Supporting Karp's finding on flexibility of closure, Gardner discovered that the two tests representing flexibility of closure, Concealed Figures and Designs, and the two representing field articulation, EFT AND RFT, had their major loadings on the same factor.

A limitation of the Gardner research with respect to its generalizability to the Witkin findings and its usefulness in

understanding the nature of the psychological activity being measured by Witkin was Gardner's use of female subjects only. Since there are well established differences between the sexes and since Witkin used male subjects primarily, it is important for investigators to employ both male and female subjects. Gardner has commented on this question and considers it a relevant issue in the evaluation of his results.

Also relevant to the present research is the relationship of Gardner's findings to the study of attention by Piaget. Gardner is one of the few investigators in this field who attempts to penetrate the psychological experience of articulation with provocative questions regarding the individual's use of attention strategies. Piaget's general conception of attention can be applied to the direction of attention to cues in the face of misleading visual cues which is central to the field articulation experimentation of Gardner and Witkin. Although Witkin's own factor-analytic studies into the role attention plays in overcoming embeddedness have proved inconclusive, his theoretical position is that EFT performance does require some kind of attention-concentration ability. The Goodenough and Karp (1961) factor-analytic study, however, also failed to find EFT loadings on the attention factor.

A further consideration of the relationship between

Witkin's work and Piaget's research concerns the importance of cognitive style as an explanation of the failure to find the expected high correlations among Piagetian tasks belonging to the same developmental level by Lovell and Ogilvie (1961) when all tasks are given to the same children.

Pascual-Leone (1965) studied this question with children and adults selected for field-dependence-independence. Significant correlations were found between Witkin measures and performance on Piagetian tasks with field dependent structure but not between Witkin measures and tasks low in field dependent structure thus lending some support to the hypothesis that cognitive style may also be a factor in the differential performance in Piagetian tasks.

Extending the finding of self consistency in perceptual functioning are the results of studies by White (1953) and Axelrod and Cohen (1961). White's study involved an auditory embedded figures test wherein the subject first listens to a series of notes and then to a melody which may or may not contain these notes. Subjects who experienced difficulty determining whether the series of notes was present in the melody were those who scored low in the visual embedded figures test. Employing another sense modality, Axelrod and Cohen made a similar discovery. Subjects who could trace a simple figure within a complex embedding

figure after they had felt the contours of the simple figure while blindfolded also scored high on the visual embedded figures test ( $r = .78$ ).

The studies referred to above have contributed in a major way to establishing the fundamental character of the perceptual phenomenon under discussion. Other studies which have focused on the differences between groups, age and sex groups primarily, will be reviewed in the following section in connection with the research on intellectual functioning.

Before taking up that topic, however, some mention should be made of the problems evident in the work of the foremost investigator in the field. As Wallach (1962) has pointed out, the contrast of "active, analytical, articulated, specific, critical, cognitive functioning with cognitive functioning that is passive, global, vague, diffuse, uncritical," is fraught with attractive possibilities for theory construction in stylistic consistency. But the empirical findings have not proved entirely consistent across investigators. Although some inconsistencies may be due to the problem already referred to, sex differences in the subjects studied and whatever differences these may be masking, other serious questions need to be considered. In comparing the work of Kagan and Moss to that of Witkin, Wallach (1962) notes the differences in shades of meaning of the term "analytical" which



would enable each group to accept relationships or lack of relationships with other tests, such as the Wechsler. The nature of the analytical cognitive experience is not specified adequately enough for comparison of findings among different investigators. Although the ambiguity of the analytical construct is not generally acknowledged, the inadequacy of the description of the global dimension is more readily admitted. The global experience is assessed and described primarily through contrast with the analytical approach.

In spite of these difficulties in definition and in the consequent interpretation of findings, a trend toward generalization of constructs characterizes current investigations rather than a demand for greater specificity and multi-dimensional approaches.

An exception to this trend is found in Sherman's (1967) review of differences in space perception and aspects of intellectual functioning in which she maintains that the term analytical is an unwarranted generality which could be described more parsimoniously within a framework of spatial perception. Sherman did not subject Witkin's entire thesis to this criticism but limited her discussion to certain measures of the global-analytical construct. Additional research of this kind is needed.

### Intellectual Functioning

Lending support to Witkin's contention that the ability to overcome an embedding context can be identified in both perceptual and intellectual functioning were a series of studies based upon the "adaptive flexibility" factor identified by Guilford et al. (1957). Two of the tests discovered by Guilford to be highly loaded on the adaptive-flexibility factor were Insight Problems similar to Duncker's and Match Problems which required repeated restructuring. Witkin's discovery of 20 significant correlations out of a possible 21 between these tests and embedded figures measures added to the growing evidence of self consistency in an individual's perceptual and intellectual functioning.

The factor-analytic study of Karp (1961) referred to above in the section on perceptual functioning is a further demonstration of stylistic consistency. Among the 18 tests which Karp included in his study were Insight Problems and several subtests of the WAIS. Those tests loading the same factor were EFT, WAIS Object Assembly, Block Design, Insight Problems, RAT and RFT. In a similar study by Goodenough and Karp (1961) comparable results were found. Other studies supporting the finding that intellectual tasks requiring the ability to isolate the essential element from its context are related to the global-articulation dimension are those of Guetskow (1951) and Fenshel (1958) in "set" breaking

situations and the study by Messick and Fritsky (1963) demonstrating a significant relationship between EFT and the element articulation factor.

It seems to these authors that some intellectual and perceptual tests have a common requirement for overcoming embedding contexts, and that the significant relationships reported between measures of field dependence and standard tests of intelligence are based primarily on this common factor, and "carried" by those subtests which are similar in structure to Witkin's battery (Sheerer, 1964). Thus one of the most persistent, and still unanswered, questions regarding the global-analytical dimension of psychological functioning is the nature of its relationship to standard measures of intellectual functioning. On the basis of his own extensive investigation as well as of his analyses of other research, Witkin maintains that the relation is based on the expression of a particular style of field approach in both. Regarding verbal functioning, a later study by Dyk and Witkin (1965) reported the finding that verbal comprehension scores (Vocabulary, Comprehension and Information subtests of WAIS) do not correlate highly with perceptual index scores ( $r = .15$ ). The evidence presently available does not permit a definite statement relating verbal skills to mode of field approach. At present no clear cut relation seems to exist between the verbal comprehension subtests

of the WISC and WAIS and the global-analytical dimension but the criticism of Wallach (1962) regarding precise definitions is relevant to this aspect of the question also.

Karp's (1963) conclusion regarding the relationship of the global-analytical dimension and intelligence scores is not that the analytical individual is more intelligent but that the composition of his intelligence is different. This hypothesis may receive support from studies like Spotts and Mackler (1967) who discovered that with intelligence held constant, analytical subjects are more creative than global or "central" subjects. Elliott's (1961) finding that the global subject is relatively unable to impose order or structure on a situation implies a cognitive approach better described as "different" rather than as simply inferior to an analytical approach. It is precisely the global subject who must be more thoroughly studied, however, to ascertain what is unique in his mode of approach. The instruments currently used are designed to assess analytic ability which characterizes the articulated individual.

Studies attempting to assess the psychological activity of the global subject tend to explore the limitations of the global approach rather than the perceptual and intellectual activity evident in the situation. A typical example is the study of Konstadt and Forman (1965) who discovered that field-dependent

subjects performed significantly more poorly on a letter cancellation task in a socially unpleasant situation than field independent subjects.

One of the few studies focusing on functioning specific to the global individual is that of Fitzgibbons and Goldberger (1965). Female subjects were tested for recall and recognition of social and neutral words presented incidentally. While the global subjects did more poorly on the focal task, recall and recognition of incidental social words was significantly correlated with globalness. Memory for incidental social stimuli was independent of performance on the focal task and not related to availability of time resulting from slower performance on the focal task.

In the studies cited above, investigations have dealt primarily with the relationship of a pervasive personality characteristic to perceptual and intellectual functioning irrespective of differences between the sexes. One of the most consistent findings, however, has been the small, but persistent and statistically significant, difference between the sexes on measures of global-analytical activity (Tyler, 1965; Witkin, 1962), with females scoring in a global direction.

Little advance in understanding the nature of and reason for this difference has been made. The fact that Witkin's major

investigations have focused on male subjects, primarily because of the persistent sex differences, has highlighted the problem not solved it. A few longitudinal studies have revealed the greater field independence of males at all ages (Witkin, Goodenough, Karp, 1967), but there are no investigations of field-dependence-independence in women to compare with the extensive investigation of this topic among males. Some attempts to generalize to the female population from findings based on studies with male subjects have been attempted (Witkin, 1962). Sweeney's (1953) comprehensive investigation in problem solving was reanalyzed by controlling the variable of ability to overcome an embedding context. This control was instrumental in accounting for the differences which appeared. Milton's (1957, 1959) reports that skill in solving problems requiring restructuring was significantly related to scores on various masculinity-femininity tests admit the interpretation that correlations between masculinity and problem solving may be an artifact of the M-F tests themselves which were constructed on the basis of just such sex differences.

Differences between the sexes seem to appear in individuals as young as eight years of age (Bieri, Bradburn and Galinsky, 1958) and from that time on they persist (Bauermeister, et al., 1963; Gardner, et al., 1959; Newbigging, 1954; Vaught, 1965; Witkin, Goodenough and Karp, 1967; Young, 1959). The Bieri et al. (1958)

study was one of the first to document the fact that opposite tendencies characterized the inter-relationships of EFT scores and measures of personality and conceptual behavior for men and women. Males scored significantly higher than females both on SAT Math tests and EFT measures ( $p < .01$ ) but when male and female subjects with the ten highest and ten lowest EFT scores were compared, the low and high males did not differ on the SAT Math scores although the low and high females did ( $p < .01$ ). The differential correlation for males and females of EFT with other measures prompted the investigators to conclude that males more effectively than females combine their mathematical ability with a conceptual approach to social and objective stimuli, a combination which they believe facilitates EFT performance.

One implication of this may be that masculinity implies learning in a prescribed direction. Vaught's (1965) study on the relationship of role identification to sex differences in field-dependence-independence, therefore, may be relevant. He concluded that since role identification as well as ego strength influenced an individual to perceive the environment in a field dependent-independent manner, observed sex differences may more appropriately be conceptualized as reflecting differences in role preferences. Sherman's (1965) argument is similar in that she maintains that global-analytic measures are related to sex-typed learning and

experiences.

Regardless of explanations offered or forthcoming, there is sufficient evidence that differences exist between the sexes on measures of field-dependence-independence and that the relationship of these differences to perceptual and cognitive functioning is extremely complex. It is also clear from the evidence available that the EFT has greater construct validity as an index of the global-analytical cognitive style for men than it has for women (Wallach and Kagan, 1965; Witkin, 1962).

#### High-low Dogmatism

Rokeach's speculation regarding the possibility of tying together belief and thought with a view to predicting conceptual behavior has generated research relevant to the present study. His own work, The Open and Closed Mind (1960), included investigations of differences between high and low dogmatic individuals in problem solving situations assessing two phases of thinking, analysis and synthesis, which are central to his theoretical formulation. Although the data are not conclusive, there is evidence supporting Rokeach's thesis that the high dogmatic individual has greater difficulty in synthesis and the use of past experience in new situations than the low dogmatic individual (Fillenbaum and Jackman, 1961; Restle, Andrews, and Rokeach, 1964).

In studies closely related to the theoretical framework



of Rokeach, additional supporting evidence differentiating dogmatism groups is also available. Powell's (1962) discovery that low dogmatic judges separate information from its source in evaluating political statements and a related finding by Vidulich and Kaiman (1961) that low dogmatic individuals are less influenced by "high status" confederates in an autokinetic experiment lend support to a theory relating personality organization to problem solving situations. Insight into the nature of this relationship was the object of a decision-making study by Long and Ziller (1965). In their study low-dogmatic individuals tended to delay a decision and engage in pre-decisional search and were more inclined to answer "don't know" under conditions of inadequate information. Related to this discovery that process is the key factor in the relationship of personality organization and problem solving is the finding of Ladd (1967) that closedmindedness hindered initial adaptation to concept learning tasks but was not related to the solution of these tasks. In addition, when a coming shift in classification principle was known, closedmindedness did not hinder the subject in making a shift.

A comprehensive study of the relationship of personality to cognitive process is the work of Robb referred to above. The results of a problem solving situation assessing cognitive process supported hypotheses predicting that open minded subjects would use the structure and the information of the problems more efficiently

than the closed minded group and that the closed minded group would perform better with concrete rather than abstract material whereas there would be no difference in the performance of the open minded group.

An aspect of the cognitive process which seems to characterize the low dogmatic individual may be a greater ability to make distinctions. This aspect of functioning is also evident in a study reported by Kaplan and Singer (1963). Their investigations revealed that high dogmatism scores were related to inability to distinguish sensory stimuli. In a related area, Riley and Armlin (1965) showed that high dogmatism was accompanied by rigidity on a perceptual-motor task. The affective component in the dogmatic dimension is singularly evident in the study of Zagona and Kelly (1966). These investigators found that although high and low dogmatic individuals did not differ in their judgments of art, high dogmatic subjects disliked novel and complex audio-visual situations significantly more than low dogmatic individuals.

Other investigators have studied relationships between broader aspects of personality functioning in learning situations and degree of dogmatism with ambiguous results. In a study conducted by Zagona and Zurcher (1965), high and low dogmatic individuals displayed marked differences in personality and verbal behavior during an investigation lasting several months. Ehrlich's (1961a) finding that low dogmatic students learned better in

introductory sociology courses was not supported by comparable results from Christensen's (1963) study of introductory psychology students. Costin's (1965) attempted reconciliation of these findings was without success.

