

**EXTENT OF PSYCHOLOGICAL DIFFERENTIATION
AS RELATED TO INTELLIGENCE**

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CURRICULUM STUDIORUM

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INTRODUCTION

A tremendous amount of data relating the perceptual dimension of field independence-dependence to a number of personality correlates have been amassed by Witkin and his colleagues in the past two decades. On the basis of their findings they have suggested that the self-consistent and stable nature of this dimension reflects a more general aspect of personal functioning, that of psychological differentiation. Thus, the degree of field dependency or independency was considered to reflect extent of differentiation.

The perceptual dimension of field independence-dependence involves the ability of a person to perceive objects in his surroundings independently of the sometimes misleading or confusing influence of the surroundings. This ability, in turn, has been defined as analytic ability.

One of the parameters of psychological differentiation is intelligence, which has been consistently shown to correlate positively with field independency. However, the reasons why this relationship exists have been hotly contested. Witkin's position is that this relationship is "carried" by the common denominator, analytic ability. Others have suggested that this relationship reflects one more facet of general intelligence.

This study will be concerned with the clarification of this issue. On the basis of research findings it is proposed that by utilizing factor analyzed intelligence tests, it would offer a promising method in which to investigate the kind of relationship that exists between extent of differentiation and intelligence.

Toward this end, this study is presented in the following order. The first chapter is divided into five sections. The first section deals with the construct of field dependence, its origin, tests, and personality correlates. In the second section, the psychological differentiation hypothesis is discussed, particularly in connection with Werner's theoretical position. The third section reports the studies that are critical of Witkin's Differentiation Hypothesis. Also included in this section are studies supporting Witkin's position. In the fourth section, studies relating psychological differentiation and intelligence are reported, which sets the background for the final section in which Guilford's tests from his model of intelligence are discussed and the research problem is proposed.

Chapter two will present the research design utilized to test the hypotheses, followed by a discussion of the psychometric instruments, subjects, procedures, and the statistical techniques utilized to analyze the data.

Chapter three will present and discuss the results of this study to be followed by a summary and conclusion section. Finally, the appendix will present an abstract of the present study.

CHAPTER I

REVIEW OF THE LITERATURE

The formulation of psychological differentiation as an explanatory construct has encouraged a great deal of research relating extent of differentiation with any number of psychological functions. The relationship between extent of differentiation as reflected by field dependence-independence and intelligence has been the object of many studies. To orient the reader to the research in this area, the relevant studies in the literature have been organized in the following manner: The first section reports the perceptual studies as related to the dimension of field dependence-independence, including a description of the perceptual tasks used. In the second section the development of the principle of psychological differentiation as generated by mode of field approach is discussed, particularly as it follows Werner's orthogenic theory. The third section is devoted to criticisms of the use of psychological differentiation as an explanatory construct. In the fourth section, studies pertaining to the relationship between extent of differentiation and intelligence are reported and discussed. The final section presents Guilford's model of intelligence, tests, and studies relating Guilford's work with field dependence-independence. Finally, the research problem is proposed.

1. Perceptual Differentiation and Field Approach.

Witkin's earlier works with Asch^{1,2,3,4} dealing with the perceptual problem of locus of spatial orientation were the beginnings in the eventual formulation of the psychological differentiation hypothesis. At that time he was concerned with whether an individual perceived the upright in space primarily through postural factors or by environmental cues in the surrounding perceptual field. Aside from the experimental problem, the ingenious method by which the solution of the problem was attempted led to the observation that the way people differed in orienting themselves in space was self-consistent and stable. This observation in the

1 S.E. Asch and H.A. Witkin, "Studies in Space Orientation: I. Perception of the Upright with Displaced Visual Fields," in Journal of Experimental Psychology, Vol. 38, No. 3, 1948, p. 325-337.

2 -----, "Studies in Space Orientation: II. Perception of the Upright with Displaced Visual Fields and with Body Tilted," in Journal of Experimental Psychology, Vol. 38, No. 4, 1948, p. 455-477.

3 H.A. Witkin and S.E. Asch, "Studies in Space Orientation: III. Perception of the Upright in the Absence of a Visual Field," in Journal of Experimental Psychology, Vol. 38, No. 5, 1948, p. 603-614.

4 -----, "Studies in Space Orientation: IV. Further Experiments in Perception of the Upright with Displaced Visual Fields," in Journal of Experimental Psychology, Vol. 38, No. 6, 1948, p. 762-782.

course of research^{5,6} was of dramatic importance to Witkin and co-workers. It became clear to them that:

[...] the way in which a person orients himself in space is an expression of a more general preferred mode of perceiving which, in turn, is linked to a broad and varied array of personal characteristics involving a great many areas of psychological functioning.⁷

The spatial orientation of a person in Witkin's perceptual tasks is reflected in a person's performance on the following tests: the Red and Frame Test (RFT);⁸ the Tilting room-tilting-chair Tests (TRTC),⁹ which are administered in two parts; the Room-Adjustment Test (RAT); and the Body Adjustment Test (BAT). One other test, the Embedded-Figures Test (EFT),¹⁰ although it does not involve spatial orientation as such, was utilized because of the similarity of ability required for this test and the other tests in the battery.

5 H.A. Witkin, "The Nature and Importance of Individual Differences in Perception," in Journal of Personality, Vol. 16, No. 2, 1949, p. 145-170.

6 -----, "Individual Differences in Cases of Perception of Embedded Figures," in Journal of Personality, Vol. 19, No. 1, 1950, p. 1-15.

7 H.A. Witkin, R.B. Dyk, H.F. Paterson, D.R. Goodenough and S.A. Karp, Psychological Differentiation, New York, Wiley, 1962, xii-418 p.

8 Ibid., p. 36-37.

9 Ibid., p. 37-39.

10 Ibid., p. 39-40.

In the RFT, the subject is seated in a completely darkened room facing a luminous rod surrounded by a luminous-edged frame. The rod, frame, and chair can be independently tilted from side to side. Three series of eight trials each make up the standard administration. In the first series the subject is tilted to one side while the frame is tilted to the same side. The task of the subject is to instruct the examiner to adjust the rod to the true upright. The rod is at times tilted on the same side as the frame, at other times to the opposite side. In the second series the body and frame are tilted to opposite sides. In the final series the body is maintained in an upright position while the frame and rod are tilted as indicated in the first series. The ability or inability to differentiate the tilt of the rod from the influence of the surrounding field is considered to be a stable part of the subject's approach to perceptual orientation and differentiation problems.

The TRTC tests are involved in evaluating a person's perception of the position of his body and of the surrounding field in relation to the upright. The apparatus consists of a box-shaped room which is suspended on ball-bearing pivots so that it can be tilted to either left or right by any number of degrees. Inside the room is a chair for the subject which also can be tilted to left or right and independently of the room. The subject is required to adjust himself to the true

upright. Thus, if the subject tilts himself far in the direction of the tilt of the room in order to perceive himself as upright, he is considered to make his judgment in terms of his apparent relationship to the field. On the other hand, a subject who is able to resist the influence of his surrounding field is considered to be more sensitive to bodily sensations.

The RAT part of the standard procedure consists of eight trials, four of which involve the initial administration of room and chair tilted to opposite sides, while in the other four trials the room and chair are tilted to the same side. On each trial the subject instructs the examiner to tilt the room until he is satisfied that the room is perceived as upright.

The BAT part consists of six trials, again half of the trials with room and chair initially tilted to the same side, and in the other half, with room and chair tilted to opposite sides. On each trial the subject's task is to direct the adjustment of the tilt of his chair to a position which he perceives as being upright.

Finally, the EFT requires the ability to find a particular simple figure within a larger complex figure. The figures selected were from those developed by Gottschaldt in 1926. The test incorporates the perceptual technique of "hiding" the simple figure into the pattern of the larger

figure by having overlapping outlines which form boundaries of several subpatterns in the complex figure.

As can be seen from the description of the tests, all require the subject to perceptually differentiate an item, whether it be a rod, a figure, or body in space, from the influence of the field. The ability or inability to do so is considered by Witkin to reflect a mode of field approach, or the dimension of field dependency-independency. The self-consistent performances of subjects on these tests were considered to support their contention that the dimension of field dependence-independence is a reflection of a stable aspect of an individual's perceptual process.¹¹ In other words, a field dependent person who experiences difficulty on the RFT would be expected to encounter similar difficulties in locating an embedded figure and in overcoming the influence of a tilted room.¹² On the other hand, a field independent subject with the ability to overcome the influence of the frame in the RFT is also expected to more quickly locate the embedded figure in the EFT and to estimate more closely the vertical position of his body in space.¹³ Thus,

11 M.A. Witkin, H.B. Lewis, M. Hertzman, K. Machover, P.B. Meissner and S. Wapner, Personality through Perception, New York, Harper, 1954, p. 61-76.

12 Witkin, et al., Op. Cit., 1962, p. 22.

13 Witkin, et al., Op. Cit., 1954, p. 61-67.

it is this dimension which reflects an individual's mode of field approach that has served as a key to what has been previously mentioned as the link between perceptual style and a varied array of personal characteristics and psychological functioning.

Because of what is observed as a consistent and stable attribute of a person's perceptual style, Witkin and co-workers considered the study of field dependence-independence as a way to obtain further information about an individual. Utilizing the information from clinical interviews, psychodiagnostic tests, along with the results from the perceptual tests, in a number of correlational designed studies, Witkin and his associates were able to identify a number of personality correlates of the field dependence-independence dimension. The subjects involved in these studies were also available for longitudinal observations which added a developmental view of the mode of field approach. The psychodiagnostic techniques utilized included observer's ratings, Rorschach, Thematic Apperception Test, Stanford-Binet, etc.