There have been limited attempts to study the dimension of dogmatism developmentally. Anderson's (1962) investigation of male and female subjects, 13 to 18 years of age, indicated a decline in dogmatism during adolescence and a significant sex by intelligence interaction. More intelligent females were more dogmatic than more intelligent males. The sex differential was also a factor in the study by Alter and White (1966). From 37 samples of various populations, their results showed women consistently lower, due primarily to a few items. These latter findings are in opposition to those of Rokeach and others who found no differences between the sexes nor differences based on intelligence scores (Ehrlich, 1961b; McGaulley, 1961; Rokeach, 1967; Rokeach and Norrell, 1966).

#### Relationship of Dogmatism and Global-Analytical Dimension

Although both Witkin and Rokeach maintain that they are investigating different aspects of personality functioning (Rokeach, 1960; Witkin, 1962), the relationship of the two dimensions is the focus of the present research. Recently there have appeared studies which touch on this same question. Ohrmacht (1966)

administered the Dogmatism and EFT measures to 40 subjects, obtained median splits on both dimensions and formed 4 groups of 10 subjects each. All subjects mastered an initial discrimination task and then one-half of each subgroup was required to master the reversal of the initial task and the other half of the subgroup the nonreversal of the initial task. The predictions were confirmed that field independent and open subjects would be more successful regardless of shift and the field dependent and closed subjects would have special difficulty with shifts regardless of the condition.

Kessler and Kronenberger (1967) studied the effects of dogmatism, perceptual analysis, as measured by EFT, and the interaction in a perceptual synthesis task, an adaptation of Koh's Block Design. Four groups of 8 male subjects each were constituted on the basis of lowest and highest scores on dogmatism and EFT measures. The investigators concluded that analytic ability, as assessed by EFT was significantly related to perceptual synthesis while dogmatism was not. The only interaction discernible was a tendency for global-closed subjects to perform poorly, but this was not significant.

Neither of these studies reported a correlation between the two dimensions under investigation or a difficulty in assigning subjects to any of the four cells. This would tend to

support the statements of Witkin and Rokeach regarding the independence of these dimensions although some evidence exists that both field-dependent and field-independent individuals score higher on dogmatism than intermediates, but the trend was not significant (McCaulley, 1964).

### Masculinity-Femininity

Evidence of the differential relationship of the sexes to the personality dimensions under investigation has been reviewed above in the respective sections for the global-analytical and high-low dogmatic dimensions. This brief section focuses on aspects of the masculinity-femininity question relevant to the present study which were not discussed above.

A major question concerns the greater construct validity of measures of the global-analytical style for men than for women. Is it possible that there is a difference between the female global-analytical style and the male global-analytical style? Evidence for the validity of this question comes from studies of the relationship of other measures to the global-analytical dimension. Significant correlations for males but not for females have been found between mode of field approach and total I.Q. (WISC), (Witkin, 1962), various measures of recall, performance in auditory situations which required that words be identified against

a background of noise (Jackson, 1955), and reading ability (Iscoe and Carden, 1961). Correlations between Witkin measures and developmental process and personality traits are different for males and females (Maccoby, 1967; Witkin, 1962) with the result that the well documented relationship between analytic cognitive style and certain personality orientations, for example, independence and initiative, may hold for males but not necessarily for females.

One attempt to take the factors of interest, value, emotion, and attitude into account in assessing influences on cognitive style has been the comparison of males and females on the basis of masculinity-femininity tests rather than sexual designation alone. Studies correlating cognitive activity with scores on masculinity-femininity tests generally assumed that interests and activities classified as "masculine" were related to analytic objectivity. Attempts to explain between-and within-sex differences in terms of M-F scores include Fink's (1959) report that scores on the MMPI-Mf scale correlated .41 for males and .28 for females with the EFT and Vaught's (1965) demonstration that the RFT was related to masculinity and ego strength in both sexes. Male superiority in problem solving, an analytical activity, has been attributed to male-role learning (Lynn, 1959, 1962; Milton, 1957, 1958, 1959) which stresses objectivity and analysis, with

an emphasis on accomplishment and concern with larger issues. Although there have been few studies correlating masculinity-femininity with dogmatism, some evidence exists that masculinity is related to open mindedness ( $r = .14$ ) (McCaulley, 1964).

Growing dissatisfaction with M-F tests generally, however, casts serious doubt on the feasibility of this approach. Correlations between M-F tests tend to be low (Barrows and Zuckerman, 1960; Engle, 1961; Guilford and Zimmerman, 1956; Heston, 1948; Nichols, 1962; Shepler, 1951). Masculinity-femininity tests are based largely on the less desirable traits of both sexes (McKee and Sherriffs, 1957; Nichols, 1962) and tend to reflect cultural stereotypes (Engel, 1962). Scores are greatly influenced by the educational and social level of the subject (Sanford, 1956). It is doubtful, therefore, what aspects of personality functioning these tests are measuring and whether correlations of M-F scores with cognitive style or problem solving ability contribute to an understanding of the dimension under investigation.

In the present research, therefore, the scores of the Gough M-F Scale (Gough, 1952) will be used primarily for control purposes and comparisons with other investigations. It is expected that the sexes will not differ fundamentally in their approach to the task in the present study although the question raised above regarding the greater construct validity of the EFT

for males than for females may be a factor in the analysis of results.

### Anxiety

The relationship of anxiety to both the global cognitive style and the dogmatic dimension has been clearly established. Witkin's (1962) general description of the global person includes a manifestation of anxiety significantly higher than analytical individuals. In his studies of the dogmatic person, Rokeach has also found significant correlations between closed mindedness and anxiety (Rokeach and Kemp, 1960; Rokeach and Borier, 1960). In general, correlations from .36 to .64 have been found in various groups tested (Rokeach, 1960). Factor analytic studies have revealed that dogmatism and anxiety emerge together as part of a single psychological factor (Fruchter, Rokeach and Novak, 1958).

These well-documented differences contrast with the ambiguity concerning differences between the sexes in anxiety and the relationship between anxiety and masculinity-femininity scores. Taylor's (1953) normative sample of males and females did not yield significant differences between the sexes on the Manifest Anxiety Scale. Although later studies by Bendig (1954), Lazowick (1955), and Wrightsman (1962) have confirmed these findings, other investigations have yielded significantly higher scores for females on the



same scale (Sinick, 1956; Brim, et al., 1962).

Studies relating anxiety to measured masculinity-femininity rather than to sex designation per se revealed that femininity in males and females was related to manifest anxiety (Cosentino and Heilbrun, 1964). In Webb's (1963) study similar results were found but they were less consistent for males.

There is some evidence that the relationship between field dependence and anxiety generally observed by Witkin and others operates differentially in the two sexes. Iscoe and Carden (1961) discovered that field dependent girls were less anxious ( $r = -.60$ ) than field independent girls. Correlations between measures of anxiety and measures of aptitude or achievement have been reported substantially negative for females whereas they have been reported either low negative, zero, or positive for males. The evidence is quite consistent regarding this difference (Davidson and Sarason, 1961; Russell and Sarason, 1965; Sarason, 1961; Walter, et al., 1964). Related to this is Crandall's (1965) finding that heightened anxiety appears to have opposite effects on the two sexes in judgment situations. High anxious men were more conceptually conservative in judgment than low anxious men whereas the opposite trend occurred for women, high anxious women were less conservative than low anxious women.

Maccoby (1966) has attempted to account for these

differences by employing the assumptions of curvilinearity and a higher base level in anxiety among females. On the basis of these assumptions, it is to be expected that increments from the base level, lower for males than females, would have different effects for the two sexes.

## CHAPTER III

### PROCEDURE

A. SUBJECTS. The 200 subjects used in this research, 100 males and 100 females, were selected from an original pool of 330 males and 492 females. The subjects were college students in attendance at Loyola University, Marquette University, Alverno College and Mount St. Paul College.

The total group of 812 subjects were given the Embedded Figures Test, Group Form, 32 achromatic patterns, Rokeach's Dogmatism Scale, and Gough's Masculinity-Femininity Scale during one of their psychology class periods. The Nicolay-Walker Personal Reaction Schedule, including the Taylor Manifest Anxiety Scale, was administered later only to those students who participated in the problem-solving session.

One hundred Ss of each sex were designated to participate in the problem solving session on the basis of their scores on the Embedded Figures Test and Dogmatism Scale. The means and standard deviations for these tests for the total group of males and females are presented in Table 1; also included are t tests of differences between the means for the sexes. The small but statistically significant differences between males and females on

TABLE 1

MEANS, STANDARD DEVIATIONS AND t-TESTS FOR  
SIGNIFICANCE OF DIFFERENCE BETWEEN MALES AND FEMALES  
FOR EMBEDDED FIGURES TEST AND DOGMATISM SCALE

Embedded Figures Test					
	M	SD	N	t	prob.
Males	12.22	6.20	330		
Females	11.26	5.78	492		
				2.24	.05
Dogmatism Scale					
	M	SD	N	t	prob.
Males	84.54	23.16	330		
Females	85.73	23.12	492		
				.72	ns

the Embedded Figures Test and the non-significant differences between the sexes on the Rokeach measure accord with previous research.

Subjects were designated high or low dogmatic and analytical or global if they scored in the upper or lower third on the respective measures. Because of the difference in means between males and females on the Embedded Figures Test a decision had to be made regarding the upper and lower third limits for each sex group. Since one of the purposes of this research was to explore differences between males and females who could be designated global or analytical, it was decided to adopt the same range of scores operationally defining the global-analytical dimension in males and females.

Therefore, Ss scoring between 15 and 28 on the Embedded Figures Test were designated analytical and Ss scoring between 0 and 9 were designated global. Scores of Ss in the upper third on the Rokeach measure ranged from 96 to 129 and in the lower third from 31 to 77. Only Ss who ranked in the upper or lower third on both tests were included in the problem solving session. Ss who scored in the middle third on either test were not included in the problem solving session.

The four groups constructed on the basis of these two tests were: Ss high on both tests, high dogmatic and analytical

(Hi D-A); Ss low on both tests, low dogmatic and global (Lo D-G); Ss high on one test and low on the other--high dogmatic and global (Hi D-G) and low dogmatic and analytical (Lo D-A).

Table 2 presents the means and standard deviations for the Embedded Figures Test and the Dogmatism Scale for the 8 groups and Tables 3 and 4 present the t scores for differences between the means for the same groups. The groups differ significantly from each other only on the measure which differentiates them. None of the groups designated global or analytical on the EFT measure differs from similarly designated groups. The same holds for the Dogmatism measure. All differences between the groups, however, on the measure which distinguishes them from each other are statistically significant well beyond the .001 level.

**TABLE 2**  
**MEANS AND STANDARD DEVIATIONS FOR EMBEDDED**  
**FIGURES TEST AND DOGMATISM SCALE FOR ALL GROUPS**

Female Groups	Embedded Figures Test		Dogmatism Scale	
	M	SD	M	SD
Lo D-G	5.44	2.25	59.84	8.23
Lo D-A	18.52	2.77	63.68	9.55
Hi D-G	6.04	2.32	108.56	9.07
Hi D-A	19.72	2.89	107.40	9.54
<b>Male Groups</b>				
Lo D-G	6.04	2.36	60.80	13.42
Lo D-A	19.32	3.66	61.64	14.58
Hi D-G	5.96	2.05	109.40	7.51
Hi D-A	19.48	3.02	110.48	9.33

TABLE 3

t SCORES FOR DIFFERENCES BETWEEN MEANS  
FOR EMBEDDED FIGURES TEST FOR ALL GROUPS

		Female			Male			
		Lo D-A	Hi D-G	Hi D-A	Lo D-G	Lo D-A	Hi D-G	Hi D-A
	Lo D-G	17.97*	.91	19.12*	.90	15.82*	.84	18.28*
Female	Lo D-A		16.91*	1.47	16.80*	.85	17.85*	1.15
	Hi D-G			18.07*	.00	14.99*	.13	17.28*
	Hi D-A				17.96*	.42	19.03*	.28
	Lo D-G					14.93*	.12	17.18*
Male	Lo D-A						15.60*	.16
	Hi D-G							18.09*
	Hi D-A							

\* p < .001



TABLE 4

t SCORES FOR DIFFERENCES BETWEEN MEANS  
FOR DOGMATISM SCALE FOR ALL GROUPS

		Female			Male			
		Lo D-A	Hi D-G	Hi D-A	Lo D-G	Lo D-A	Hi D-G	Hi D-A
Female	Lo D-G	1.49	19.49*	18.49*	.29	.53	17.84*	19.94*
	Lo D-A		16.70*	15.86*	.86	.57	18.44*	17.17*
	Hi D-G			.43	14.45*	13.38*	.35	.72
	Hi D-A				13.87*	12.86*	.81	1.13
	Lo D-G					.21	15.48*	14.89*
Male	Lo D-A						14.26*	13.82*
	Hi D-G							.44
	Hi D-A							

\* p < .001

B. MATERIALS. The problems used in this study are described in full in publications by Rimoldi, et.al. (1962, 1964). The problems were of two types: verbal and geometrical. The verbal problems are divided into two kinds, each of which has two variations. Therefore, there were a total of four verbal problems: 31 A, 31 B, 35 A, 35 B. All four of the problems are of the type that presents a verbal definition of a problem situation together with a series of questions printed on separate cards. Each card contains a question on one side and the question and answer on the reverse side. The questions and answers contain information relevant to the problem situation, some of which is necessary for the solution of the problem. The subject selects the cards he feels will give the information needed for a solution and also records the order in which he chose to have the various questions answered. This establishes a sequence for each individual which describes his process, and, also, supplies sufficient information for the experimenter to score the answers.

In identifying the problems, the number refers to a particular type of schema, or framework or set of logical relationships or structures, upon which is superimposed various contents which are identified by letters. (See Appendices III and IV for the logical structures of the 31 and 35 problems). The numbers, 31 and 35, refer to two different types of problem structure.

The two structures represent a rather simple, #31, and a somewhat more complex, #35, type of problem. The letter "A" presents the problem in abstract language, or by means of letters that represent, symbolically, non-specified concrete objects. In both of these forms of the problem, the answers are given in numbers.

Two geometrical problems, 40 and 42, have been included in order to provide a variation of the verbal problems. These problems are of the type that presents a geometrical figure with various enclosed areas one of which is the correct solution of the problem. The procedure for the solution is the same as with the verbal problems. (Appendices V through X contain all of the problems in detail.)

C. SCORING PROCEDURES. Since the unique contribution of Rimoldi et al. (1964) centers on the notion of process, the scoring techniques devised are of great importance. A process is experimentally characterized by the sequence of questions asked by the subject, according to Rimoldi and Haley (1962). Thus, the characterization of the process and the scoring techniques must include the number of questions asked, the specific questions asked in terms of the information they provide, and the order in which the questions are asked. Among the scoring procedures devised by Rimoldi et al. (1964), three will be used in this research: a) pulling out method, b) group performances, and

c) information values. Each of these will be discussed in turn.

a) Pulling Out Method

The decision to use the pulling out method for scoring subjects' performance was based on previous experimentation and on the results obtained by Erdmann, 1964, where this approach was shown to be consistently better than other methods of scoring performance in the type of problems used in this research.

In essence, the pulling out method is used as follows: After determining by a logical analysis of the structure of the problem, the best tactic or tactics by means of which a problem can be solved, these are tabulated considering each question in each order in which it occurs in the various tactics, Rimoldi, Haley, Fogliatto and Erdmann, (1963). This table of frequencies is converted into a table of proportions. Each question will have a weight according to the frequency with which it occurs in a particular order. The next step is the application of this table of weights to an observed sequence. A previous method had merely summed the weights corresponding to the questions and the order of these questions in the observed sequence. This was called the schema method. The pulling out method uses the same norms as the schema method and differs from it only in the application of the norms to the individual observed sequence. This method attempts to account for any restructuring or "late" understanding of the nature of the problem by the performer. In other words the benefit of the doubt is given to the subject in the evaluation of his performance.

The procedure involves a kind of matching of the observed sequence with one of the ideal sequences. That is, the scorer determines the ideal sequence which best approximates the observed sequence and will therefore maximize the evaluation of the performer. Obviously, there are certain rules according to which this is done.

The first step is to remove all the irrelevant (as far as the ideal sequence is concerned) questions from the observed sequence. It is important to maintain the order of the questions as selected by the subject.

What results may be a complete or partial ideal sequence.

In order to be complete, the order of the relevant observed questions must duplicate the ideal sequence. If this occurs, then one finds the value of the ideal sequence which would maximize the score for the observed sequence. This completes the second step in the determination of a final score for the pulling out method. The third and final step is to divide the value, found at the completion of the second step, by the number of questions of the original observed sequence, i.e., before any pulling out of irrelevant questions.

The sequence resulting from the pulling out of irrelevant questions, however, may only partially duplicate an ideal sequence. In this case credit is given for the partial sequence. This value is again divided by the number of questions of the original observed sequence to determine the final score.

An example of the technique is in order to clarify the application. Suppose the observed sequence 1,6,3,8,2,10. Assume that the ideal sequences of the problem are 6,3,10 and 10,3,6. Pulling out the irrelevant questions leaves 6,3,10 for the observed sequence. This exactly duplicated the ideal sequence 6,3,10 so the final score is the value of the 6,3,10 sequence in the schema norms divided by 6 (the number of questions from the original observed sequence). Had the original sequence been 1,10,8,3,2,6 then the ideal sequence 10,3,6 would have been duplicated with results exactly as above.

In some instances, the ideal sequence will not be duplicated. Assuming the observed sequence 1,6,7,8,2,3,5, the ideal sequence approximating it best is 6,3,10. However, there is only partial approximation here, namely 6,3. The final score is, therefore, the value of 6,3 in the schema norms, divided by 7 (in this case). The remnants of the observed sequence following the pulling out of irrelevant questions must follow the order of one of the ideal sequences so that an observed sequence without 3 and 6 in it would obtain no value at all. If either occurred at the end of the sequence only that question would contribute any value. For instance, the observed sequence 1,3,8,4 would have zero as a final score. The sequence 1,3,6,5,7, would have the value of 6 in the first position in the schema norms divided by 5.

This technique, in summary, works to the advantage of the subject by giving him the benefit of the doubt as far as the occurrence of restructuring or reshaping the problem is concerned.

It also incorporates the advantages of the schema method and adds the feature of differentially penalizing the subject for the prodigal selection of cards! (Erdmann, 1964, Loyola Psychometric Lab, Pub. No. 40.) (Rimoldi et al., 1964, pp. 114-116).

#### b) Group Performances

This approach estimates for each problem and for each group of subjects the frequency with which each question was asked in each possible order.

These frequencies correspond to the values observed in two-way entry tables where columns represent questions, and rows, order in the sequence. If the subjects in a group follow exactly the same tactic, then all the cells in the table will present zero entries, with the exception of one cell per row and per column with a frequency equal to the total number of subjects in the group. In fact, the highest possible dependency between questions and order is at the basis of this type of performance; knowing a question, the order of choice is also known, and vice versa, the uncertainty being minimal.

If the subjects in a group perform in such a way that no relationship whatsoever exists between questions and order of choice, then the cell frequencies will be identical throughout the table. No information can be gained in terms of associating a given question with a given order, the uncertainty being maximal.

Seldom, if ever, will all actual performances follow any of the two previously described patterns. In practice, the performance of a group may approach either of the uncertainty levels just defined. This will depend on two major variables that can be experimentally controlled: a) characteristics of the group, b) characteristics of the problems.

Considering the logical structure of the problem, the language used, the number and wording of the questions and of the corresponding answers, etc., it is possible to state for each problem the sequence or sequences of questions that as a result will represent the maximum empirical association between question and order of choice. This set of sequences corresponds to the schemata norms. In this sense, schemata

norms represent the lower empirical limit of uncertainty based on a logical analysis of the problems. This shall be considered to be the criterion of minimal uncertainty for a group performance. It is theoretically conceivable that an observed group performance may yield an uncertainty value smaller than that indicated by the schemata, but in such cases, this may be due to guessing, incomplete performance, poorly constructed problems, etc.

The definition of a criterion for maximum uncertainty is more complex. Several hypotheses can be defended of which only one, designated H, will be discussed.

In this hypothesis, the assumption of no association between questions and order is maintained, but the following conditions are added: a) that subjects may choose sequences of varying lengths, b) that these sequences of different lengths have the same chances of appearing. For a discussion of the derivation of the values for this hypothesis, confer Rimoldi, et al. (1964).

Any observed performance can be then located along a continuum varying from minimum uncertainty, as defined by the schemata, to maximum uncertainty as defined by H. For each problem, these limits can be assigned without any references to group performance. They will be considered to be inherent properties of the problems and thus help to define the instruments employed in the experiment. This attempt at characterizing instruments without resort to group indexes is a feature which deserves special emphasis.

The uncertainty value  $H(x,y)^*$  was computed for H and for the schemata in each problem. Further, this value was also calculated for the observed group performances in all the problems. These uncertainty values should not be interpreted strictly in terms of information theory. As stated before, they serve to characterize the patterns present in the tables. The discussion will be limited to define trends in these patterns. (Rimoldi, et al., 1964, pp. 104-107)

$*H(xy) = \log_2 n - \frac{1}{n} \sum_{i=1}^n n_i \cdot \log_2 \frac{n_i}{n}$ , where n equals total number of entries in the table and  $n_i$  frequencies in each cell.

### c) Information Values

In this part of the study, we shall present a method of

scoring individual performances in terms of the processes followed by a subject in solving a problem. This method is independent of group performances and attempts to analyze at each step in the process the amount of uncertainty reduction with respect to the total uncertainty of the problem. This was accomplished for those problems in which figures are presented.

We are assuming that at the outset of the problem, all the alternatives are equally likely. On this basis the total uncertainty value for each problem can be calculated according to the total number of these equally likely alternatives. Then in order to solve the problem in a logical fashion or at least in a fashion eliminating guessing or hunches it becomes necessary for a subject to reduce the uncertainty of a problem to zero. This he can do by asking questions and obtaining the corresponding answers. Each of these questions and answers will reduce the total uncertainty according to the information contained in them and the order in which they were asked. It thus becomes a matter of determining for each question and answer that part of the total uncertainty of the problem that is eliminated according to the order in which it was asked. The next step is to consider an individual sequence of questions and to establish the amount of uncertainty reduction accomplished by each in the particular order it was asked. These values can be accumulated for individual questions of an observed sequence in the order in which they were asked so that at any point in the process, the amount of uncertainty reduced can be indicated. Obviously, certain questions asked in a definite order can maximize this process of uncertainty reduction, and this can be seen more clearly by plotting the cumulative values for successive questions. Tactics following the "best" sequence(s) as determined by the schema should be those that maximize the reduction of uncertainty with each successive question.

According to the nature of the problems, the solution to be obtained will be achieved through a process of either rejecting or retaining certain alternatives. This binary characteristic of the process suggests the use of a system of evaluation which embodies these properties, such as the transformations implied in "information theory". (Rimoldi et al., 1964, pp. 134-135) For an illustration of this method, confer Rimoldi et al., (1964).



D. DESIGN OF THE EXPERIMENT. The Ss selected on the basis of their EFT and Dogmatism scores, as previously indicated, participated in one problem-solving session of approximately 75 to 90 minutes. No time limit was set for the solution of the problems. The problems were administered to Ss in small groups of 7 to 12 members. The Ss participated in a session which was convenient for them and, therefore, each session contained Ss from every group.

Six problems were administered to each group in the following order: 31A, 31B, 40, 42, 35A, 35B. There were two reasons for administering all the problems in the same order. The first was based on the rationale that learning would be constant for all subjects over trials. The second reason was based on the authority of past research in which the problems were presented in the same order to each subject (Rimoldi et al., 1964).

The following instructions were given to the Ss at the beginning of the problem solving session. Each S was given a mimeographed copy of the instructions. The sections in parentheses were added orally and demonstrated by the E as she read the instructions with the Ss.

You will be given a packet of cards on which are typed a particular problem situation and a set of

questions and answers relevant to the problem. (The question is on one side of the card and the question with its answer is on the other side.)

READ OVER THE PROBLEM SITUATION CAREFULLY, noting especially the specific problem to be solved.

NEXT, READ OVER ALL THE QUESTIONS, which are typed on one side of the cards. At this time, do not turn the cards over.

Decide the first question you would like to have answered. Then, WRITE THE NUMBER OF THE QUESTION ON THE SHEET PROVIDED. If it is the first question you ask, its number goes next to no. 1, etc.

TURN THE CARD OVER AND READ THE ANSWER ON THE CARD.

After having read the answer, decide on the next question you would like to have answered. Write its number on the page provided, then turn it over to read the answer. (So, decide the first question you want to ask, then write its number after number 1 on the sheet provided. With the information you have when you find the answer on the reverse side of the card decide which question you want to ask second. Proceed in this way.)

When you are satisfied that you have arrived at the answer, stop asking questions, and write down your answer. Do not ask more questions than you think you need to solve the problem, but do not hesitate to ask those questions that appear to be necessary. A previously selected question may be referred to as often as one wishes in the process of solving the problem. (There is no time limit for the solution of any of the problems. When you are finished, I will give you the packet of cards for the next problem.)

When the S had completed the last problem, he took the Nicolay-Walker Personal Reaction Schedule and left.

## CHAPTER IV

### RESULTS

Data on intellectual ability, as assessed by verbal and quantitative CEEB scores, was obtained for 84 of the 100 males and 96 of the 100 females participating in the study. Table 5 contains means and standard deviations on these verbal and quantitative scores for the 4 groups of each sex. Tables 6-10 present t scores for the differences between means for subjects grouped on the basis of the Dogmatism Scale, EFT scores, and sex.

The high dogmatic females did not differ significantly from the low dogmatic females nor the high dogmatic males from the low dogmatic males on either the verbal or quantitative scores. Significant differences occurred between high and low dogmatic females and the high dogmatic males on the quantitative scale and between these same female groups and the low dogmatic males on the verbal scale.

Differences in intellectual ability were not expected on the Dogmatism measure and did not occur within sex groups. Differences between the sexes did occur, however, due to the higher quantitative scores of the high dogmatic males and the

**TABLE 5**  
**MEANS AND STANDARD DEVIATIONS OF ALL GROUPS**  
**ON CEEB VERBAL AND QUANTITATIVE SCORES**

Female Groups	Verbal		Quantitative	
	M	SD	M	SD
Lo D-G (23)	477.26	73.04	439.17	86.77
Lo D-A (24)	539.00	80.60	547.62	79.16
Hi D-G (25)	465.12	87.69	460.56	64.10
Hi D-A (24)	531.88	81.53	535.54	81.89
<b>Male Groups</b>				
Lo D-G (20)	544.55	89.61	478.60	78.66
Lo D-A (19)	552.58	87.60	572.26	100.34
Hi D-G (22)	469.83	97.60	481.54	85.27
Hi D-A (23)	546.39	96.05	596.61	69.92

TABLE 6

t SCORES FOR DIFFERENCES BETWEEN MEANS  
ON VERBAL SCORES FOR HIGH-LOW DOGMATISM GROUPS

	F HI-D	M Lo-D	M HI-D	M	SD
F Lo-D	.61	2.10*	.01	508.79	82.95
F HI-D		2.69*	.54	497.82	91.06
M Lo-D			1.87	548.46	88.73
M HI-D				508.96	104.10

\*p < .05

TABLE 7

t SCORES FOR DIFFERENCES BETWEEN MEANS ON  
QUANTITATIVE SCORES FOR HIGH-LOW DOGMATISM GROUPS

	F HI-D	M Lo-D	M HI-D	M	SD
F Lo-D	.14	1.35	2.22*	494.55	99.12
F HI-D		1.33	2.29*	497.29	82.38
M Lo-D			.73	524.23	101.34
M HI-D				540.36	96.76

\*p < .05

TABLE 6

$t$  SCORES FOR DIFFERENCES BETWEEN MEANS  
ON VERBAL SCORES FOR WITHIN GROUPS

	F A	M G	M A	M	SD
F G	3.85**	1.75	4.19**	470.94	81.23
F A		1.52	.74	535.44	81.15
M G			2.05*	505.40	101.02
M A				549.19	92.38

\* $p < .05$

\*\* $p < .01$

TABLE 9

t SCORES FOR DIFFERENCES BETWEEN MEANS  
ON QUANTITATIVE SCORES FOR WITHIN GROUPS

	F A	M G	M A	M	SD
F G	5.62**	1.76	7.75**	450.31	76.56
F A		3.53**	2.47*	541.58	80.76
M G			5.68**	480.14	82.20
M A				585.60	85.90

\*  $p < .05$   
\*\*  $p < .01$



TABLE 10

MEANS, STANDARD DEVIATIONS, AND  $t$  SCORES FOR  
FEMALES AND MALES ON CEEB QUANTITATIVE AND VERBAL SCORES

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CEEB Quantitative Scores			
	M	SD	$t$
Females	495.95	90.72	
Males	532.87	99.24	
			6.53 < .001

---

CEEB Verbal Scores			
	M	SD	$t$
Females	503.19	88.32	
Males	527.30	99.31	
			3.98 < .001

---

higher verbal scores of the low dogmatic males.