Some of the personality characteristics attributable to the field dependent end of the dimension are: a less well developed notion of self esteem and body image; more sensitivity or attentiveness to social contacts; maintenance of attitudes that are popular; and more apt to change stated

views on social issues in the direction of the attitudes of an authority. On the other hand, the field independent end of the dimension is frequently associated with characteristics in direct contrast to many of these attributes.¹⁴

Although many of the personality characteristics were far removed from the perception-personality linkage, Witkin et al. insisted that their findings were anchored to the observations they had initially made of how people perceive. The following is an example of this linking process: A field dependent performance on the BAT suggested the possibility of a poorly developed body concept while a field independent performance on the same test reflected, at least on the surface, a relatively well-developed conception of the body. This kind of postulating was rewarding in later studies which revealed differences in body concept among children and adults with different modes of perceiving.¹⁵ Furthermore, the evidence suggesting the ability to experience the body as a discrete entity also tended to reflect a distinct sense of self. Thus, people with a relatively independent way of perceiving have a more developed sense of their identity and of their separateness from others. A self which is less segregated from the field or

¹⁴ Witkin, et al., Op. Cit., 1962, p. 2-3.

¹⁵ Ibid., p. 5.

loses itself in the field in experience is characteristic of people who tend to experience the body or for that matter, any object as being fused with its surroundings.¹⁶

2. Psychological Differentiation Hypothesis.

Longitudinal and cross sectional observations of field dependence-independence led Witkin and his co-workers to consider the developmental aspects of this dimension.¹⁷ A field dependent way of perceiving was observed to be more common with immaturity while a field independent way was associated with a higher level of development. Thus, children tended to function in a field dependent manner, that is, in a global or undifferentiated way. With age and within the limits of their own developmental framework they tend to function more field independently. This is understandable in view of the developmental parallel in general personality characteristics. For example, a child's self concept is initially undifferentiated and lacking in decisiveness of nearly all areas of functioning. Then, as the child matures, he is more able to distinguish self from others, objects from other objects, time from other time, etc.

¹⁶ Witkin, et al., Op. Cit., 1962, p. 134-156.

¹⁷ Witkin, et al., Op. Cit., 1954, p. 120-152.

In view of the parallel development of perceptual style to general personality growth, this linkage was now considered to reflect a more complex and encompassing aspect of personality functioning. It is at this point in Witkin's work that the theoretical formulation of differentiation became evident. The dimension of field dependence-independence was now thought to indicate the extent of differentiation.¹⁸ The concept of differentiation is, of course, not original with Witkin, but seemed to Witkin and his colleagues to offer a feasible theoretical basis for their research findings. The theoretical work of Werner (orthogenic theory)¹⁹ offered the desired framework.

Werner, in describing the orthogenic principle of differentiation, states, "[...] an increasing differentiation and refinement of mental phenomena and functions and a progressive hierarchization may be accepted as a basic principle."²⁰ This development of differentiation is considered to proceed from a relatively diffuse or global or undifferentiated state toward more differentiation and hierarchic integration. Furthermore, Werner considers both

¹⁸ Witkin, et al., Op. Cit., 1962, p. 9.

¹⁹ H. Werner, Comparative Psychology of Mental Development, New York, Science Editions, 1948, xii-564 p.

²⁰ Ibid., p. 51.

an external and internal aspect to differentiation.²¹ For example, the primitive or "yet to develop" personality structure is more homogeneous, more globally determined, similar to Levin's concept of the inner-personal region of an undifferentiated person.²² The external aspects have to do with the extent of differentiation between self and other, which is reflected in the global and undifferentiated perceptual processes. In other words, the undifferentiated individual is diffuse and global both in his inner psychological structure and in his functioning. Consequently, he would be expected to experience difficulty in perceiving an object out of context of its surroundings or to have a definitive concept of himself.

Witkin and his colleagues have followed the principle of Werner's orthogenic theory when they defined differentiation as:

[...] the complexity of a system's structure. A less differentiated system is in a relatively homogeneous structural state; a more differentiated system in a relatively heterogeneous state.²³

21 Werner, Op. Cit., p. 40.

22 C.S. Hall and G. Lindzey, "Levin's Field Theory" in Theories of Personality, New York, John Wiley and Sons, Inc., 1957, p. 212-213.

23 Witkin, et al., Op. Cit., 1962, p. 9.

In terms of the system's functioning, Witkin et al. again followed the theoretical work of Werner and Lewin:

Among the major characteristics of the functioning of a highly differentiated system is specialization. The subsystems which are present within the general system are capable of mediating specific functions which, in a relatively undifferentiated state, are not possible or are performed in a more rudimentary way by the system as a whole.

When used to describe an individual's psychological system specialization means a degree of separation of psychological areas, as feeling from perceiving, thinking from acting. It means as well specificity in manner of functioning within an area. Specific reactions are apt to occur in response to specific stimuli as opposed to diffuse reaction to any variety of stimuli. Parts of a perceptual field are experienced as discrete, rather than fused with their background. Impulses are channelized, contrasting with the easy 'spilling over' characteristic of the relatively undifferentiated state. More or less discrete feelings and needs are likely to be present.

[...] With respect to relation with the surrounding field, a high level of differentiation implies clear separation of what is identified as belonging to the self and what is identified as external to the self. The self is experienced as having definite limits or boundaries. Segregation of the self helps make possible greater determination of functioning from within, as opposed to a more or less enforced reliance on external nurturance and support for maintenance, typical of the relatively undifferentiated state.²⁴

It can be seen that Witkin's perceptual measures, in effect, operationally define the extent to which a person is differentiated. The relatively undifferentiated person would tend to be field dependent in his perceptual performance while the more differentiated person is expected to perform in a field independent manner. In other words,

²⁴ Witkin, et al., Op. Cit., 1962, p. 9-10.

a subject who is more differentiated relies less on the external environment for support and maintenance, for example, as reflected in the ability to separate rod from frame.

3. Criticisms of Witkin's Psychological Differentiation Hypothesis.

Perhaps the major attack on Witkin's use of the concept of differentiation is in its broad implications. The term, psychological differentiation, seems to imply that differentiation occurs in all psychological areas. In his review of Witkin et al.'s latest book, Gardner stated: "The term, 'psychological differentiation' seems to imply more generality than is warranted even by the notable consistencies described."²⁵ Gardner's criticism was prompted by studies which indicated that verbal and some problem-solving skills obviously requiring a high level of differentiation were not found to relate to Witkin's measures of differentiation. Zigler²⁶ suggested that Witkin's concept of differentiation was driven to a point no longer tenable. Zimiles' review was critical in the same vein when he

²⁵ R.W. Gardner, "Book Reviews," in The American Journal of Psychology, Vol. 76, No. 4, 1963, p. 709-711.

²⁶ E. Zigler, "Zigler Stands Firm," in Contemporary Psychology, Vol. 8, No. 11, 1963, p. 459-461.

stated a preference for the term field dependence to differentiation as an explanatory construct.²⁷

Witkin, however, was not unaware of this problem when he stated:

Though numerous questions are left unanswered by the findings reported, the evidence does indicate that the development of at least some kinds of verbal skills may follow a different pathway than the development of mode of field approach and other characteristics of developed differentiation.²⁸

The development of verbal skills in relatively undifferentiated children was thought to be the result of several possibilities:

Children whose limited self-differentiation and poorly developed capacity for control and direction of energy make the handling of many ordinary life situations difficult may substitute 'talking about' for active coping with situations.

.....
 Another possible reason for particular investment in some kinds of verbal skills on the part of individual children with a global field approach may lie in their greater need for guidance and support from others. Verbal communication serves to elicit suggestions and directions from other persons.²⁹

²⁷ H.L. Zimiles, "The Problem of Individuality in Systematic Research," in Merrill-Palmer Quarterly, Vol. 10, 1964, p. 375-383.

²⁸ Witkin, et al., Op. Cit., 1962, p. 198.

²⁹ Ibid., p. 199-200.

Another possibility was suggested by the results of a study by Haggard.³⁰ In this study three subgroups were identified within a larger pool of school children who were all considered to be of superior intelligence with over-all high academic achievement. The three subgroups were made up of high achievers in spelling and language, reading, and arithmetic. The children who achieved highest in language and spelling were measured on a personality study as dependent on outside sources for direction of their thoughts and actions, marked passiveness, and reliance on conformity and social techniques to gain acceptance. Haggard considered these characteristics to parallel these children's interest in language and spelling in that these skills require the obedient following of rules, primarily learned by rote. Commenting on Haggard's study Witkin stated:

The results of this study by Haggard suggest that particular proficiency in spelling and language of some children with a global field approach may reflect their preference for tasks requiring obedient rote learning and application of mechanical rules toward which their need for external guidance directs them.³¹

Other criticisms levied at Witkin and his associates primarily have to do with Witkin's efforts to link

³⁰ E.A. Haggard, "Socialization, Personality and Academic Achievement in Gifted Children," in School Review, Vol. 65, No. 4, 1957, p. 388-414, as cited by Witkin, et al., Op. Cit., 1962, p. 200-201.

³¹ Witkin, et al., Op. Cit., 1962, p. 201.

personality and perception through a uni-dimensional measure. For example, Gruen³² severely criticized Witkin and his group for the perception-personality relationship as being naive. He claimed that a few isolated personality traits do not warrant such a broad assumption. He deplored the grouping of a wide variety of behavior along one continuum. With respect to body orientation Gruen complained:

This method of reporting very likely conceals the possibility that the body can be used in many different ways by the same as well as different individuals in these situations.³³

Other critics^{34,35} have voiced complaints about the possibility of biased effect, particularly in Witkin et al.'s earlier work, in the perception-personality relationship in that the experimenter's prior knowledge of the subject's field dependence score may have contaminated the results.

As with any theoretical schema, the criticisms, although pertinent, seem to be a healthy sign of a theory

³² A. Gruen, "A Critique and Re-evaluation of Witkin's Perception and Perception-Personality work," in Journal of General Psychology, Vol. 56, First Half, 1957, p. 73-93.

³³ Ibid., p. 85.

³⁴ W.H. Holtzman, "Review of E.A. Witkin, H.B. Lewis, M. Hertzman, A. Machover, P. Meissner and S. Wapner, "Personality through Perception," in American Journal of Psychology, Vol. 68, No. 3, 1955, p. 501-504.