On the basis of sex designation alone, significant differences occurred in both quantitative and verbal ability (Table 10). Correlations were made between CEEB quantitative and verbal scores and Rokeach scores. Table 11 and 12 present these correlations for all groups and subgroups. The only significant correlation occurred in the female low dogmatic-analytic group ( $r = -.44$ ;  $p < .05$ ) indicating that for this group a significant negative relationship existed between verbal ability and dogmatism. Since this was the only significant correlation, however, out of 38, it could perhaps more validly be construed as a chance occurrence. A consistent phenomenon was the opposite correlation for male and female Ss. All the correlations between quantitative and dogmatism scores were positive for males and negative for females.

In the groups organized on the basis of the Witkin test, differences of greater significance appeared. On the CEEB quantitative measure all groups were significantly different from each other except the male and female global groups. On the CEEB verbal measure the global females did not differ from the global males, nor the analytical females from the global or analytical males.

Differences between groups on the Witkin measure were

TABLE 11

## CORRELATIONS BETWEEN QUANTITATIVE AND DOGMATISM SCORES

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<u>Groups</u>	<u>r</u>
All subjects	.06
All females	-.03
All males	.14

	<u>Female</u>	<u>Male</u>
Lo D-G	-.16	.10
Lo D-A	-.22	.22
Hi D-G	-.17	.12
Hi D-A	-.23	.05
Lo D	-.03	.18
Hi D	-.20	.15

---

TABLE 12  
CORRELATIONS BETWEEN VERBAL AND DOGMATISM SCORES

<u>Groups</u>	<u>r</u>		
All subjects	-.13		
All females	-.10		
All males	-.16		
		<u>Female</u>	<u>Male</u>
Lo D-G		-.25	-.12
Lo D-A		-.44*	.10
Hi D-G		.19	.20
Hi D-A		-.20	-.10
Lo D		-.24	-.004
Hi D		-.02	.08

\* p < .05

expected in view of Witkin's consistent findings of the relationship between embedded figures scores and certain measures of quantitative ability. The relationship between verbal ability and embedded figures scores is less clear, although there is some evidence in the literature for a positive relationship between verbal ability and embedded figures scores for global subjects.

Correlations were also run between CEEB quantitative and verbal scores and Witkin scores. This data is presented in Tables 13 and 14. Consistent significant correlations between verbal and quantitative scores and EFT scores were most evident for the total groups with correlations between quantitative scores and EFT consistently higher. The correlations for the subgroups were less consistent; however, a clear cut finding was the strong significant correlation between both quantitative and verbal ability and EFT in the male analytical subgroup and the negative correlation for the male global subgroup. Correlations for females tended to be in the opposite direction and were not as consistent.

In addition to the study of differences between subgroups in measured intelligence, an investigation of the relationship between the two personality dimensions in the total group and subgroups was undertaken. Table 15 contains correlational data for all groups for the global-analytical and dogmatism

**TABLE 13**  
**CORRELATIONS BETWEEN CEEB QUANTITATIVE AND WITKIN SCORES**

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<u>Groups</u>	<u>r</u>	
All subjects	.55**	
All females	.54**	
All males	.58**	
	<u>Female</u>	<u>Male</u>
Lo D-G	.66**	-.20
Lo D-A	.46*	.64**
Hi D-G	.07	-.07
Hi D-A	-.18	.38
G	.40**	-.13
A	.11	.51**

---

\*  $p < .05$

\*\*  $p < .01$

TABLE 14  
CORRELATIONS BETWEEN CEEB VERBAL AND WITKIN SCORES

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---

<u>Groups</u>	<u>r</u>	
All subjects	.33**	
All females	.38**	
All males	.28**	
	<u>Female</u>	<u>Male</u>
Lo D-G	.40*	-.25
Lo D-A	.06	.23
Hi D-G	.18	-.07
Hi D-A	-.06	.60**
G	.26	-.13
A	-.01	.42**

---

\*  $p < .05$

\*\*  $p < .01$

TABLE 15  
CORRELATIONS BETWEEN EFT SCORES AND DOGMATISM SCORES

<u>Groups</u>	<u>r</u>	
All Subjects	.06	
All females	.09	
All males	.04	
	<u>Female</u>	<u>Male</u>
Lo D-G	.58**	.45*
Lo D-A	-.22	.18
Hi D-G	.30	-.26
Hi D-A	-.36	-.20
Lo D	.24	.14
Hi D	-.08	-.02
G	.27	.07
A	.07	.04

\*  $p < .05$

\*\*  $p < .01$



dimensions. Significant correlations occurred in the low dogmatic-global groups of both sexes.

#### A. Pulling Out Method

The pulling out method scores the individual on the basis of his recognition and use of the structure built into the problem. Each subject was scored by this method for each problem; average pulling out scores were computed for each group for each problem. The mean and standard deviation for each group is presented in Table 16. An analysis of variance was performed on the data derived from the pulling out method by summing scores on the verbal problems (31 A, B; 35 A, B) for each individual. The scores from these 4 problems were used because of the similarity of the problems in language and structure. It was believed that the summed scores would provide a basis upon which to investigate differences within groups. Table 17 gives the results of this analysis. Differences significant at the .01 level were found for the main effects of analytical-global and open-closed dimensions. There were no significant sex differences nor interactions. High dogmatic individuals and analytical individuals performed better on this analysis across problems.

Differences in individual problems analyzed separately by sex on the open-closed and analytical-global dimensions are

TABLE 16

MEANS AND STANDARD DEVIATIONS FOR ALL  
SUBGROUPS BASED ON PULLING OUT METHOD

Female Groups								
	Lo D-G		Lo D-A		Hi D-G		Hi D-A	
	M	SD	M	SD	M	SD	M	SD
31 A	.05122	.0167	.06105	.0120	.05613	.0169	.06564	.0046
31B	.04053	.0172	.04244	.0234	.04665	.0174	.04878	.0175
40	.03609	.0330	.06032	.0292	.03266	.0245	.05062	.0384
42	.03778	.0302	.06766	.0338	.03959	.0331	.07555	.0347
35 A	.01979	.0065	.02102	.0048	.02125	.0050	.02328	.0012
35 B	.01807	.0054	.02114	.0043	.01824	.0059	.02172	.0039
Male Groups								
31 A	.05494	.0140	.05881	.0121	.05838	.0149	.06321	.0091
31 B	.03968	.0193	.04200	.0250	.04088	.0202	.05170	.0164
40	.03237	.0236	.05521	.0355	.03738	.0348	.05972	.0335
42	.04765	.0322	.06344	.0358	.05833	.0338	.07021	.0342
35 A	.02074	.0049	.02171	.0037	.02084	.0048	.02124	.0049
35 B	.01926	.0061	.02114	.0044	.01977	.0052	.02211	.0029

TABLE 17  
 ANALYSIS OF VARIANCE BASED ON SUMMED SCORES  
 FOR PROBLEMS 31 A, B; 35 A, B

Source	DF	SS	MS	F
Within (W)	1	.011147900		13.25**
Between (R)	1	.00669012		7.72**
Sex (S)	1	.00000102		.001
W x R	1	.00034471		.40
W x S	1	.00010347		.12
R x S	1	.00013479		.16
W x R x S	1	.00021114		.24
Error	192	.16630305	.00086616	

\*\* p < .01

presented in Tables 18 and 19. It is between the analytical-global groups that the differences were significant with the analytical groups for both sexes having higher scores on problems 40, 42 and 35 B and in addition the females having significantly higher scores on problem 31 A.

To assess the influence of intelligence and personality dimensions in problem-solving activity, correlations were run between ability measures, Witkin and Rokeach scores and problem-solving scores and in addition, an analysis of covariance was performed with the quantitative score as the covariate. The correlational data is contained in Tables 20, 21, 22, 23 and the analysis of covariance in Table 24.

Not only was the relationship between quantitative scores and problem-solving activity more significant for males than for females, it was also reversed for the sexes. For males the relationship between quantitative ability and problem-solving activity was stronger if the males were open-minded; for females the relationship was stronger if they were closed-minded. The relationship between verbal ability and problem-solving activity was significant only in the total groups and in the open-minded groups for both sexes. The relationship between EFT scores and problem-solving activity was significant only for the total groups and for open-minded females and closed-minded males.

TABLE 18

t VALUES FOR DIFFERENCES BETWEEN DOGMATISM GROUPS  
BASED ON PULLING OUT METHOD

	Lo D Females		Hi D Females		<u>t</u>
	M	SD	M	SD	
31 A	.056136	.015376	.060886	.013286	1.64
31 B	.0411485	.020583	.047715	.017497	1.62
40	.048206	.033455	.041642	.033417	.97
42	.052722	.035380	.057572	.038360	.65
35 A	.020402	.005751	.022266	.002203	2.14*
35 B	.019609	.005104	.019980	.005325	.35

	Lo D Males		Hi D Males		<u>t</u>
	M	SD	M	SD	
31 A	.056876	.013268	.060796	.012571	1.50
31 B	.040838	.022354	.046289	.019141	1.30
40	.043790	.032229	.048552	.035948	.69
42	.055546	.034941	.064268	.034511	1.24
35 A	.021227	.004352	.021043	.004860	.20
35 B	.020201	.005368	.020939	.004345	.75

\*  $p < .05$

TABLE 19

t VALUES FOR DIFFERENCES BETWEEN WITHIN GROUPS  
BASED ON PULLING OUT METHOD

	G Females		A Females		<u>t</u>
	M	SD	M	SD	
31 A	.053670	.017008	.063346	.009823	3.45**
31 B	.043589	.017590	.045611	.020922	.52
40	.034376	.029125	.055472	.034448	3.27**
42	.038688	.031684	.071606	.017852	6.34**
35 A	.020516	.005844	.022151	.003692	1.67
35 B	.018154	.005679	.021435	.004105	3.30**

	G Males		A Males		<u>t</u>
	M	SD	M	SD	
31 A	.056660	.014561	.061012	.019067	1.90
31 B	.040277	.019749	.046850	.021663	1.57
40	.034876	.029849	.057466	.034586	3.46**
42	.052988	.033425	.066826	.035169	2.00*
35 A	.020794	.004820	.021476	.004370	.74
35 B	.019517	.005643	.021623	.003731	2.20*

\*  $p < .05$

\*\*  $p < .01$

TABLE 20  
CORRELATIONS BETWEEN CEEB QUANTITATIVE  
SCORES AND PROBLEM SOLVING SCORES

<u>Groups</u>	<u>r</u>	
Females	.36**	
Males	.43**	
Total	.38**	
	<u>Female</u>	<u>Male</u>
Lo D-G	.15	.51*
Lo D-A	.28	.39*
Hi D-G	.38	.31
Hi D-A	.32	.08
Lo D	.32*	.49**
Hi D	.42**	.36**
G	.27	.41**
A	.26	.30*

\*  $p < .05$

\*\*  $p < .01$

TABLE 21

## CORRELATIONS BETWEEN CEEB VERBAL SCORES AND PROBLEM SOLVING SCORES

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<u>Groups</u>	<u>r</u>
Females	.24*
Males	.24*
Total	.23**

	<u>Female</u>	<u>Male</u>
Lo D-G	.30	.37
Lo D-A	.15	.29
Hi D-G	.12	.03
Hi D-A	.09	.19
Lo D	.31*	.33*
Hi D	.20	.24
G	.18	.14
A	.11	.23

---

\* p &lt; .05

\*\* p &lt; .01



TABLE 22

CORRELATIONS BETWEEN EFT SCORES AND PROBLEM SOLVING SCORES

---



---

<u>Groups</u>	<u>r</u>		
Females	.31**		
Males	.25*		
Total	.28**		
		<u>Female</u>	<u>Male</u>
Lo D-G	.27		-.36
Lo D-A	.16		.16
Hi D-G	.01		.12
Hi D-A	.13		.37
Lo D	.30*		.11
Hi D	.29		.46**
G	.16		-.19
A	.19		.23

---

\* p &lt; .05

\*\* p &lt; .01

TABLE 23

## CORRELATIONS BETWEEN ROKEACH SCORES AND PROBLEM SOLVING SCORES

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---

<u>Groups</u>	<u>r</u>	
Female	.19	
Male	.07	
Total	.13	
	<u>Female</u>	<u>Male</u>
Lo D-G	.15	- .22
Lo D-A	-.16	- .21
Hi D-G	.08	- .003
Hi D-A	-.07	- .36
Lo D	.04	- .21
Hi D	-.003	- .17
G	.21	.02
A	.19	.11

---

TABLE 24

ANALYSIS OF COVARIANCE BASED ON SUMMED SCORES  
 FOR PROBLEMS 31 A, B; 35 A, B, WITH CEEB  
 QUANTITATIVE SCORES AS COVARIATE

Source	Df	SS	MS	F
Within (W)	1	.00064493		.66
Rokeach (R)	1	.00240498		2.46
Sex (S)	1	.00144994		1.47
W x R	1	.00031773		.32
W x S	1	.00000276		.002
R x S	1	.00024407		.25
W x R x S	1	.00182085		1.85
Error	144	.14125934	.00098096	

There were no significant correlations between dogmatism scores and problem-solving activity.

The analysis of covariance (Table 24) parallels the findings from the correlational data. The significant differences between personality groups noted in Table 11 disappear for all measures. The Witkin measure was most affected as was to be expected on the basis of the differences between Witkin subgroups on quantitative ability and on the basis of the significant correlations noted above in Tables 13, 20, and 22.

That significant differences between the dogmatic groups should also be eliminated was not as predictable since these subgroups did not differ from each other on quantitative ability except for the male high dogmatic group. The elimination of the influence of the higher quantitative scores of the males accounts for the increased F score for differences between the sexes with the females achieving the higher score.

#### B. Group Performance Method

Uncertainty values were computed, according to the method described by Attneave (1959), from the frequencies in a scatter diagram which has, as the abscissa, the numbers of all the questions which may be asked, and as the ordinate, the order in which the questions were actually asked by the subject.

Uncertainty values for each group for each problem are

presented in Table 25 along with the minimum uncertainty value for each problem, as determined by scheme or "X" norms, and with the maximum uncertainty value, as determined by H norms. The uncertainty values listed in column "X" depend exclusively on the minimum number of questions needed to solve the problem, whereas the schema norms depend on the total set of sequences which represent the maximum empirical association between the questions and order of choice. Thus, when there is more than one sequence which will solve the problem, the schema and the "X" norms will differ. On the other hand when there is only one sequence, these norms will be the same. The higher the value of the ratio between schema and "X" values, the greater is the uncertainty of the schema in relation to the uncertainty of one of the ideal sequences.

The uncertainty values presented in Table 25 indicate that the high dogmatic and analytical groups had lower scores for both sexes. The only exception to this trend was for problem 35 A for the low-dogmatic males who had lower scores than the high dogmatic males.

Although it was not appropriate to subject the scores derived by this method to the use of ordinary tests of statistical significance, it was possible to compare the groups on the basis of the number of problems for which a given group had lower uncertainty scores than the group being contrasted with it. Using

TABLE 25

UNCERTAINTY VALUES,  $H(x, y)$ , FOR DOGMATISM AND WITKIN GROUPS  
TOGETHER WITH THE SCHEMA, X, AND H NORMS

	Female		Male		Schema	X	H
	Lo D	Hi D	Lo D	Hi D			
31 A	4.20115	3.80943	4.28703	3.96537	2.252	1.585	6.426
31 B	5.62495	5.17165	5.44958	5.21360	2.252	1.585	6.426
40	6.08716	5.75291	6.04043	5.73088	1.000	1.000	6.426
42	5.78022	5.47010	5.85767	5.59291	2.000	2.000	6.426
35 A	5.51598	4.99197	5.57740	5.67748	3.922	2.322	7.934
35 B	5.67217	5.62041	5.45735	5.38536	3.933	2.322	7.934

	Female		Male		Schema	X	H
	G	A	G	A			
31 A	4.50505	3.47301	4.27304	3.97670	2.252	1.585	6.426
31 B	5.42002	5.39541	5.58492	5.04823	2.252	1.585	6.426
40	6.23500	5.59745	6.29825	5.37542	1.000	1.000	6.426
42	6.11864	5.07011	6.07144	5.33411	2.000	2.000	6.426
35 A	5.45125	5.07834	5.81458	5.43614	3.922	2.322	7.934
35 B	6.03672	5.22457	5.79604	5.00261	3.933	2.322	7.934

the Sign Test described by Siegel (1956), the probability of a specified group having lower scores on all six problems is .016. This is indicative of the significance of differences between the open and closed-minded females and both sexes on the analytical-global dimension, with the high dogmatic females and all analytical subjects employing more efficient tactics in eliminating uncertainty. Differences between sex groups were not significant.

### C. Information Values

In using information values, an S is scored according to the average amount of information he acquires in his pursuit of the solution of the problem. Each question asked results in information, some of which may be relevant and some of which may be irrelevant. If the information is relevant, some of it may be new or some of it may be repeated from previous questions. The information value is the average resulting from the division of the numerical calculation of the total, new, relevant information, by the number of questions asked. The numerical calculation is derived from a method described by Attneave (1959).

With the use of these scores, the information value of the questions is maximized and the structural properties of the problem are minimized. Thus, a high score can be reached if the necessary questions are asked no matter in what order they are asked. When the pulling out method is used, the order is of prime importance.

Information values for the two geometrical problems were evaluated for each subject and the group averages were computed. Only these two problems were used because there is only one correct sequence of questions leading to the solution of the problem. Means, standard deviations and  $t$  values for the groups are presented in Table 26. There were no significant differences between high-low dogmatic  $Ss$ ; however, analytical males and females performed significantly better than their respective global groups. There were no significant sex differences.

#### D. Scoring in Terms of Correct Answers

The previous scoring methods discussed evaluate process of solution rather than the solution itself because of the desirability of assessing the subject's psychological activity in terms of efficiency rather than the end product of this activity which may or may not provide an adequate demonstration of the subject's approach to the problem.

In order to ascertain, however, whether differences among groups in correct solutions also reflected the differences described above,  $X^2$  was computed for the groups for each problem. Table 27 contains the data for these tests. Only four of the 24 tests were statistically significant, both on the analytical-global dimension. In problems 31 B, 42 and 35 B the analytical females had significantly more correct solutions than global



TABLE 26

MEANS, STANDARD DEVIATIONS AND  $t$  VALUES  
BASED ON INFORMATION VALUES

Lo-D Female			Hi-D Female		
Prob.	M	SD	M	SD	$t$
40	.86176460	.43503398	.97925580	.37455217	1.45
42	.86115620	.24910574	.89664160	.23873280	.73
Lo-D Male			Hi-D Male		
40	.86052540	.44777205	.93218180	.44099361	.81
42	.85365620	.26744111	.92531000	.23094869	1.43
G Female			A Female		
40	.79740020	.39948616	1.04362020	.38281150	3.15**
42	.78068280	.23234947	.97711500	.21540090	4.38**
G Male			A Male		
40	.78444360	.38191767	1.00826360	.47606058	2.59*
42	.82688580	.23926113	.95208040	.24969271	2.56*

\*  $p < .01$

\*\*  $p < .001$

TABLE 27

$\chi^2$  TEST ON THE NUMBER OF CORRECT AND INCORRECT ANSWERS BETWEEN VARIOUS GROUPS

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Hi-Lo Dogmatic Females

Problem	DF	$\chi^2$	Significance
31 A	1	.07	n.s.
31B	1	.23	n.s.
40	1	*	n.s.
42	1	.31	n.s.
35 A	1	.00	n.s.
35 B	1	.04	n.s.

Hi-Lo Dogmatic Males

31 A	1	.35	n.s.
31 B	1	.00	n.s.
40	1	*	n.s.
42	1	.07	n.s.
35 A	1	.85	n.s.
35 B	1	.42	n.s.

Global-Analytical Females

31 A	1	1.86	n.s.
31 B	1	5.83	.02
40	1	*	n.s.
42	1	11.29	.001
35 A	1	.28	n.s.
35 B	1	5.47	.02

Global-Analytical Males

31 A	1	.35	n.s.
31 B	1	1.97	n.s.
40	1	*	n.s.
42	1	.67	n.s.
35 A	1	.09	n.s.
35 B	1	7.90	.01

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\*Fisher Exact Probability Test used.

females; in problem 35 B, the analytical males had significantly more correct solutions than global males. There were no significant sex differences. Scoring procedures based on number of correct solutions was not as sensitive a measure as the procedures assessing process discussed above.

#### Personality Traits: Anxiety

An analysis of variance based on scores from the Taylor Manifest Anxiety Scale was performed for all groups. Means and standard deviations for all groups are presented in Table 28, and the results of the analysis of variance are presented in Table 29. Only the subjects scoring high on Rokeach's Dogmatism scale and designated as closed were significantly more anxious than any other group. The F score of 11.12 is significant beyond the .01 level.

The suggestion of an interaction between Witkin and Rokeach scores and between Witkin and sex reflects the fact that if females were open minded, they tended to be less anxious if they were also global; whereas if females were closed-minded, they tended to be less anxious if they were analytical, whereas males whether open or close-minded, tended to be less anxious if they were also analytical. Least anxious were open-minded global females and open-minded analytical males; most anxious were closed-minded global subjects of both sexes.

TABLE 28  
 MEANS AND STANDARD DEVIATIONS FOR ALL GROUPS  
 FOR TAYLOR MANIFEST ANXIETY SCALE

Group	M	SD
<u>Female</u>		
Lo D-G	12.00	6.41
Lo D-A	14.80	7.30
Hi D-G	17.20	9.99
Hi D-A	15.96	7.41
<u>Male</u>		
Lo D-G	13.08	7.70
Lo D-A	11.88	6.68
Hi D-G	18.28	4.07
Hi D-A	14.80	9.09

TABLE 29  
ANALYSIS OF VARIANCE BASED ON  
TAYLOR MANIFEST ANXIETY SCORES

Source	DF	SS	MS	F
Within (W)	1	30.42		.52
Rokeach (R)	1	655.22		11.12**
Sex (S)	1	11.52		.20
W x R	1	124.82		2.12
W x S	1	121.68		2.06
R x S	1	9.48		.16
W x R x S	1	9.88		.17
Error	192	11309.48	58.90	

\*\* p < .01

Analyses of variance were also performed for the three scales of the Personal Reaction Schedule (PRS): Motor, Object and Personal Anxiety. Means and standard deviations are contained in Table 30; the data from the analyses of variance are contained in Tables 31, 32, and 33. The trend for the most anxious subjects--closed-minded global subjects of both sexes--was the same for these tests as for the MAS. The trend for the least anxious subjects, however, was not as consistent over the three tests. The least anxious female subgroup in motor anxiety was the same as for the MAS--open-minded global subjects--but the open-minded analytical females were least anxious in object and personal anxiety. The least anxious males in motor and object anxiety were open-minded analytical subjects as in the MAS, but in personal anxiety open-minded global males were least anxious.

Correlations were computed between Manifest Anxiety Scores and the Witkin Rokeach measures for all groups and subgroups. This data is contained in Table 34.

The only significant correlation between anxiety and EFT emerged for the high dogmatic-global males for whom anxiety was negatively correlated with analytical ability as measured by EFT.

There were four significant correlations between the scores for anxiety and dogmatism, all of them among male groups.

TABLE 30

MEANS AND STANDARD DEVIATIONS FOR ALL GROUPS  
FOR MOTOR, OBJECT AND PERSONAL ANXIETY OF PRS

Group	Motor Anxiety		Object Anxiety		Personal Anxiety	
	M	SD	M	SD	M	SD
<u>Female</u>						
Lo D-G	7.64	2.84	6.64	3.19	8.80	3.31
Lo D-A	8.96	4.11	6.60	3.41	8.68	3.46
Hi D-G	12.24	4.16	9.56	4.61	11.76	4.93
Hi D-A	10.80	3.43	8.12	4.00	10.00	4.11
<u>Male</u>						
Lo D-G	10.32	3.89	7.04	4.35	8.12	4.24
Lo D-A	9.00	3.57	6.72	3.17	9.12	3.91
Hi D-G	12.16	3.68	10.72	3.28	11.68	4.04
Hi D-A	10.88	3.34	9.04	3.64	10.76	4.68

TABLE 31  
ANALYSIS OF VARIANCE BASED ON  
MOTOR ANXIETY SCORES OF PRS

Source	Df	SS	MS	F
Within (W)	1	23.12		1.73
Rokeach (R)	1	322.58		24.11***
Sex (S)	1	23.12		1.73
W x R	1	23.10		1.73
W x S	1	19.22		1.45
R x S	1	23.10		1.73
W x R x S	1	24.54		1.84
Error	192	2564.72	13.36	

\*\*\*  $p < .001$



TABLE 32  
 ANALYSIS OF VARIANCE BASED ON  
 OBJECT ANXIETY SCORES OF PRS

Source	Df	SS	MS	F
Witkin (W)	1	371.85		2.59
Rokeach (R)	1	340.61		23.34***
Sex (S)	1	21.13		1.45
W x R	1	23.80		1.63
W x S	1	.84		.06
R x S	1	7.60		.52
W x R x S	1	.01		.0006
Error	192	2800.56	14.59	

\*\*\* p < .001

TABLE 33  
ANALYSIS OF VARIANCE BASED ON  
PERSONAL ANXIETY SCORES OF PRS

Source	Df	SS	MS	F
Within (W)	1	10.13		.57
Rokeach (R)	1	280.85		15.90***
Sex (S)	1	.61		.03
W x R	1	39.60		2.24
W x S	1	12.00		.68
R x S	1	2.64		.15
W x R x S	1	.25		.01
Error	192	3391.28	17.66	

\*\*\*  $p < .001$

TABLE 34

CORRELATIONS BETWEEN MANIFEST ANXIETY SCALE  
SCORES AND WITKIN AND ROKEACH MEASURES FOR ALL  
GROUPS AND SUBGROUPS

Groups	N	Correlations			
		MAS - Witkin		MAS - Rokeach	
Females	100	.04		.19	
Males	100	-.08		.27**	
Subgroups		Female	Male	Female	Male
High Dogmatism	50	-.09	-.09	-.14	-.09
Low Dogmatism	50	.18	-.06	.24	.35*
Global	50	.10	-.03	.25	.29*
Analytical	50	-.12	.15	.11	.26
Lo D-G	25	.10	-.16	.29	.23
Lo D-A	25	.05	.16	.15	.48*
Hi D-G	25	-.11	-.45*	-.29	-.13
Hi D-A	25	-.17	.13	.04	-.04

\*  $p < .05$

\*\*  $p < .01$

There seemed to be a stronger relationship between anxiety and dogmatism among global and open-minded males than among the analytical and closed-minded males.