³⁵ A. Anastasi, Differential Psychology, New York, MacMillan, 1950, p. 357.

building process. As pointed out in Hellkamp's thesis:

Since experimental research directly concerned with the problem of psychological differentiation has been rather sparse until the entrance of Witkin et al.'s work, it would appear that we might be throwing out the baby with the bath water if the 'abandon hypothesis' [Zigler's contention that Witkin's use of differentiation was carried to a point no longer tenable.] was accepted at this time.³⁶

The heuristic value of the psychological differentiation principle is a matter of fact. It is a known axiom in psychology that theory should beget more theories through more research. Too, Witkin and his colleagues have amassed considerable data to support their uni-dimensional approach to the study of psychological functioning. Therefore, for the purposes of this study, the dimension of field dependence-independence is assumed to reflect extent of psychological differentiation.

4. Psychological Differentiation and Intelligence.

In Hellkamp's review of the literature, he refers to three parameters of field dependence³⁷ as a way of grouping studies dealing with (a) the relationship of field approach to intellectual functioning, (b) sex differences and

³⁶ D. Hellkamp, "Extent of Psychological Differentiation Among Hospitalized Male Schizophrenics Classified Along the Process-Reactive and Delusional-Hallucinatory Dimensions," unpublished doctoral dissertation, University of Ottawa, Ontario, 1967, p. 25-26.

³⁷ Ibid., p. 8-20.

field approach, and (c) the stability of field approach. Of primary concern in this study is the relationship between field approach and intellectual functioning. With regard to the other two parameters Hellkamp's review indicated generally consistent findings.

In the sex difference and field approach relationship nearly all studies cited found consistent differences between males and females with males more field independent than females. Two studies were cited^{38,39} that suggested no significant sex differences in field approach before the age of eight which, incidentally, also lends support to the developmental aspect of differentiation. Another article mentioned indicated that sex differences in field approach disappear in geriatric groups.⁴⁰ Seemingly, the age group which falls between the "very young" and the "very old" perform in predictable fashion with males more field independent than females. One notable exception is

³⁸ C.H. Crudden, "Form Abstraction by Children," in Journal of Genetic Psychology, Vol. 58, 1941, p. 113-129, as cited in Hellkamp, Op. Cit., p. 12.

³⁹ D.R. Goodenough and C.J. Eagle, "A Modification of the Embedded-Figures Test for Use with Young Children," in Journal of Genetic Psychology, as cited in Witkin, et al. Op. Cit., 1962, p. 215.

⁴⁰ S.A. Karp, "Field Dependence and Aging," in Research Reports, Sinai Hospital of Baltimore, Vol. 1, 1966, p. 1-9, as cited in Hellkamp, Op. Cit., p. 12.

Goldstein's study.⁴¹ When exposed to an extended series (sixty-eight trials) of the EFT, the initial sex-related mean difference was reduced to about zero.

With regard to the stability of field approach, Hellkamp, in his investigation of the literature, found support for Witkin's stand that the mode of field approach is a stable phenomenon. In a summary of the studies made in this subject area Hellkamp⁴² found that the following variables did not have any significant effect on the mode of field approach: psychotherapy, marriage or divorce, drugs, stress situations (heart surgery, sensory isolation) and special training (in the long run). The variables that have been found to have significant effect on field dependence performance are: sex, electro-convulsive treatment, brain injury, alcoholism, and direct experimental distraction during the test itself. The results overwhelmingly suggest that the field approach dimension is a stable and pervasive part of a person's perceptual process. Also, coefficients of stability reported in longitudinal and cross-sectional studies for the perceptual measures are impressively high (.66 to .88) particularly in view

⁴¹ Alvin G. Goldstein and June E. Chance, "Effects of Practice on Sex-related Differences in Performance on Embedded Figures," in Psychonomic Science, Vol. 3, No. 8, 1965, p. 361-362.

⁴² Hellkamp, Op. Cit., p. 20.

of the time lapse between initial testing and retesting (one to three years).⁴³

Wolf,⁴⁴ however, in investigating the stability of perceptual style, questioned Witkin's previous studies of the effects of stress, drugs, and alcohol on the field dependence measures. He considered the possibility that although alcohol and drugs do produce disorientation, they may also produce a lessened awareness or a desensitization to the potency of environmental cues. Following this line of thought he presumed the stressful experience must be one that involves immediate internal disruption and be of such a character that the operation of intervening cognitive mechanisms for resolving the disruption is minimal. In order to satisfy this requirement he required his test subjects to be rotated at a rate that resulted in temporary disruption, but without an appreciable loss of sensitivity to environmental cues. The subjects were assigned to one of three groups: (a) immediate test group (RFT administered immediately after rotation), (b) delay test group (RFT administered ten minutes after rotation), and (c) control group (RFT re-administered after fifteen minutes' delay).

⁴³ Witkin, et al., Op. Cit., 1962, p. 370.

⁴⁴ Abraham Wolf, "Body Rotation and Stability of Field Dependency," in Journal of Psychology, Vol. 59, No. 1, 1965, p. 211-217.

In group (a) the decrease in field dependency was only slightly more than the control group, while group (b) showed no appreciable change. In no case was there a mean increase of field dependency. The results of this study may raise some questions regarding the disrupting influence of certain drugs or alcohol. However, the results in the final analysis lend further support to Witkin's contention that mode of field approach is a stable part of an individual's functioning.

Studies dealing with the field approach-intelligence relationship have quite consistently resulted in a significantly positive relationship between field independence and standard intelligence tests. In fact, this kind of relationship was anticipated in Witkin et al.'s earlier book in which they state:

It is likely--and this is of course subject to experimental test--that if a person has this basic ability to 'break up' a configuration it will be manifested not only in straightforward perceptual situations, but in problem-solving situations as well.⁴⁵

The evidence at that time primarily came from Woerner and Levine's work⁴⁶ in Witkin's laboratory with a small group

⁴⁵ Witkin, et al., Op. Cit., 1954, p. 477.

⁴⁶ Margaret Woerner and T. Levine, "A Preliminary Study of the Relation between Perception and Thinking in Children," unpublished study, 1950, cited in Witkin, et al., Op. Cit., 1962, p. 59-60.

of twelve year old children. They found a significant relationship between Witkin's perceptual tests and scores on the Wachler Intelligence Scale for Children (WISC). The results suggested the possibility that field independence may be associated with superior intelligence. However, on closer inspection of the results, the perceptual measures were found to relate more highly with the performance section of the WISC and particularly on such subtests as Block Design. This raised a further possibility, that the relationship between the perceptual measures and total I.Q. may be influenced by an ability common to both. From another perspective, Witkin et al. also noted that in contrast to field dependent youngsters, field independent children appeared to have "[...] more penetrating awareness of people and situations, more developed interests, and more crystallized views of the future."⁴⁷ This difference was thought to reflect qualitative differences in intellect.

From these beginnings a number of follow-up studies were made to test the perception-intelligence hypothesis. One such study⁴⁸ was initiated to find further evidence for the relationship between field independence and intelligence. The 1937 Revised Stanford-Binet (Form I) was administered to

⁴⁷ Witkin, et al., Op. Cit., 1962, p. 60.

⁴⁸ Ibid.

forty-eight 10 year olds (24 of each sex) which resulted in further support of Woerner and Levine's work with the WISC. The correlation coefficient for boys was .57, $P < .01$ and for girls, .76, $P < .01$. Test item analysis was made on an inspection basis only since all subjects did not work on the same test items. A number of other studies conducted in this area since has been cited by Witkin et al. which showed significant relationships between field independence and performance on standard tests of intelligence.

To investigate the basis of the relationship between mode of field approach and intellectual functioning Goodenough and Karp⁴⁹ factor analyzed a test battery which included the RFT, EFT, RAT, and WISC administered to a group of ten and twelve year old children. Three factors emerged from their analysis: (1) Verbal-Comprehension factor as defined by the Vocabulary, Information and Comprehension subtests, (2) Attention-Concentration factor as defined by the Digit Span, Arithmetic and Coding subtests, and (3) "Analytical Field Approach" factor as defined by the Block Design, Picture Completion, and Object Assembly subtests. The three perceptual tests loaded highest on this last factor. Correlations between perceptual index scores and

⁴⁹ D.R. Goodenough and S.A. Karp, "Field Dependence and Intellectual Functioning," in Journal of Abnormal and Social Psychology, Vol. 63, No. 2, 1961, p. 241-246.

the three factors were .26 (not significant), .16 (not significant), and .66 ($P < .01$) respectively. The analysis of the specific subtests suggested to the researchers that Block Design, Picture Completion, and Object Assembly all required the ability to overcome an embedding context.

The reasoning in the Picture Completion subtest is that the item missing from each picture necessitates the test subject to neglect or disregard the organization and instead give his attention successively to one part at a time. The Block Design subtest requires the subject to "break up" the reference design into component blocks which, then, can be used to reproduce the design. In the Object Assembly subtest the subject is required to assemble parts of a known or imagined whole which seems somewhat similar to the Block Design in its requirements.

A later factor analytic study by Karp⁵⁰ added further evidence for this kind of relationship between perceptual and intellectual functioning. The subjects in this study were 150 male college students who took the EAT, RFT (series 3 only), EFT (short form), six subtests of the Wechsler Adult Intelligence Scale (WAIS), along with a modified version of a seventh subtest (Digit Symbol). The

⁵⁰ S.A. Karp, "Overcoming Embeddedness in Perceptual and Intellectual Functioning," unpublished study, 1962, cited in Witkin, et al., Op. Cit., 1962, p. 70-71.

six subtests were Block Design, Object Assembly, Vocabulary, Comprehension, Arithmetic, and Digit Span. Three factors emerged again with the loading corresponding very closely to the previous study described above.

In still another study, Davies⁵¹ found the ability to adjust the rod to the vertical was related to a nonverbal intelligence test (Raven's Progressive Matrices). This test is essentially a perceptual test which required the subject to choose a form and color pattern from several to match the blank space in the reference design. At least on the surface it seems to require a similar kind of ability defined by Witkin's perceptual measures.