For females there seemed to be no consistent pattern relating scores for anxiety with scores on the Witkin or Rokeach measures.

#### Personality Traits: Masculinity-Femininity

Analysis of variance based on scores from Gough's Masculinity-Femininity scale were performed for all groups. Means and standard deviations for all groups are presented in Table 35 and the results of the analysis of variance are presented in Table 36. All the main effects were significant indicating that female subjects and those subjects who were global and closed-minded scored significantly more feminine.

The trend toward interaction between Witkin and sex reflected a greater tendency for global males to be more feminine with respect to analytical males than for global females to be more feminine than analytical females.

Correlations were computed between M-F scores and Witkin and Rokeach scores for all groups and subgroups. This data is contained in Table 37. The most significant finding in correlational data was the differential relationship between M-F and EFT for low dogmatic females. If females were global and

TABLE 35  
 MEANS AND STANDARD DEVIATIONS FOR M-F  
 SCORES FOR ALL GROUPS

Group	M	SD
<b>Female</b>		
Lo D-G	35.48	3.41
Lo D-A	34.76	3.65
Hi D-G	37.40	3.73
Hi D-A	36.72	4.46
<b>Male</b>		
Lo D-G	28.32	7.04
Lo D-A	25.32	4.36
Hi D-G	29.92	5.58
Hi D-A	27.52	3.91

TABLE 36  
ANALYSIS OF VARIANCE BASED ON  
GOUGH MASCULINITY-FEMININITY SCORES

Source	DF	SS	MS	F
Witkin (W)	1	144.50		9.96**
Rokeach (R)	1	184.32		12.70**
Sex (S)	1	3461.12		238.53***
W x R	1	1.28		.09
W x S	1	50.00		3.44
R x S	1	.02		.001
W x R x S	1	.98		.07
Error	192	2785.80	14.51	

\*\* p < .01

\*\*\* p < .001

TABLE 37  
 CORRELATIONS BETWEEN MASCULINITY-FEMININITY  
 AND WITKIN AND ROKEACH MEASURES FOR ALL  
 GROUPS AND SUBGROUPS

Groups	N	Correlations			
		M-F - WITKIN		M-F - ROKEACH	
Females	100	-.07		.26**	
Males	100	-.20*		.18	
Subgroups		Female	Male	Female	Male
High Dogmatism	50	-.10	-.10	.07	.06
Low Dogmatism	50	-.07	-.27	.11	.18
Global	50	.40	-.03	.26	.13
Analytical	50	-.22	-.02	.27	.26
Lo D-G	25	.65**	-.02	.06	.26
Lo D-A	25	-.39*	-.25	.20	.11
Hi D-G	25	.15	-.04	.02	.11
Hi D-A	25	-.21	.26	.11	.03

\*  $p < .05$

\*\*  $p < .01$

open-minded, femininity was positively correlated with EFT scores ( $r = .65$ ). If females were analytical and open-minded, femininity was negatively correlated with EFT scores ( $r = -.39$ ). Regarding the Rokeach measure, there was a trend for femininity to be related to closedness; this was significant for females at the .01 level.



## CHAPTER V

### DISCUSSION

Guiding the present investigation of the relationship of basic dimensions of personality to cognitive functioning was the belief that subjects should be selected on the basis of both dimensions under study. Previous research regarding the interaction of these personality characteristics and I.Q., while revealing correlations between these variables, has failed to clarify to what degree the differential influence of the personality dimensions under study can be attributed to differences in I.Q.

Neither is it known, because of the few studies undertaken so far, how the combination of extremes on the two variables would be related to I.Q. or other intelligence measures.

It was decided to choose subjects on the basis of the two dimensions in a manner which would reflect their actual existence in the population, recognizing that this might give rise to differences among groups in measured I.Q. The advantages and disadvantages of this approach are evident in the results of this study.

Regarding differences in intelligence as measured by CEEB quantitative and verbal scores, the finding that analytical and global groups and male and female groups differed significantly from each other and that dogmatism groups did not differ from each other supported previous research in this area. Significantly higher scores for analytical subjects on the verbal measure as well as the quantitative measure, however, call into question the contention of Witkin that if verbal measures differentiate groups, they tend to favor global subjects. The correlational data, however, supported earlier findings that the relationship between verbal ability and EFT measures is weaker and less consistent than that between quantitative ability and EFT.

The differences in correlational data between the sexes were notable even if not always statistically significant. For men classified as global, intellectual ability was less predictive of performance on EFT measures, whereas for analytical men both verbal and quantitative measures were significant predictors of EFT scores ( $r$ 's = .42 and .51 respectively). The opposite trend held for females. For global females quantitative measures were significant predictors of EFT performance ( $r$  = .40) whereas for analytical females they were not significant except when females were also open minded ( $r$ 's = .40, .66, .46). Open mindedness exerted more influence among women than among men in accounting

for the relationship between ability and EFT. These findings contribute to the growing conviction that the global-analytical construct may reflect a somewhat different aspect of personality functioning in women than in men.

Given these differences in measured intelligence in the subgroups, the following discussion assesses the possibility that differences between groups in problem solving activity may be due solely to differences in mental ability as well as the possibility that personality or selection factors may account for the complex results obtained.

The analysis of covariance of pulling out scores, with quantitative ability as the covariate, revealed no significant differences between personality or sex groups (Table 24). In view of this disappearance of significant differences between personality groups obtained in the analysis of variance (Table 17), consideration of EFT and Rokeach scales as measures of mental ability rather than as measures of more pervasive personality functioning might be justified. Attributing differences in problem solving activity primarily to differences in quantitative ability, therefore, might be the most parsimonious interpretation.

Statistical data based on information values lends support to such an interpretation (Table 26). Because of the nature of the scoring systems it was not possible to employ an

analysis of covariance on data based on information values. Even without this analysis, however, there were significant differences only between the global and analytical groups, both male and female. Between the high and low dogmatic groups, which did not differ within sexes on verbal or quantitative scores, there were no significant differences. Only between those personality groups which also differed significantly in intellectual ability, therefore, were there significant differences in performance in terms of reduction of uncertainty without reference to the structure of the problem or an ideal sequence to be followed.

The third method of scoring, which estimates the uncertainty of the group in terms of the structure of the problem, contributed further to this general picture (Table 25). Analytical groups of both sexes employed more efficient methods in solving the problems than their global counterparts ( $p < .02$ ). Among the females, closed minded subjects performed more effectively than open minded subjects ( $p < .02$ ); the trend was in the same direction for males but did not reach statistical significance ( $p = .11$ ) since closed minded males performed better on only five of the six problems.

Based on these three methods of scoring, the most consistent differences in efficiency of problem solving activity were between analytical and global groups with the high and low

dogmatic groups showing significant differences only in the group performance method with female subjects. Since the analytical and global groups differed significantly in intellectual ability and the significant influence of this ability was revealed by analysis of covariance, it is possible to conclude that intellectual ability was the critical factor in these differences.

One major argument against this conclusion was the failure to find significant differences between the sexes in problem solving activity, even though the differences between males and females in quantitative and verbal ability were significant at the .001 level (Table 10) with males having higher scores in both areas.

In the analysis of covariance, the F score for differences between the sexes actually showed an increase from the original F score in the analysis of variance, thus revealing the slightly superior quality of the problem solving activity of females when the higher quantitative scores of the males were held constant. If mental ability were the primary factor operating in the problem solving activity under investigation, males should have performed consistently superior to females. This was not the case. In no analysis were any sex differences found. Although this is in accord with one of the hypotheses of this study, no interpretation is presently offered since the influence and relationship of

quantitative ability emerged as a more significant influence in problem-solving activity than the hypothesized influence of personality characteristics.

It may be suggested, however, that since females as a group were not handicapped in their problem solving activity by lower ability scores, factors other than ability were influencing the results.

Regarding the personality factors under investigation, the finding that closed minded individuals performed more effectively than open minded individuals, contrary to the hypothesis proposed in this study, called for analysis of the original selection of subjects.

Subjects for the present study were designated open or closed according to the procedure described by Rokeach (1960). Subjects indicate disagreement or agreement with each item of Rokeach's 40-item Dogmatism Test on a scale ranging from -3 to +3, with the 0 point excluded in order to force responses toward disagreement or agreement. This scale is subsequently converted for scoring purposes to a 1-to-7 scale by adding a constant of 4 to each item score. The total score is the sum of scores obtained on all items in the test. This provides a range of scores from 40 to 280. This same procedure was followed in the present research except that instead of converting the scale to

a 1-to-7 scale, 100 points were added to each individual's score providing a possible range of -20 to 240.

In employing open and closed minded individuals in his research, Rokeach usually selected the extreme scorers on his Dogmatism Scale and classified them as open or closed on the basis of their score with respect to the mean of the group. Thus, in one sample the mean of the high dogmatic subjects was 157.2 and the mean of the low dogmatic group was 101.1.

Since disagreement with the 40-item scale signifies open mindedness, using Rokeach's system scores under 120 would signify open mindedness and scores above 160 would signify closed mindedness. In the example just cited, it is questionable whether using a relative mean led to formation of groups which could be classified open or closed on the basis of their actual response to the Dogmatism Scale. It is possible that two groups could be statistically different from each other but still share the same personality characteristic, for example, both groups be open minded, one less open than the other but not classifiable as closed minded.

Something like this may be operating in the groups classified open or closed in the present research. The mean of the high dogmatic group on the Rokeach Scale was 108.96 which was significantly different from the low dogmatic group mean of 61.24.

With the present scoring system, a score of 100 would constitute the midpoint distinguishing individuals who generally agreed or disagreed with the scale items. A group with a mean of 108.96 might more accurately be classified as "central" rather than as "closed" regardless of the statistical difference between the means of the "extreme" groups. If this is so, then the two groups contrasted in the present research were open and central rather than open and closed.

This may assist in understanding why the present results differed markedly from those of Robb who employed open and closed subjects in a similar problem solving situation. Robb's open minded subjects performed significantly better than his closed minded subjects. The mean of the closed group was 135.53 and the mean of the open group was 72.77 thus making it possible to designate the groups closed or open on the basis of the distance from the midpoint on the Dogmatism Scale as well as on the basis of their statistical difference with respect to each other.

In the present study "central" dogmatic individuals performed more efficiently than low dogmatic individuals whose mean was eleven points lower than the mean of Robb's open group. On the basis of these two studies, it is possible to suggest that extreme scorers in the direction of disagreement may be less effective than individuals who tend to be open but do not score



at the extreme low end of the Dogmatism Scale.

Relative to this point was the finding that the two personality dimensions were not independent of each other in all subgroups (Table 15). In the low dogmatic-global groups of both sexes, correlations between dogmatism and the analytical dimension were positive and significant ( $r = .58$  for females and  $.45$  for males). The more extreme scorers in the direction of disagreement with the Dogmatism Scale scored in the extreme global direction on the Witkin measure; low dogmatic individuals who scored more centrally on the Rokeach measure did the same on the Witkin measure. Correlations between these measures for the other groups were not significant.

How this relationship between these two dimensions in this open-global group affected the functioning of the group was impossible to assess. It seems evident, however, that in those individuals in whom the extremes of these two dimensions were found, each characteristic may be affected and manifest itself differently than in the other subgroups.

Regarding the relationship of anxiety to the subgroups under discussion, the results supported previous findings that closed minded individuals were significantly more anxious than open minded individuals. This was consistent in all four tests of anxiety. The finding that the sexes did not differ in anxiety

supported the hypothesis of this study and contributed to previous research in which anxiety failed to distinguish the sexes on the basis of sex designation alone.

As discussed earlier anxiety has been found to characterize the global individual but in the present study no such finding emerged. The relationship of anxiety to the Witkin measure is a complex one and the present study adds to the complexity. An important consideration for further investigation is the difference in correlational data between males and females. For example, among analytical females, anxiety is negatively correlated with analytical scores whereas among analytical males anxiety is positively correlated with anxiety scores. It seems increasingly clear that general findings regarding the global-analytical construct cannot be applied indiscriminately to both males and females and that more research needs to be done among women in this area.

The results of the analysis of the masculinity-femininity data served to confirm the findings of previous research. Besides the obvious difference between the sexes on this measure, both global and closed individuals scored more "feminine" than their counterparts. Since Gough's M-F Inventory is based on stereotyped interest and behavior patterns in men and women, this data is provocative regarding the interest

patterns and developmental history particularly of closed and global individuals of both sexes.

In conclusion, the results of this study raised the question of the influence of intellectual ability on both Witkin and Rokeach measures of personality functioning while at the same time offering some support for the contention that these measures assessed aspects of personal functioning other than intellectual.

The finding that closed individuals performed more efficiently than open individuals was discussed within the framework of Rokeach's scoring system and the description of the closed individuals in this study was changed to "central" on the dogmatism dimension.

As predicted no differences between the sexes occurred in either problem solving activity or anxiety. There were complex interrelationships with other variables which differentiated the sexes and supported the belief that the two personality dimensions under investigation operate differently within the sexes.

## SUMMARY

This investigation explored differences in the problem solving activity of subjects selected on the basis of two personality characteristics: global-analytical functioning and open-closedness. The study was based primarily on the theoretical and empirical investigations of Witkin and Rokeach.

The subjects were 200 male and female college students selected on the basis of scores in the upper or lower third on both the Embedded Figures Test and the Dogmatism Scale. The following four groups of each sex were formed: low dogmatism-global; low dogmatism-analytical; high dogmatism-global; high dogmatism-analytical. The subjects worked a series of six problems devised by Rimoldi with a set logical structure which could be scored by various methods in terms of process.