Witkin et al. adopted the term "analytical field approach" as representing a style of functioning in both the perceptual and intellectual processes of an individual.⁵² It involves the ready ability to overcome an embedding context and to experience items as discrete from their backgrounds. On the other hand, the term "global field approach" is used to describe the style of functioning that involves submission to the organization of the field and the tendency to experience difficulty in isolating items out of context

⁵¹ Ann D.M. Davies and G.W.H. Leytham, "Perception of Verticality in Adult Life," in British Journal of Psychology, Vol. 55, No. 3, 1964, p. 315-330.

⁵² Witkin, et al., Op. Cit., 1962, p. 6.

from their backgrounds. Field dependence independence represents the perceptual aspects of the analytical field and global field approaches.

In summary, Witkin et al. state:

The significant relation frequently reported between measures of field dependence and total standard intelligence test scores is 'carried' largely by those portions of intelligence tests which require analytical functioning. In other words, the relation is based on the expression of a particular style of field approach in both.⁵³

However, this explanation of the relationship between intellectual and perceptual functioning has been severely criticized by others. Zigler,^{54,55} for one, hotly contested Witkin and his group in two articles, the first one a critical review of their most recent book. On the strength of Cohen's factor analytic study⁵⁶ on the WISC Zigler states:

⁵³ Witkin, et al., Op. Cit., 1962, p. 80.

⁵⁴ E. Zigler, "Zigler Stands Firm," in Contemporary Psychology, Vol. 8, No. 11, 1963, p. 459-461.

⁵⁵ -----, "A Measure in Search of a Theory," in Contemporary Psychology, Vol. 8, No. 4, 1963, p. 133-135.

⁵⁶ J. Cohen, "The Factorial Structure of the WISC at Ages 7-6, 10-6, and 13-6," in Journal of Consulting Psychology, Vol. 23, No. 4, 1959, p. 285-299.

[...] the empirical relationships found between field-dependence measures and many of the scores employed by Witkin are due to the common relationship between all these scores and general intelligence as defined by standard intelligence tests. Such a view is supported by the relationship repeatedly found between field-dependence measures and full scale intelligence quotients. Many of the TAT, Rorschach, figure drawing, and behavioral measures found to be related to the field-dependence scores are obviously related to general intelligence and in some instances have been employed by others as tests of general intelligence.⁵⁷

Witkin's use of projective techniques may be worthy of note with respect to the intelligence issue. The following comments were made by Witkin and his colleagues regarding the subject's approach to the Rorschach:

Is he able to respond differentially to the succession of stimuli presented to him, or do they tend to 'look alike' and to fuse with one another? Is his 'hold' on his percepts sufficiently secure so that, in the inquiry, he can recall and specify what he saw? Or are his percepts unstable, so that he forgets what he has seen? Is he able to impose an organization eliminating or otherwise actively handling distracting aspects of the stimulus material that do not fit in with his percept? Or does he become confused allowing distracting aspects of the material to interfere with his thought process?⁵⁸

Trites⁵⁹ correctly pointed out the underlying denominators of the above comments as being what most psychodiagnosticians

⁵⁷ Zigler, "A Measure in Search of a Theory," p. 134.

⁵⁸ Witkin, et al., Op. Cit., 1962, p. 62.

⁵⁹ R.L. Trites, "Perceptual Differentiation of the Field as Related to Differentiation of the Perceived Self," unpublished doctoral dissertation, University of Ottawa, Ontario, 1965, p. 9.

refer to as indication of general intelligence. No mention of this was made by Witkin.

To continue with Zigler's pertinent comments, he states:

Witkin attempts to negate the importance of this issue by demonstrating through factor analytic techniques that in his groups of boys the field-dependence measures are significantly related to certain subtests on the WISC (Block Design, Picture Completion, and Object Assembly) and not to others (Vocabulary, Information, and Comprehension). Witkin then combines the three subtests found to be correlated with his field-dependence measures into an 'intellectual index' and the three tests found not to be positively correlated into a 'verbal index'. [...] Not once does Witkin present the relationship between his many measures and his subjects' total intelligence scores.⁶⁰

Cohen, in the study previously cited, found that in ten year olds the three subtests comprising Witkin's intellectual index had correlations with "G" of .58, .42, and .43. The three subtests that made up the verbal index correlated with "G" .86, .79, and .74. Although the magnitude of relationship to "G" differs between the two indices, they both load significantly on "G".

In a somewhat similar view, a study of fifty grade school children (25 boys and 22 girls) from six years, 10 months, to twelve years, 5 months, old was conducted by

⁶⁰ Zigler, "A Measure in Search of a Theory," p. 135.

Crandall and Sinkeldan.⁶¹ Their evidence indicated that the major portion of the children's performances contributing to their WISC scores have very little to do with field dependence. Perceptual field dependence was found to associate with WISC verbal subtest scores as often as with the performance subtest scores. Moreover, their findings indicate field independence to be positively and significantly associated with competent performance on the Information, Comprehension, and Vocabulary subtests, none of which entails the analysis of figure-ground relationship.

Interestingly enough, Witkin's case history studies⁶² of the "prototypes" of highly differentiated and limitedly differentiated children seem to lend additional support for his critics. Of the five cases representing the highly differentiated, all the children were well within the superior end of the intellectual range. The following are their I.Q. scores:

Case 1.- Stanford-Binet (Form L), I.Q. 153

Case 2.- WISC, Full scale=138, Verbal scale=139, Performance scale=131. [In this case, although he obtained the highest score in his group in Picture Completion, Object Assembly, and Block Design, his verbal

61 Vaughn J. Crandall and Carol Sinkeldan, "Children's Dependent and Achievement Behaviours in Social Situations and Their Perceptual Field Dependence," in Journal of Personality, Vol. 32, No. 1, 1964, p. 1-22.

62 Witkin, et al., Op. Cit., 1962, p. 229-269.

index (Vocabulary, Comprehension, Information) was even higher.]

Case 3.-at age 14, Wechsler-Bellevue, Full scale=139, Verbal scale=147, Performance scale=123
at age 17, Full scale=144, Verbal scale=144, Performance scale=132

Case 4.-at age 13, WISC, Full scale=115, Verbal scale=106, Performance scale=122
at age 17, Full scale=121, Verbal scale=112, Performance scale=125

Case 5.-Stanford-Binet (Form L), I.Q. 120

On the other hand, the limitedly differentiated children obtained the following scores:

Case 6.-WISC, Full scale=100, Verbal scale=101, Performance scale=99 [This child has a history of poor achievement in school.]

Case 7.-WISC, Full scale=104, Verbal scale=104, Performance scale=103

Case 8.-WISC, Full scale=123, Verbal scale=140, Performance scale=99 [Although the authors did not state it, this child's scores along with the reported history of uneven development and temper outbursts suggest brain damage, in which case, a deficit in intellectual functioning may be underlying the limited extent of differentiation.]

In Hellkamp's study⁶³ it was reported that a significant relationship existed between the Vocabulary subtest of the WAIS and Witkin's perceptual measures. Correlations of .42 ($P < .01$) and .52 ($P < .01$) with the EFT and RFT, respectively, were obtained. The results appear to refute Witkin's contention that his "analytical ability" is not

63 Hellkamp, Op. Cit., p. 68-69.

reflected in other measures of intelligence, particularly verbal skills.

Guilford, in his recent book, indicates that Witkin's field dependence-independence score correlates with so many other variables that it gives the impression of being factorially complex.⁶⁴ The implication here is that Witkin may be premature in his factorial explanation of field dependency-independency. Guilford suggests that only a factor analysis of Witkin's perceptual tests along with appropriate marker tests of the likely intellectual abilities would clear up the mystery.

The controversy over the perception-intelligence issue seems to arise, at least in large measure, out of the use of intelligence tests which were not factorially constructed in the first place. This means that factor analytic techniques applied to these tests may result in overlapping loadings on an "overall" factor as in the case of "G" in the Wechsler tests. Guilford's comments on Wechsler seem pertinent:

⁶⁴ J.P. Guilford, The Nature of Human Intelligence, New York, McGraw-Hill Company, 1967, p. 130.

The point of interest here is the recognition of multiple aspect of this thing called 'intelligence'. Wechsler has been rather ambivalent on this point, however. On the one hand, he has recognized from the far-from-perfect correlations among tests the clearly indicated fact that something other than a monolithic unit is involved and that it pays to give attention to the added information that a more analytical scoring provides. On the other hand, when he selected tests for his battery, he favored tests that correlated better with the composite score, for such tests were regarded as better measures of intelligence. The psychometric facts of life, however, are such that if one wanted to emphasize differential information, one would aim at tests that correlate as low as possible with one another, which would mean that they would also correlate lower with the sum of all scores.⁶⁵

5. Guilford's Structure of Intellect Tests and the Research Problem.

On the basis of the studies mentioned in the last section it would seem some clarification of the perception-intelligence issue should be attempted. Is it, as Elliott⁶⁶ suggests, more profitable and economical to study psychological functioning by investigating intellectual abilities? In this approach, field dependence can be viewed as some kind of intellectual deficit and only secondarily as a personality correlate. Or, are Witkin et al. correct to insist that extent of differentiation as reflected in a uni-dimensional

⁶⁵ Guilford, Op. Cit., p. 7.

⁶⁶ R. Elliott, "Interrelationships among Measures of Field Dependence, Ability, and Personality Traits," in Journal of Abnormal and Social Psychology, Vol. 63, No. 1, 1967, p. 27-36.

perceptual style is the key to intellectual style, as well as to other personality variables? In the first instance, mode of field approach is merely an extension of intellectual functioning; in the second, intellectual functioning or parts of intellectual functioning is a reflection of a broader based extent of psychological differentiation.

In an effort to clarify this issue it would seem that the first step to take is to avoid the confusion of single score or composite score tests of intelligence in which the items or subtests are intercorrelated and have significant weighting on the final score. By relating field dependence to factored tests of intelligence this confusion might be avoided or at least minimized. This kind of approach would also give some indication as to the qualitative aspects of differentiation with respect to intellectual functioning.