The results showed more efficient problem-solving activity among analytical and closed-minded subjects while at the same time revealing complex relationships of intellectual ability to the dimensions of personality under investigation. The more efficient problem solving activity of the closed-minded subjects was reanalyzed within the framework of Rokeach's definition of open-closedness. Although the male subjects were superior to the female subjects in intellectual ability, there were no sex differences in problem solving. A reappraisal of the relationship between the two constructs under investigation was suggested.

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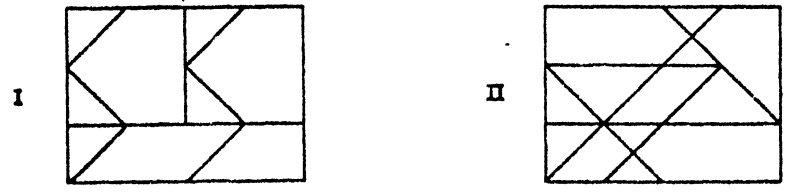
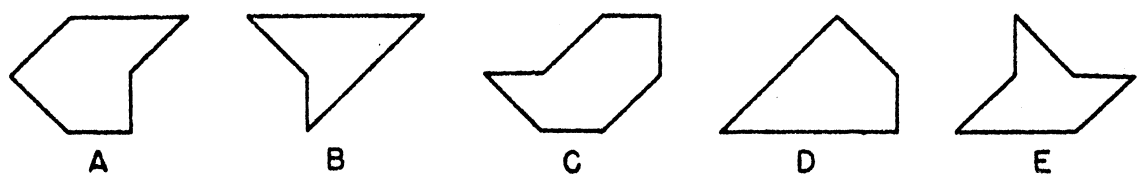
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**APPENDIX I**  
**EMBEDDED FIGURES TEST**

### HIDDEN FIGURES

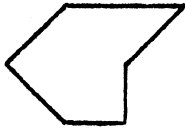
In this test you are to determine which one of five simple figures, the patterns lettered A, B, C, D, and E at the top of each page, is contained in each of the more complex problem figures. There is only one lettered pattern in each problem figure. The pattern will always be right side up and will be the exact size and shape of one of the lettered patterns at the top of the page. Try sample problems I and II; then check your answers with the figures in the box below.



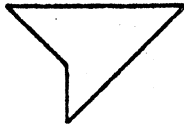
The figures below illustrate how the patterns are included in the problem figures. Pattern A is contained in the first problem and pattern D in the second.

Two sample problem figures labeled I and II are shown. Figure I is a square divided into several regions by lines, with a notch on the left side. Figure II is a square divided into several regions by lines, with a notch on the right side.

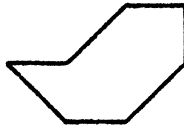
There are 16 problem figures in each section of this test and you will have 10 minutes for each section. Work as carefully and as quickly as you can. When you are given the signal, turn the page and begin working on the first section. Mark your answers on the answer sheet.



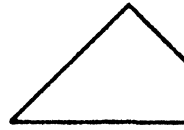
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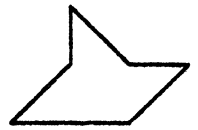
B



C



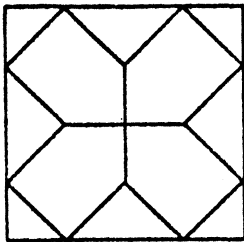
D



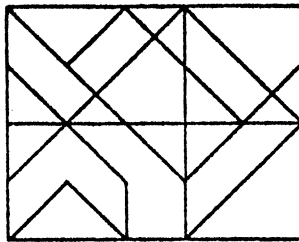
E



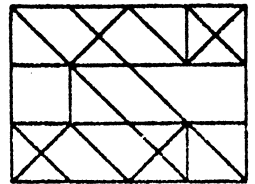
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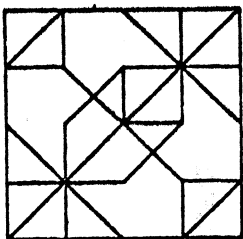
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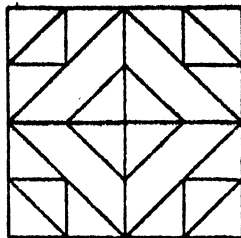
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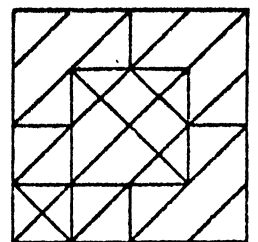
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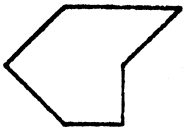
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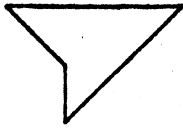
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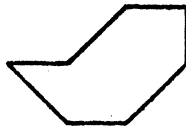




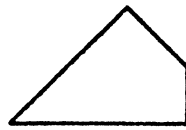
A



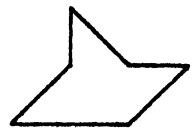
B



C

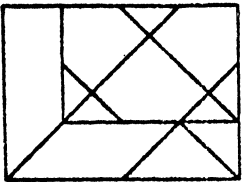


D

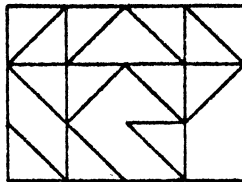


E

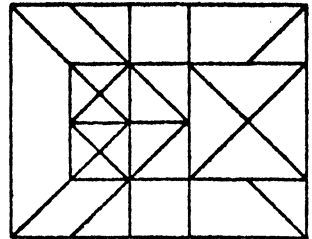
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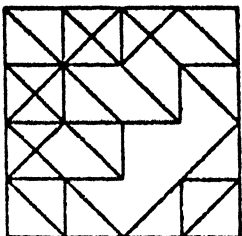
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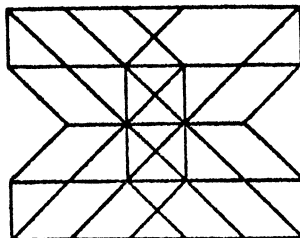
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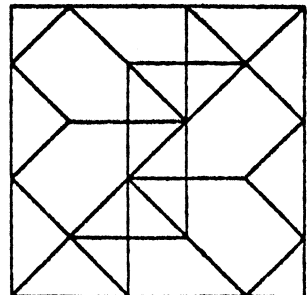
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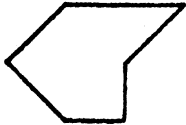


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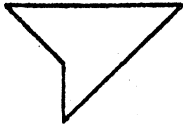


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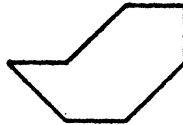




A



B



C

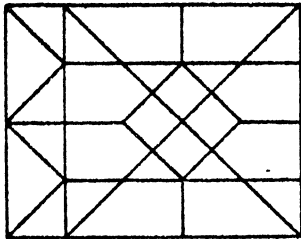


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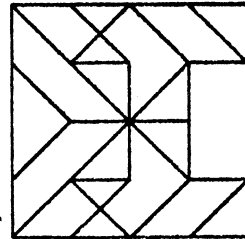


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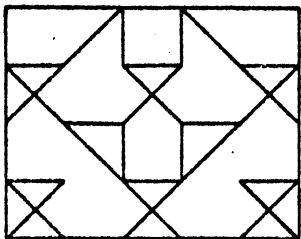
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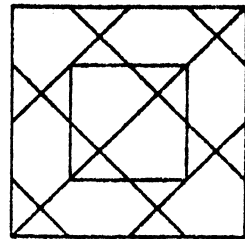
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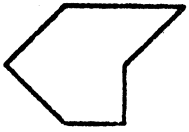
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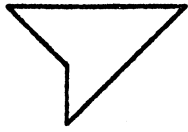
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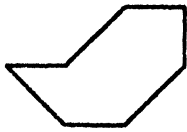
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Part 2 (10 minutes)

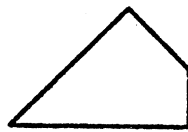
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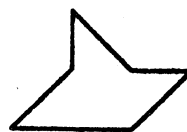
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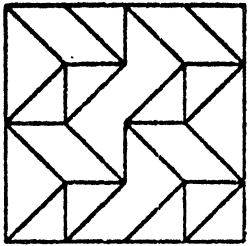
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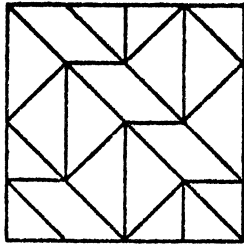


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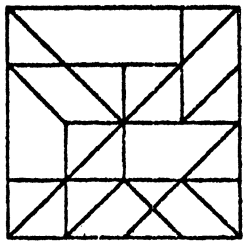
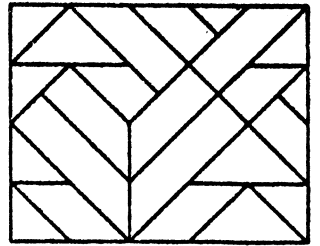


7.

18.

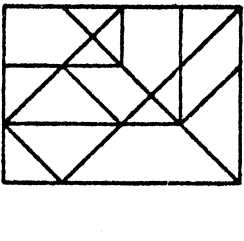


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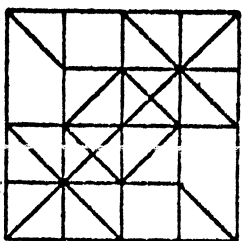
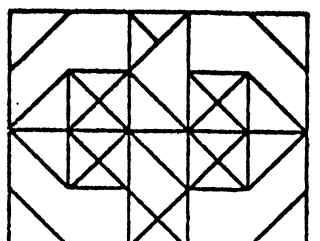


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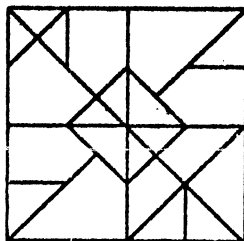


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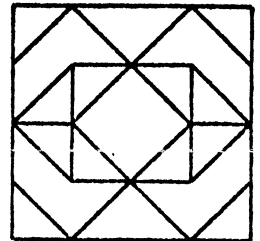


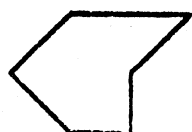
23.

24.



25.



Part 2 (continued)

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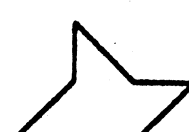
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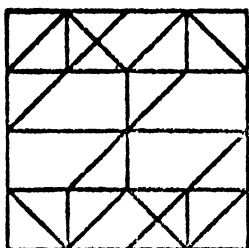
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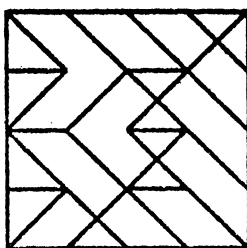
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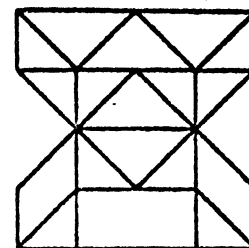
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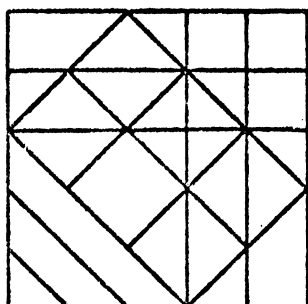
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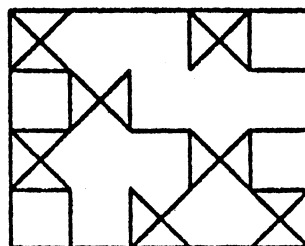
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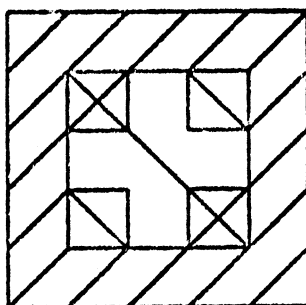
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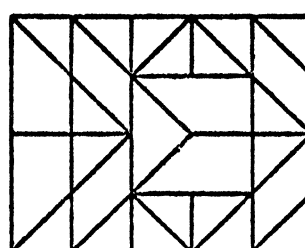
30.



31.



32.



DO NOT GO BACK TO PART 1, AND  
DO NOT GO ON TO ANY OTHER TEST UNTIL ASKED TO DO SO.

STOP.

## APPENDIX II

### ROKEACH DOGMATISM SCALE

The following is a study of what the general public thinks and feels about a number of important social and personal questions. The best answer to each statement below is your personal opinion. We have tried to cover many different and opposing points of view; you may find yourself agreeing strongly with some of the statements, disagreeing just as strongly with others, and perhaps uncertain about others; whether you agree or disagree with any statement, you can be sure that many people feel the same as you do.

Mark each statement on the answer sheet according to how much you agree or disagree with it. Make an X through +1, +2, +3, or -1, -2, -3, depending on how you feel in each case.

+1: I agree a little	-1: I disagree a little
+2: I agree on the whole	-2: I disagree on the whole
+3: I agree very much	-3: I disagree very much

- 
1. The United States and Russia have just about nothing in common.
  2. The highest form of government is a democracy and the highest form of democracy is the government run by those who are most intelligent.
  3. Even though freedom of speech for all groups is a worthwhile goal, it is unfortunately necessary to restrict the freedom of certain political groups.
  4. It is only natural that a person would have a much better acquaintance with ideas he believes in than with ideas he opposes.
  5. Man on his own is a helpless and miserable creature.