Tests from Guilford's "Structure of Intellect" (SI) model⁶⁷ may be used toward this end. In brief, Guilford's model is a three-dimensional factor analytic structure which can be best viewed as a cube. One "edge" of the cube represents the number of different ways in which we think, which Guilford has labelled "operations." There are five kinds of operations: (The letters represent Guilford's coding system of his factors.)

⁶⁷ Guilford, Op. Cit., p. 70-249.

- (1) Cognition (C)-- Immediate discovery, awareness, rediscovery, or recognition of information in various forms; comprehension or understanding.
- (2) Memory (M)-- Retention or storage, with some degree of availability, of information in the same form it was committed to storage and in response to the same cues in connection with which it was learned.
- (3) Divergent Production (D)-- Generation of information from given information, where the emphasis is upon variety and quantity of output from the same source. Likely to involve what has been called transfer. This operation is most clearly involved in aptitudes of creative potential.
- (4) Convergent Production (N)-- Generation of information from given information, where the emphasis is upon achieving unique or conventionally accepted best outcomes. It is likely the given (cue) information fully determines the response.
- (5) Evaluation (E)-- Reaching decisions or making judgments concerning criterion satisfaction (correctness, suitability, adequacy, desirability, etc.) of information.⁶⁵

The second "edge" or dimension refers to the number of kinds of information which are dealt with in intellectual activities. This "edge" has been labelled "contents."

There are four classes or types of content:

- (1) Figural (F)-- Information in concrete form, as perceived or as recalled possibly in the form of images. The term "figural" minimally implies figure-ground perceptual organization. Visual spatial information is figural. Different sense modalities may be involved.

⁶⁵ J. P. Guilford and Ralph Hoepfner, "Structure-of-Intellect Factors and Their Tests, 1966," Reports from the Psychological Laboratory, University of Southern California, No. 36, June 1966, p. 3.

- (2) Symbolic (S)-- Information in the form of denotative signs, having no significance in and of themselves, such as letters, numbers, musical notations, codes, and words, when meanings and form are not considered.
- (3) Semantic (M)-- Information in the form of meanings to which words commonly become attached, hence most notable in verbal thinking, and in verbal communication but not identical with words. Meaningful pictures also often convey semantic information.
- (4) Behavioral (B)-- Information, essentially non-verbal, involved in human interactions where the attitudes, needs, desires, moods, intentions, perceptions, thoughts, etc., of other people and of ourselves are involved.⁶⁹

The combination of operation and content gives rise to the third "edge," or dimension, or "products." There are six general categories of products which are essentially forms that information takes in the processing of it:

- (1) Units (U)-- Relatively segregated or circumscribed items of information having 'thing' character. May be close to gestalt psychology's 'figure on a ground.'
- (2) Classes (C)-- Conceptions underlying sets of items of information grouped by virtue of their common properties.
- (3) Relations (R)-- Connections between items of information based upon variables or points of contact that apply to them. Relational connections are more meaningful and definable than implications.
- (4) Systems (S)-- Organized or structured aggregates of items of information; complexes of inter-related or interacting parts.
- (5) Transformations (T)-- Changes of various kinds (redefinition, shifts, or modifications) of existing information or in its function.

6) Guilford and Hoepfner, Op. Cit., p. 4.

- (6) Implications (1)-- Extrapolations of information, in the form of expectancies, concomitants, or consequences. The connection between the given information and that extrapolated is more general and less definable than a relational connection.⁷⁰

The SI model is a theoretical model which has generated considerable research. Guilford and his group have isolated eighty-two factors that fit in his cell structures.⁷¹ The model is theoretically open to 120 total factors. Although it may be desirable to utilize as many of the intellectual tasks isolated into the SI cells in a proposed study as this, practical limitations seem to warrant a smaller selection of tests. For the present purpose, it seems feasible that the five operations in combination with three of the four contents across the most simple product for a total of fifteen tests could be considered. This method of selection would have the advantage of including as many different kinds of intellectual abilities within manageable limits with which mode of field approach could be related. Within this selective range a basis for further limiting the final selection of tests is to utilize only those tests that have been demonstrated to either include or not include Witkin's analytic ability. Of the fifteen

70 Guilford and Hoepfner, Op. Cit., p. 4.

71 Guilford, Op. Cit., p. 65.

possibilities, ten tests met this requirement. Each of the tests discussed in the following paragraphs was selected for the present study.

The Gestalt Completion Test⁷² loads on Guilford's trigram factor, cognition for figural units (CFU). The subject's task in this test is to identify as quickly as possible objects or words presented in silhouette figures with parts of the objects or words blotted out. The task necessitates closure on limited sensory input of information. Thurstone⁷³ identified this factor as "speed-of-closure" since tasks of this nature require immediate and spontaneous identification of an impoverished figure. The Street Gestalt Completion (forerunner to Guilford's Gestalt Completion Test) was found to be loaded on this factor.

A Study by Crutchfield et al.⁷⁴ indicated the MFT to be unrelated to a modified version of the Street Gestalt test, but significantly related to the scores of the Thurstone Gottschaldt, which is similar in makeup to Witkin's MFT. In fact, Thurstone Gottschaldt, Guilford's Midden

72 Guilford and Hoepfner, Op. Cit., p. 5.

73 L.L. Thurstone, "A Factorial Study of Perception," in Psychometric Monograph, No. 4, 1944, as cited in Witkin, et al., Op. Cit., 1962, p. 55.

74 R.S. Crutchfield, D.G. Woodworth and Ruth E. Albrecht, "Perceptual Performance and the Effective Person," in Personnel Laboratory Report, Lackland Air Force Base, 1958, as cited in Witkin, et al., Op. Cit., 1962, p. 55-57.

Figures Test (which will be discussed separately), and Witkin's EFT are all modifications of the original Gottschaldt figures.

In another study, however, Goodman⁷⁵ found correlations of another modified Street Gestalt test (Mooney Closure Test) with scores for the BAT, RFT, and EFT were all in the direction of relationship, and two of the three (BAT and RFT) were significant. Two other studies, one by Longenecker⁷⁶ and the other by Gump,⁷⁷ also resulted in similar findings. Longenecker found a significant correlation between scores for the RFT and Mooney Closure Test while Gump's study resulted in a significant relationship between Mooney Closure and the Thurstone Gottschaldt tests.

The seeming contradiction between Crutchfield et al.'s findings and Goodman's, Longenecker's, and Gump's results is considered by Witkin as a function of the difference between the Mooney Closure and the Street Gestalt tests. The latter test has a short time limit for recognition while the former

⁷⁵ Beverly Goodman, "Field Dependence and the Closure Factors," unpublished study, 1960, as cited in Witkin, et al., Op. Cit., 1962, p. 56.

⁷⁶ E.D. Longenecker, "Form Perception as a Function of Anxiety, Motivation, and the Testing Situation," unpublished doctoral dissertation, University of Texas, as cited in Witkin, et al., Op. Cit., 1962, p. 56.

⁷⁷ P.V. Gump, "Relation of Efficiency of Recognition to Personality Variables," unpublished doctoral dissertation, University of Colorado, as cited in Witkin, et al., Op. Cit., 1962, p. 56.

allows considerably more time. The argument presented by Witkin et al. is that "Recognition after prolonged study may involve different processes than rapid recognition."⁷⁸

Mooney's factor analytic study⁷⁹ of his test lends support to this view. His closure test loaded on both speed of closure and a factor labelled "cognitive rigidity." This latter factor was thought to be similar to a "flexibility of closure" factor. (Guilford's Hidden Figures Test, Thurstone Gottschaldt, and Witkin's EFT load on this factor.)

Since the Gestalt Completion Test requires immediate and spontaneous recognition it would be expected that no significant differences in the performances of field independent from field dependent subjects would be obtained on this test.

The second of Guilford's test selected is the Word Combination Test⁸⁰ which loads on his cognition of symbolic units (CSU) factor. In this test the subject is required to make a new word using the last letters of one word and the initial letters of the next. The task seems to require the ability to breakup a given gestalt to perceive new combinations. Guilford stated that this test tended to have a

78 Witkin, et al., Op. Cit., 1962, p. 56.

79 C.M. Mooney, "A Factorial Study of Closure," in Canadian Journal of Psychology, Vol. 6, No. 2, 1954, p. 51-60.

80 Guilford and Hoepfner, Op. Cit., p. 5.

little variance from another of his factors called convergent symbolic transformation (NST).⁸¹ Guilford's comments in this regard seem pertinent:

In theorizing about the nature of the FID [field independence-dependence] variable, Witkin concludes that it is an ability to break up or to analyze a perceived visual structure. It is not analysis in the usual sense, of arriving at significant parts that help one to understand a totality. The emphasis should be on breakup; even destruction would be a better word with which to describe what happens with words in connection with NST or with figures in connection with NPT [convergent figural transformation].⁸²

Thus, if the Word Combination Test has some variance from NST it would be expected that this test would be related to mode of field approach.

The Wide Range Vocabulary Test⁸³ loads on the cognition of semantic units (CMU) factor. It requires cognition of the meaning to a word label. Guilford's works in this area suggest that CMU loads on many kinds of verbal tests, such as verbal analogies and verbal relations as well as general verbal comprehension.

With respect to the verbal skills, Witkin et al. state:

⁸¹ Guilford, Op. Cit., p. 73-75.

⁸² Ibid., p. 180-181.

⁸³ Ibid., p. 75.

One kind of unrelated verbal skill has been designated 'verbal comprehension' in factor analytic studies of the Wechsler Scales. It is best defined by the Vocabulary, Information, and Comprehension subtests of the WISC and WAIS. Neither on conceptual grounds nor from the existing factor-analytic literature would we expect a relation to exist.⁸⁴

If what Witkin claims is true it would not be expected that field dependent and field independent subjects would differ in their performance on this test.

The Auditory Number Span⁸⁵ loads on the memory for symbolic units (MSU) factor. It requires the correct repetition of sequences of numbers which are read aloud by the examiner. It is comparable to the Digit Span subtest in the WAIS.

With regard to memory abilities Witkin et al. state:

Children whose experiences characteristically register in clearly structured fashion would tend to remember past events better than children whose experiences tend to be unstructured. We might further anticipate that if the experiences of children with an analytical field approach are relatively structured, they would tend to have better memory for earlier events than children with a global approach -- Impressions formed in the course of many varied contacts with our children were in line with this expectation. On interview, for example, boys with an analytical approach often seemed to recall earlier events with greater precision and certainty than boys with a more global approach.⁸⁶

⁸⁴ Witkin, et al., Op. Cit., 1962, p. 203.

⁸⁵ Guilford, Op. Cit., p. 115-116.

⁸⁶ Witkin, et al., Op. Cit., 1962, p. 100.

In a study of retroactive inhibition Gollin and Baron's⁸⁷ results tend to support this view. Using college men as subjects, nonsense syllables were presented for both original and interpolated learning. Field dependency-independency was determined by the Gottschaldt. As expected, field dependent subjects experienced greater difficulty with retroactive inhibition than field independent subjects.

However, in a similar study by Miller,⁸⁸ the previous findings were not confirmed. In fact, the results suggest that field independent subjects suffered significantly more retroactive inhibition than field dependent subjects.

In a study of retroactive inhibition in children,⁸⁹ Witkin and his colleagues found that measures of retroactive inhibition were not related to mode of field approach. They also found that relearning and recall measures for nonsense syllables were not significantly related to comparable measures for words.

⁸⁷ E. Gollin and A. Baron, "Response Consistency in Perception and Retention," in Journal of Experimental Psychology, Vol. 47, No. 4, 1954, p. 259-262.

⁸⁸ Ann S. Miller, "An Investigation of Some Hypothetical Relationships of Rigidity and Strength and Speed of Perceptual Closure," unpublished doctoral dissertation, University of California, as cited in Witkin, et al., Op. Cit., 1962, p. 100.

⁸⁹ Witkin, et al., Op. Cit., 1962, p. 100.

On the basis of the studies cited above, Witkin et al. suggest further work in the area should be conducted before definitive statements can be made. However, in the studies mentioned initial learning was handled equally well between field dependent and field independent subjects. Since Guilford's Auditory Number Span has to do with recall of material in its original form without intervention of different material, it would be expected that no significant difference would occur between the performances of field independent and field dependent subjects.

The next test is called Match Problems⁹⁰ which loads on the divergent figural transformation factor (DFT). This factor is also known as "adaptive flexibility." The items in the test are presented in the form of adjacent squares with each side of a square representing a removable "match stick." The subject's task is to remove a set number of "matches" in order to leave the desired number of squares or triangles. In each set there are four alternative solutions. The test seems to require the ability to shift tactics as the subject indulges in trial and error. In other words, every time the subject thinks in terms of one tentative solution, he is also required to make a change in the configuration of lines that he sees to a new configuration of the kind that he thinks he wants.

⁹⁰ Guilford, Op. Cit., p. 152-153.

Within considered Guilford's "adaptive flexibility" factor similar to mode of field approach. In order to check this possible relationship, a series of nine tests including the Match Problems were administered to thirty-one college men. The results suggest a close connection between Within's perceptual measures and Match Problems: .37 ($P < .05$) with BAT, .55 ($P < .01$) with RFT, and .60 ($P < .01$) with EFT.⁹¹ These findings parallel Karp's factor analytic study.⁹² On the basis of the demonstrated relationship, field independent subjects would be expected to obtain better scores (number of correct solutions) than the field dependent subjects.

The Hidden Figures Test⁹³ which has been previously mentioned, loads on the convergent figural transformation factor (NFT). The relationship between this test and Within's perceptual measures has been clearly demonstrated by several studies.^{94,95,96} This test requires the subject to choose

91 Witkin, et al., Op. Cit., 1962, p. 73-74.

92 Karp, Op. Cit., p. 70-71.

93 Guilford, Op. Cit., p. 179-180.

94 S.A. Rudin and R. Stagner, "Figure-ground Phenomena in the Perception of Physical and Social Stimuli," in Journal of Psychology, Vol. 45, First Half, 1958, p. 213-225.

95 Crutchfield, Op. Cit., p. 55-57.

96 Goodman, Op. Cit., p. 56.

from several reference designs the correct design which is embedded in a more complex design.

The Additions Test⁸⁷ loads on the convergent symbolic implications factor (NSI) and it requires the addition of columns of figures as quickly as possible. No directly relevant study was found, however, Witkin et al. state:

Evidence suggests that in general only performance in relatively complex arithmetical tasks, requiring a fairly high level of reasoning, relates to mode of field approach.⁹⁸

The Identical Pictures Test⁹⁹ loads on the evaluation of figural units factor (EFU), and it requires the appropriate selection from several pictures of objects that match the reference picture. This factor is also known as "perceptual speed." It was initially isolated by Thurstone¹⁰⁰ who, at first, considered this factor to tap the ability to overcome embeddedness, the correct object being embedded in irrelevant material. However, Guilford, considered this to be in error since the quality mentioned by Thurstone suited better the NFT factor. Furthermore, the tests in the EFU factor are considered to be typically so

⁸⁷ Guilford, Op. Cit., p. 181-182.

⁹⁸ Witkin, et al., Op. Cit., 1962, p. 201.

⁹⁹ Guilford, Op. Cit., p. 186-187.

¹⁰⁰ L.L. Thurstone, "Primary Mental Abilities," in Psychometric Monograph, No. 1, 1938, as cited in Guilford, Op. Cit., p. 186.

easy that if the subject has sufficient time he would be expected to complete all items with almost no mistakes. Thus, "perceptual speed" is considered more appropriate than embeddedness.

Finding A's Test¹⁰¹ requires the subject to locate words in a list that have the letter "A" in the word. This test loads on the evaluation of symbolic units factor (ESU). Although, on the surface, this test appears to have an embedded quality, it does not load on NPT, but rather somewhat on DSU (Word Ending Test). The DSU factor, in turn, tends to have some variance with CMU (e.g. Wide Range Vocabulary Test). As indicated earlier the CMU factor does not load on Witkin's perceptual measures. For this reason it would not be expected that Finding A's Test would relate significantly with mode of field approach.

Finally, the Nonsense Syllogism Test¹⁰² requires the ability to choose the correct conclusion from the given syllogisms without regard to the nonsensical aspects of the statements. This test loads on the evaluation of semantic relation's factor (EMR). A study by Linton¹⁰³ indicates no

101 Guilford, Op. Cit., p. 188-189.

102 Ibid., p. 194-195.

103 Harriet B. Linton, "Relation between Mode of Perception and Tendency to Conform," unpublished doctoral dissertation, Yale University, 1952, as cited in Witkin, et al., Op. Cit., 1962, p. 79.

relation between syllogistic reasoning ability and measures of field dependence.

Before proceeding with the proposal of the research problem it may be helpful to summarize some of the key points discussed in the last two sections: (1) The relationship between intelligence and extent of differentiation has been demonstrated. (2) Witkin et al. have contended that this relationship is a function of analytic ability. (3) Critics have suggested that this relationship is a function of general intelligence. (4) Factor Analyses of standard tests of intelligence have been the primary sources for support for both points of view. (5) The issue seems confounded because factor analytic techniques applied to these tests have resulted in overlapping loadings on an "overall" factor as in the case of "G" in the Wechsler tests and in relatively high subtest correlations. (6) The use of factored tests of intelligence was discussed as a way to avoid or at least minimize the confusion surrounding single or composite I.Q. tests as related to mode of field approach.

The research problem can now be proposed. If what Witkin and his co-workers claim is correct, the perceptual-intelligence relationship is accounted for by what has been called analytic field ability, which, in turn, reflects extent of differentiation. It would then follow that on

intellectual tasks not "weighted" with analytic ability, there should be no significant differences in performance between field dependent and field independent subjects.

If, on the other hand, within et al.'s critics are correct in assuming that field independency is but an extension or a reflection of a more general "ability," intelligence, then it would follow that on these same tasks the higher scores would be obtained by the field independent subjects.

The following chapter is devoted to the research design which was developed to test these alternate hypotheses.

CHAPTER II

EXPERIMENTAL DESIGN

The general research problem as proposed in the previous chapter will be operationally treated under the following sub-headings: (1) the Research Hypotheses, (2) the Psychometric Instruments, (3) the Subjects, (4) the Procedure, and (5) the Statistical Techniques for Analyzing the Data.

1. Research Hypotheses.

As indicated in the general statement of the problem at the conclusion of the previous chapter the performances of field dependent and field independent subjects are expected to differ significantly only on those tests "weighted" with analytic ability. In other words, from Witkin's theoretical position significant differences in performance favoring the field independent subjects would be expected on the following tests: Word Combination Test, Match Problems, and Hidden Figures Test. However, for the purposes of statistical analysis a "no difference" hypothesis is stated for all tests. Also, the inclusion of a standard I.Q. test was considered desirable for secondary comparison purposes with the general findings of previous studies utilizing single I.Q. or composite I.Q. scores.

In order to facilitate the reading of the problem, a single statement covering all of Guilford's tests is made. The hypotheses, then, are stated as follows:

- A. There is no significant difference between field dependent subjects and field independent subjects as rated on the RFT with respect to their performance on each of the following tests:

Gestalt Completion
Word Combination
Wide Range Vocabulary
Auditory Number Span
Match Problems
Hidden Figures
Additions
Identical Pictures
Finding A's
Nonsense Syllogism

- B. There is no significant difference between field dependent subjects and field independent subjects as rated on the RFT with respect to their performance on the Otis Self-Administering Test of Mental Ability (Otis).

2. Psychometric Instruments.

The tests used for the present study will be discussed in the following order: (a) the RFT, (b) the Otis, and (c) each of the Guilford tests. The RFT was utilized to assess the extent of psychological differentiation. The Otis was used to indicate "general intelligence" while each of the Guilford tests was considered to indicate "specific" intellectual ability.