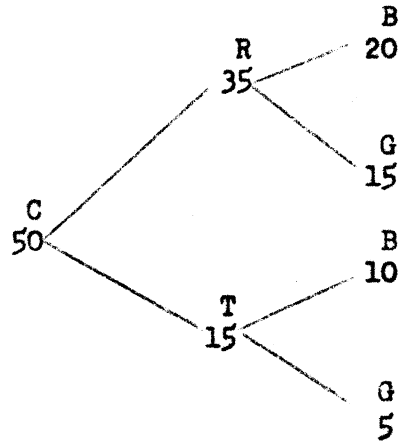
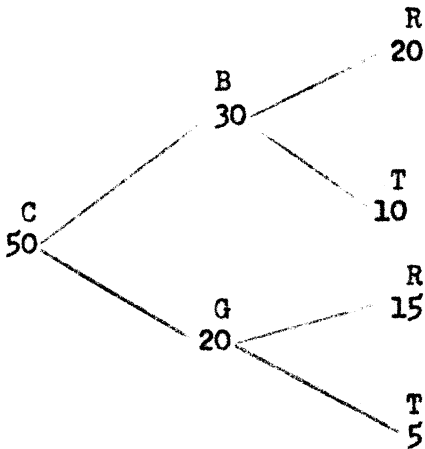
6. Fundamentally, the world we live in is a pretty lonesome place.
7. Most people just don't give a damn for others.
8. I'd like it if I could find someone who would tell me how to solve my personal problems.
9. It is only natural for a person to be rather fearful of the future.
10. There is so much to be done and so little time to do it in.
11. Once I get wound up in a heated discussion I just can't stop.
12. In a discussion I often find it necessary to repeat myself to make sure I am being understood.
13. In a heated discussion I generally become so absorbed in what I am going to say that I forget to listen to what the others are saying.
14. It is better to be a dead hero than to be a live coward.
15. While I don't like to admit this even to myself, my secret ambition is to become a great man, like Einstein, or Beethoven, or Shakespeare.
16. The main thing in life is for a person to want to do something important.
17. If given a chance I would do something of great benefit to the world.
18. In the history of mankind there have probably been just a handful of really great thinkers.
19. There are a number of people I have come to hate because of the things they stand for.
20. A man who does not believe in some great cause has not really lived.
21. It is only when a person devotes himself to an ideal or cause that life becomes meaningful.

22. Of all the different philosophies which exist in this world there is probably only one which is correct.
23. A person who gets enthusiastic about too many causes is likely to be a pretty "wishy-washy" sort of person.
24. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.
25. When it comes to differences of opinion in religion we must be careful not to compromise with those who believe differently from the way we do.
26. In times like these, a person must be pretty selfish if he considers primarily his own happiness.
27. The worst crime a person could commit is to attack publicly the people who believe in the same thing he does.
28. In times like these it is often necessary to be more on guard against ideas put out by people or groups in one's own camp than by those in the opposing camp.
29. A group which tolerates too much difference of opinion among its own members cannot exist for long.
30. There are two kinds of people in this world; those who are for the truth and those who are against the truth.
31. My blood boils whenever a person stubbornly refuses to admit he's wrong.
32. A person who thinks primarily of his own happiness is beneath contempt.
33. Most of the ideas which get printed nowadays aren't worth the paper they are printed on.
34. In this complicated world of ours the only way we can know what's going on is to rely on leaders or experts who can be trusted.
35. It is often desirable to reserve judgment about what's going on until one has had a chance to hear the opinions of those one respects.

36. In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own.
37. The present is all too often full of unhappiness. It is only the future that counts.
38. If a man is to accomplish his mission in life it is sometimes necessary to gamble "all or nothing at all."
39. Unfortunately, a good many people with whom I have discussed important social and moral problems don't really understand what's going on.
40. Most people just don't know what's good for them.



APPENDIX III

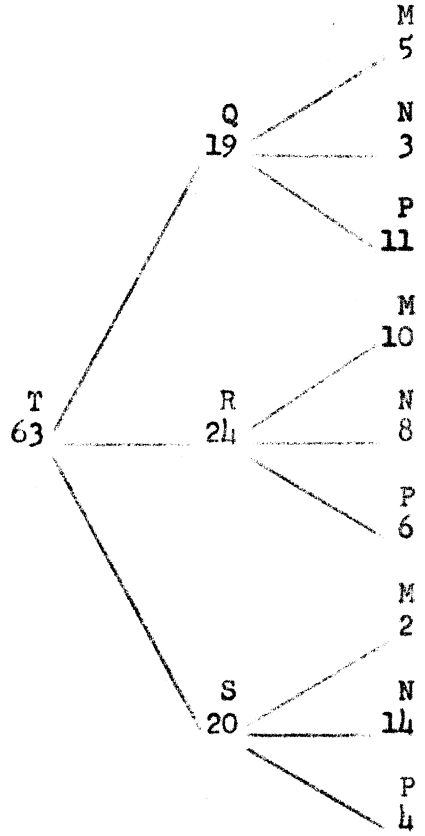
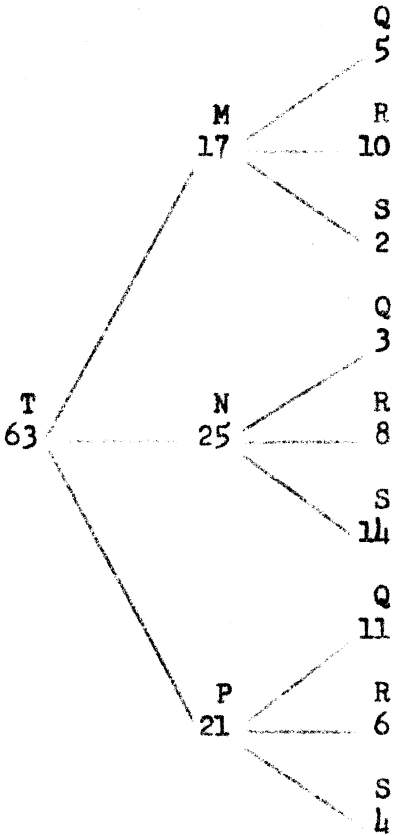


The Structure and Content of Problem 31 B

R	20	15	35
T	10	5	15
	30	20	50C

A Two by Two Matrix of the Structure and Content of Problem 31 B

APPENDIX IV



The Structure and Content of Problem 35 B

	M	N	P	
Q	5	3	11	19
R	10	8	6	24
S	2	14	4	20
	17	25	21	63T

A Three by Three Matrix of the Structure and Content of Problem 35 B

## APPENDIX V

### Problem 31 A

#### Instructions and Corresponding Questions and Answers

At Spencer High School the annual fall dance is about to be held. A dance committee has been selected to make the necessary arrangements. Both boys and girls are on the committee. A part of the committee 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 is to discover the number of girls involved in the sale of tickets.

Questions	Answers
1. Is Spencer High School the only co-educational school in the city?	1. No.
2. How many boys attend Spencer High?	2. 240 boys attend Spencer High.
3. How many boys are on the dance committee?	3. 10.
4. Are there more girls than boys at this school?	4. Yes.
5. How many students on the dance committee are assigned to supplying the refreshments?	5. 14.

- |   |               |
|---|---------------|
| 6. What is the total number of students on the fall dance committee?                | 6. 25.        |
| 7. How much time would the committee as a whole spend in preparation for the dance? | 7. 275 hours. |
| 8. How much time would the average committee member contribute?                     | 8. 11 hours.  |
| 9. How many boys on the committee are involved in the sale of tickets?              | 9. 6 boys.    |
| 10. How many girls are on the refreshment part of the dance committee?              | 10. 10 girls. |

Solution: 5 girls

## APPENDIX VI

### Problem 31 B

#### Instructions and Corresponding Questions and Answers

We have a certain number of objects, M, a part 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 a G and vice versa. Some of the C's also are R's and some others are T's. No R is a T and vice versa. How many G's are also T's?

Questions	Answers
1. Are there C's that are not B's and G's?	1. No.
2. How many B's are C's?	2. 30.
3. How many B's are M's?	3. 120.
4. How many C's are R's?	4. 35.
5. Are there more G's than B's among the M's?	5. Yes.
6. What is the value of k times the C's?	6. 550.
7. What is the total number of C's?	7. 50.
8. How many B's that are C's are also T's?	8. 10.
9. How many G's that are C's are also R's?	9. 15.
10. What is the value of k?	10. 11.

Solution: 5 G's.

## APPENDIX VII

### Problem 35 A

#### Instructions and Corresponding Questions and Answers

A college choral group is composed of freshmen, sophomores, and juniors. The chorus has three voices or parts which are high, medium, and low. The questions and answers below give vital information concerning the group. From these facts you are to find the number of juniors singing the middle or medium part.

Questions	Answers
1. How many juniors are in this college?	1. 1567.
2. How many freshmen are in the chorus?	2. 23.
3. How many sophomores are in the middle voice?	3. 10.
4. How many chorus members are there?	4. 76.
5. How many girls are in the chorus?	5. 45.
6. How many sophomores are in the chorus?	6. 28.
7. How many juniors sing the high voice?	7. 7
8. How many freshmen are in this college?	8. 1848.
9. How many freshmen sing the high voice?	9. 8.
10. How many low voice members are there?	10. 28.
11. How many sophomores sing the high part?	11. 9.

- |  |         |
|--|---------|
| 12. How many pianos does the chorus have?          | 12. 3.  |
| 13. How many freshmen sing the low part?           | 13. 9.  |
| 14. How many chorus members sing the high voice?   | 14. 24. |
| 15. How many juniors are in the low voice section? | 15. 10. |
| 16. How many freshmen sing the middle voice?       | 16. 6.  |
| 17. How many sophomores sing the low part?         | 17. 9.  |

Solution: 8 juniors

## APPENDIX VIII

### Problem 35 B

#### Instructions and Corresponding Questions and Answers

T objects are composed of M, N, and P types. Each of these latter three types may or may not also be Q's, R's and S's. From the questions and answers you can discover the various relationships of these objects. Make use of this available information to determine how many T objects are N's and also S's.

Questions	Answers
1. How many S's are A's?	1. 350.
2. How many Q's are there among the T's?	2. 19.
3. How many G's are there among the T's?	3. 43.
4. How many R's are also N's?	4. 8.
5. What is the total number of T objects?	5. 63.
6. How many P's are there among the T's?	6. 21.
7. How many R's are there among the T's?	7. 24.
8. How many Q's are also M's?	8. 5.
9. How many R's are also M's?	9. 10.
10. How many S's are also M's?	10. 2.
11. How many Q's are A's?	11. 400.



- |                                     |         |
|-------------------------------------|---------|
| 12. How many R's are also P's?      | 12. 6.  |
| 13. How many Q's are also N's?      | 13. 3.  |
| 14. How many S's are also P's?      | 14. 4.  |
| 15. How many M's are among the T's? | 15. 17. |
| 16. How many Q's are also P's?      | 16. 11. |
| 17. How many N's among the A's?     | 17. 2.  |

Solution: 14 T objects are N's and also S's.

## APPENDIX IX

### Problem 40

#### Instructions and Corresponding Questions and Answers

This figure is composed of 20 areas. One of the areas has been selected. Your task is to discover the selected area. You may discover this area by using any of the questions you like to arrive at the answer.

Proceed by reading over all the questions. Decide the first question you would like to have answered and write its number on the page provided. Then, read the answer on the back of the card. After having read the answer, decide on the next question you would like to have answered. Write down its number and read the answer. When you are satisfied that you have arrived at the answer, stop asking questions, and write down your answer. Remember, you may ask as many questions as you need to find the correct area, but do not ask more questions than you need.

Questions	Answers
1. Is the value of the area divisible by 10?	1. No.
2. Is the value of the area divisible by 2?	2. No.
3. Is the value of the area divisible by both 2 and 3?	3. No.

- |  |         |
|--|---------|
| 4. Is the value of the area divisible by 4?            | 4. No.  |
| 5. Is the value of the area divisible by 9?            | 5. No.  |
| 6. Is the value of the area divisible by both 2 and 4? | 6. No.  |
| 7. Is the value of the area divisible by 3?            | 7. No.  |
| 8. Is the value of the area divisible by 6?            | 8. No.  |
| 9. Is the value of the area divisible by 5?            | 9. No.  |
| 10. Is the value of the area divisible by 7?           | 10. No. |

Solution: 11

## Problem 40

20	9	4	35
25	2	55	6
8	21	10	39
33	11	27	12
16	14	18	5

## APPENDIX X

### Problem 42

#### Instructions and Corresponding Questions and Answers

This figure is composed of 24 areas. The numbers in the areas are merely for the purpose of identifying a particular area and have no bearing on the solutions of the problem whatsoever.

One of the areas has been selected. Your task is to discover the selected area. You may discover this area by using any of the questions you like to arrive at the answer.

Proceed by reading over all the questions. Decide the first question you would like to have answered and write its number on the page provided. Then, read the answer on the back of the card. After having read the answer, decide on the next questions you would like to have answered. Write down its number and read the answer. When you are satisfied that you have arrived at the answer, stop asking questions, and write down your answer. Remember, you may ask as many questions as you need to find the correct area, but do not ask more questions than you need.

Questions	Answers
1. Is it above the unbroken curve line?	1. No.
2. Does it have 2 curved lines as borders?	2. No.

- |  |         |
|--|---------|
| 3. Is it to the right of the vertical curve line?  | 3. Yes. |
| 4. Does it have 2 continuous straight lines and 2 broken lines as borders?                     | 4. No.  |
| 5. Does it have 2 broken straight line borders?  | 5. No.  |
| 6. Does it have any combinations of 2 broken and 2 curved sides?                               | 6. No.  |
| 7. Is it below the dotted curve line?  | 7. No.  |
| 8. Does it have 3 continuous straight lines and 1 broken straight line as borders?             | 8. No.  |
| 9. Does it have a broken curved line as a border?  | 9. No.  |
| 10. Does it have at least 1 continuous straight line and 2 continuous curved lines as borders? | 10. No. |

Solutions: 23

## Problem 42

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24

APPROVAL SHEET

The dissertation submitted by Sister Mary Austin Doherty, OSF has been read and approved by the director of the dissertation. Furthermore, the final copies have been examined by the director 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.

July 9, 1968  
Date

Ronald E. Walker  
Signature of Adviser