(a) Rod and Frame Test (RFT).-- As described in chapter one, this test requires the subject to adjust the

rod to the upright or true vertical regardless of its starting position and the tilt of the frame. The further the adjustment of the rod is made from a true vertical position, the greater is the error score for the subject. The error score, in turn, is defined as a relatively field dependent or field independent performance. The error score is the average of all scores obtained for all trials in a given series. The standard procedure for administration of this test includes three series, each consisting of eight trials. In the first series the subject's chair is tilted 28° to the left and in the second, the same number of degrees to the right. In both series the rod and frame are initially tilted 28° in the following manner: (1) frame right, rod right; (2) frame right, rod left; (3) frame left, rod left; (4) frame left, rod right. The above procedure is then repeated to complete the eight trials. In the third series the rod and frame are presented in the order just indicated, but the subject's chair is not tilted at any time. For the present study only the third series was used since it has been found to correlate highly with the total score on the RFT. Witkin has pointed to the economy of this method without loss in validity.¹

1 H.A. Witkin, R.E. Dyk, H.F. Faterson, D.R. Goodenough and S.A. Karp, Psychological Differentiation, New York, Wiley, 1962, p. 41.

The apparatus consists of a rod which is mounted within a square frame. The dimensions of the rod are one-half inch wide and thirty-eight and one-half inches long. The frame's sides are one and one-half inches wide and forty-two inches long. The frame's sides and the rod are coated with luminous paint. In a darkened room only the painted parts of the apparatus can be seen. Both the rod and the frame are pivoted at their centers and mounted on separate shafts so that each can be tilted side to side independently of the other. Protractors (one degree calibrations) are mounted on both the frame's shaft and the rod's shaft and move in relationship to the frame's position and the adjustment of the rod against stationary pointers. This arrangement permits direct readings of the position of the frame and the rod. A wooden chair with a high back support, an adjustable headrest, and a footrest is placed seven feet from the rod and frame apparatus. After each trial a reading of the adjustment of the rod was made with the help of a flashlight while the subject was screened from viewing this procedure.

With respect to the reliability of the BFT, it has been amply demonstrated by a number of investigators. As indicated in the previous chapter test-retest correlations over a period of one to three years ranging from .66 for women to .88 for men have been reported.² Corrected odd-even

² Witkin, et al., Op. Cit., 1962, p. 370.

correlations obtained by other investigators^{3,4} ranged from .89 to .92 which are comparable to Witkin et al.'s findings on odd-even reliability coefficients of .90 for men and .91 for women.⁵ Hellkamp⁶ obtained an odd-even coefficient of .92 in his study.

With regard to the validity of the RFT, Witkin and his group have reported significant relationships with a number of criterion tests which "reflect" psychological differentiation. In their recent book⁷ the chapters on analytical functioning in intellectual activities, structuring and articulation of experience, articulation of body concept, sense of separate identity, nature of controls and defenses, and activities illustrate the direction of the

3 R.W. Gardner, D.N. Jackson and S.J. Messick, "Personality Organization in Cognitive Controls and Intellectual Abilities," in Psychological Issues, Vol. 2, Whole No. 8, 1960, as cited in Witkin, et al., Op. Cit., 1962, p. 40.

4 R.G. Loeff, "Embedding and Distracting Field Contexts as Related to the Field Dependence Dimension," unpublished Master's thesis, Boston College, as cited in Witkin, et al., Op. Cit., 1962, p. 40.

5 H.A. Witkin, H.B. Lewis, M. Hertzman, K. Machover, P.B. Meissner and S. Wapner, Personality through Perception, New York, Harper, 1954, p. 73.

6 D. Hellkamp, "Extent of Psychological Differentiation Among Hospitalized Male Schizophrenics Classified Along the Process-Reactive and Delusional-Hallucinatory Dimensions," unpublished doctoral dissertation, University of Ottawa, Ontario, 1967, p. 25-26.

7 Witkin, et al., Op. Cit., 1962.

relationship between RFT performance (as well as the other perceptual tests in the battery) and these factors.

In summary, the reliability and validity for the RFT appear to be adequate for research purposes.

(b) Otis.- The inclusion of a standard test of intelligence in the present study was considered desirable because it offers the opportunity to compare the results with previous studies which utilized single or composite I.Q. scores. It also provides the opportunity to investigate the influence of intelligence on perceptual differentiation from both the "specific abilities" and "general abilities" points of view.

The Otis was selected because of its relatively widespread use along with its obvious advantages of simplicity of administration and scoring. The full time limit of thirty minutes for testing was utilized.

Reliability coefficients⁸ of .90 to .97 have been reported for the twenty minute time limit, and .86 for the thirty minute time limit. Alternate forms have been found to intercorrelate .92.

Validity coefficients⁹ based on the relationship with the Binet tests have been reported to range from .50

⁸ Donald E. Super and John O. Crites, Appraising Vocational Fitness, New York, Harper & Row, 1962, p. 4.

⁹ Ibid., p. 4-5.

to .55. When related with school achievement on the high school level coefficients of .55 to .5 were obtained.

The reliability and validity of the Otis have been generally accepted in many settings where group screening for intelligence is required. For the purpose of this research it was considered to be an adequate instrument to indicate "general intelligence."

(c) Guilford's tests.- Since each of the Guilford tests selected has been described previously, the present section is devoted to reporting of the statistical status of each of the tests. In the studies utilizing these tests the subjects were high school students or adults usually numbering over two hundred in each sample size. The tests were also extensively pretested with groups of university students.

Gestalt Completion Test.- This test has been one of the marker tests in Guilford's CPU (cognition of figural units) factor or what is frequently called the "speed-of-closure" factor. Factor loading of this test has been reported to be in the neighborhood of .45.¹⁰ Reliability coefficient of .41 based on communality as a lower-bound

¹⁰ Maureen O'Sullivan, J.P. Guilford and R. deMille, "The Measurement of Social Intelligence," Reports from the Psychological Laboratory, University of Southern California, No. 34, June 1965, p. 23.

estimate of reliability is reported.¹¹ The test consists of two parts with 10 items in each part. Time limit per part is three minutes.

Word Combination Test.- Guilford et al.¹² report a loading of .52 on the CSU (cognition of symbolic units) factor for this test with a reliability estimate of .62 based upon alternate-form correlations extended by the Spearman-Brown prophecy formula. As mentioned in the previous chapter, this test is also known to have some variance from the NBT factor with a loading of .26 (Guilford's cutoff for significant loading is .30). This test consists of two parts with 15 items in each part. The time limit per part is four minutes.

Wide Range Vocabulary Test.- Guilford states, "The most dependable and most univocal measure of CMU (cognition of semantic units) is a vocabulary test of some kind[...]."¹³

Although no statistical figures regarding this particular

11 O'Sullivan, et al., Op. Cit., p. 16.

12 J.P. Guilford, P.R. Merrifield, P.R. Christensen and J.W. Frick, "An Investigation of Symbolic Factors of Cognition and Convergent Production," Reports from the Psychological Laboratory, University of Southern California, No. 23, April 1960, 1-27 p.

13 J.P. Guilford, The Nature of Human Intelligence, New York, McGraw-Hill, 1967, p. 75.

test were given, other studies^{14,15} utilizing vocabulary tests resulted in factor loadings in the .50+ range on factors similar to Guilford's CMU. Reliability coefficients were reported to be in the .80+ range. There are two parts with 24 items in each part, and with a time limit of six minutes for each part of this test.

Auditory Number Span Test.- This test is similar in makeup to the Digit Span subtest in the WAIS in that it requires immediate recall of a given series of numbers. Although no statistics bearing on this particular test were found, factor loadings of this type of test on the memory factor (Guilford's MSU, memory for symbolic units, factor) have been reported by Rinaldi¹⁶ to range from .40+ to .50+. No reliability coefficient was reported. The test consists of one part with 24 items and with no time limit.

Match Problems.- Loadings of .43 to .50 on the DPT (divergent production of figural transformations) factor

¹⁴ J.W. Frick, J.P. Guilford, P.R. Christensen and P.H. Merrifield, "A Factor-Analytic Study of Flexibility in Thinking," Educational and Psychological Measurement, Vol. 19, No. 4, 1959, p. 469-496.

¹⁵ Benjamin Fruchter, "The Nature of Verbal Fluency," Educational and Psychological Measurement, Vol. 8, No. 1, 1948, p. 33-47.

¹⁶ H.J.A. Rinaldi, "Study of Some Factors Related to Intelligence," Psychometrika, Vol. 13, No. 1, March 1948, p. 27-46.

and reliability coefficients of .65 to .70 based on alternate-form correlations have been reported by Guilford et al.^{17,18} This test consists of two parts with 5 items in each part. The time limit per part is seven minutes.

Hidden Figures Test.- This test has a loading of .39 on the NPT (convergent production of figural transformation) factor and a reliability coefficient of .72 based on the Kuder-Richardson formula.¹⁹ It has been used as a marker test for the NPT factor. There are two parts with 16 items in each part, and with a time limit of ten minutes per part in this test.

Additions Test.- Factor loadings of .56 to .59 on the NSI (convergent production of symbolic implications) factor with a reliability coefficient of .90 has been reported.²⁰ The test consists of two parts with 16 items in each part. Time limit per part is two minutes.

17 J.P. Guilford, R.M. Berger and P.R. Christensen, "A Factor-Analytic Study of Planning," Reports from the Psychological Laboratory, University of Southern California, No. 12, May 1955, 1-23 p.

18 Ralph Hoepfner and J.P. Guilford, "Figural, Symbolic, and Semantic Factors of Creative Potential in Ninth-Grade Students," Reports from the Psychological Laboratory, University of Southern California, No. 35, June 1965, 1-31 p.

19 O'Sullivan, et al., Op. Cit.

20 Russel F. Green, J.P. Guilford, P.R. Christensen and A.L. Conrey, "A Factor-Analytic Study of Reasoning Abilities," Psychometrika, Vol. 18, No. 2, June 1953, p. 135-160.

Identical Pictures Test.- No statistical data bearing on this particular test was found. However, on a similarly constructed test a factor loading of .52 on the EPU (evaluation of figural units) factor with a reliability coefficient of .70 (Spearman-Brown alternate-form formula) has been reported.²¹ This test consists of two parts with 48 items in each part. The time limit per part is one and one-half minutes.

Finding A's Test.- No statistics on this test were found with regard to Guilford's ESU (evaluation of symbolic units) factor. However, Guilford's Finding U's Test which parallels this test was found to load .52 on ESU with a reliability coefficient of .81.²² The test consists of two parts with 125 items in each part. Time limit per part is two minutes.

Nonsense Syllogisms Test.- A factor loading of .50 on the EMR (evaluation of semantic relations) factor for this test has been obtained while reliability coefficients based on alternate-form correlations have ranged from .78

21 Hoepfner, et al., Op. Cit.

22 Mary L. Tenopyr, J.P. Guilford and R. Hoepfner, "A Factor Analysis of Symbolic Memory Abilities," Reports from the Psychological Laboratory, University of Southern California, No. 38, December 1966, p. 1-3.

to .02.^{23,24} This test consists of two parts with 15 items in each part, and with a time limit of four minutes per part.

3. Subjects.

All subjects used in the present study were qualifying year students and adults enrolled in the evening introductory psychology class in a small liberal arts college. This level of schooling was considered to offer a relatively wider range of intellectual abilities among the subjects than the upper classes. Also, in order to avoid possible influence of known brain dysfunction, each subject's background regarding head injury or serious infection was investigated in informal interviews. Suspect subjects were eliminated from further consideration. The subjects ranged in age from seventeen to forty-eight for the males and sixteen to fifty-four for the females. Educational backgrounds were similar in that all subjects had either grade twelve or grade thirteen.

²³ J.P. Guilford, N.W. Kettner and P.R. Christensen, "A Factor-Analytic Investigation of the Factor Called General Reasoning," Reports from the Psychological Laboratory, University of Southern California, No. 14, August 1955, p. 12.

²⁴ K. Mihira, J.P. Guilford, R. Hoepfner and P.R. Merrifield, "A Factor Analysis of the Semantic-Evaluation Abilities," Reports from the Psychological Laboratory, University of Southern California, No. 32, December 1964, p. 11.

As indicated in the previous chapter, differences between the sexes on the RFT have been consistently demonstrated. For this reason, the male and female subjects were studied separately.

Although the subjects were volunteers, strong "pressure" was exerted to encourage as many participants as possible. However, since administration of the test battery extended over three separate testing dates a fairly high attrition rate was not unexpected. From a total pool of eighty-one qualifying year students and eighty-five adults, only eighty-nine subjects (49 males and 40 females) agreed to the testing. Of this group only seventy-four (40 males and 34 females) took all tests in the battery. All of the eighty-nine subjects took the RFT and at least two of the rest of the tests.

Final selection of the subjects into the field dependent and field independent groups was based on the rank order of the mean error scores obtained from the RFT with the top half and bottom half of the order representing the two modes of field approach. This procedure resulted in a final grouping of twenty field dependent and twenty field independent males. For the females the final grouping resulted in seventeen subjects in each mode of field approach group.

In order to investigate possible differences that may not be shown by using the entire RFT range the ranked order of mean error scores on the RFT was re-divided for comparison of extreme groups (upper 25% vs. lower 25%) for both male and female subjects. This procedure resulted in a grouping of ten field independent and ten field dependent males. For the females this resulted in eight subjects in each mode of field approach group.

4. Procedure.

All tests except for the RFT were administered in group settings. On each occasion an examiner was helped by at least one monitor who aided in the passing out and collecting of the test material. The examiners were senior students who were members of the college psychology club and trained in the administration of the tests. They were not fully aware of the nature of the research. Since the entire test battery took three to four hours, the testing was carried out on three separate occasions within a few months' time. The subjects were told that they were participating in an ongoing testing and research program, but no details were offered. The scoring of the group tests was done in the manner suggested by the authors. This amounted to recording the number of items marked correctly.

The RFT was administered individually by trained examiners who did not participate in the administration of the group tests. Before entering the examination room each subject was queried as to his understanding of verticality. After it was clearly understood, the subject was led into the dimly lit room to the subject's chair but was screened from viewing the rod and frame apparatus. The following instructions were then read to the subject:

In a few minutes, all you will see in this room is a square frame with a rod in it. At that time, I will ask you to tell me if the rod is in a straight up and down, or vertical position. You can answer me by saying, 'Yes, the rod is in a vertical position,' if it appears vertical to you, or, 'No, it is not in a vertical position,' if it does not appear to be in a vertical position. I will then ask you to tell me in which direction it should be moved to become in a vertical position--to the right or to the left. We will then move the rod until you tell us to stop--and that should be when the rod appears to be vertical or straight up and down. Do you understand? (If the subject said 'no,' instructions were repeated and verticality was re-explained.)

The subject was allowed to dark-adapt and the testing proceeded. After each trial a reading of the subject's performance was made with the help of a flashlight while the subject was screened from viewing the rod and frame apparatus. One examiner was responsible for manipulating the apparatus and the scoring while the other examiner was responsible for the reading of the instructions and in screening the subject at the appropriate times. Analysis of the data was conducted after all testing was completed.

5. Statistical Techniques for Analyzing the Data.

Reliability coefficients for the test were computed with the following statistical techniques. The Spearman-Brown formula²⁵ for alternate-forms was used to compute reliability on all of Guilford's tests except for the Auditory Number Span and the Hidden Figures Test. This technique was selected because in cases where Guilford et al. reported reliability data, the coefficients were computed in this fashion. Odd-even coefficients for estimating the internal consistency of the Auditory Number Span and RFT were obtained with the use of Mosier's formula.²⁶ The Spearman-Brown formula²⁷ was applied to the obtained odd-even coefficients for estimation of reliability of the total test for each test. Since the Auditory Number Span is essentially a power test and without an alternate form built into it, the odd-even technique was considered. On the RFT, there is a precedence for this approach in previous studies. The Kuder-Richardson formula was used to compute reliability on the

²⁵ J.P. Guilford, Fundamental Statistics in Psychology and Education, New York, McGraw-Hill, 1965, p. 457.

²⁶ -----, Psychometric Methods, New York, McGraw-Hill, 1954, p. 377.

²⁷ -----, Fundamental Statistics in Psychology and Education, p. 458.

Hidden Figures Test in order to make a direct comparison with the reliability coefficient previously reported for this test. Guilford et al. computed reliability with the Kuder-Richardson formula. Test-retest reliability was obtained on the Otis for a randomly selected group of fifteen subjects. Retesting was done between two to three months of the original testing data. This method of computing reliability was selected because it was considered desirable to obtain a relatively stable measure of "general intelligence," rather than a check on the internal consistency of the test.

The t test of significance²⁰ was utilized to test the difference between the means of the field dependent and field independent groups for each of Guilford's tests and for the Otis. For the significantly different means, point bi-serial correlations were obtained from the t test in order to estimate the size of effect or degree of relationship of the difference.²¹

The results of these analyses are presented and discussed in the following chapter.

20 Guilford, Fundamental Statistics in Psychology and Education, p. 104.

21 Jacob Cohen, "Some Statistical Issues in Psychological Research," in B.B. Wolman, (ed.), Handbook of Clinical Psychology, New York, McGraw-Hill, 1965, p. 15-121.

CHAPTER III

PRESENTATION AND DISCUSSION OF RESULTS

This chapter presents the results and discussion of this study under the following sub-headings: (1) Reliability of the Instruments, (2) Results on the Male Subjects, (3) Results on the Female Subjects, and (4) Discussion of the Results.

1. Reliability of the Instruments.

Except for the Otis on which a test-retest reliability coefficient was computed for a randomly selected group of fifteen subjects, all reliability data was computed for all seventy-four subjects. On the RFT coefficients of reliability were obtained separately for the forty male and thirty-four female subjects because of the demonstrated difference in performance on this test.

Corrected odd-even coefficients of correlation of $+.82$ ($P < .01$) for the male subjects and $+.95$ ($P < .01$) for the female subjects were obtained on the RFT. These coefficients of correlation generally parallel those that

are summarized by Witkin et al.¹ and as reported for the earlier standardization groups.²

For the Otis a test-retest reliability was computed. From the final group of seventy-four subjects a randomly selected group of fifteen subjects was asked to re-take the Otis a few months after the initial testing period. A reliability coefficient of $+ .89$ was obtained which is similar to what has been reported previously.

On the Auditory Number Span a corrected odd-even coefficient of correlation of $+ .69$ ($P < .01$) was obtained. As stated earlier no reliability data was found on this specific test. Although no direct comparison can be made, Wechsler's work with the Digit Span subtest of the WAIS may be relevant. Wechsler³ has reported reliability coefficients ranging from $.66$ to $.71$ on the Digit Span which closely parallel the present finding. The Digit Span is similar in makeup to the Auditory Number Span in that the subject is required to recall numbers read aloud by the examiner.

1 H.A. Witkin, H.B. Dyk, H.F. Fateron, D.R. Goodenough and S.A. Karp, Psychological Differentiation, New York, Wiley, 1962, p. 40.

2 H.A. Witkin, H.B. Lewis, M. Hertzman, K. Machover, P.B. Meissner and S. Wapner, Personality through Perception, New York, Harper, 1954, p. 73.

3 David Wechsler, Manual for the Wechsler Adult Intelligence Scale, New York, The Psychological Corp., 1955, p. 13.

On the Hidden Figures Test, internal consistency was computed through the Kuder-Richardson formula since item difficulty could be assumed to be fairly equal for all items. The previously reported reliability coefficient of +.72 for this test was also computed by the Kuder-Richardson formula. For this study a coefficient of reliability of +.61 ($P < .01$) was obtained. The sample on which the coefficient of correlation was reported differed from the subjects in the present study in several respects which may have accounted for the difference in the coefficients. The previous study⁴ included 240 eleventh grade students whose mean age was 16.7 years. Subjects in the present study are college students whose mean age is 26.5. Further, although the I.Q.'s reported could not be directly compared since the measuring instruments used were not the same, there seems to be more homogeneity with respect to range of I.Q.'s among the college subjects than with the high school students.

The reliability coefficients on the remainder of the instruments used were computed by the Spearman-Brown formula of estimating whole-test reliability from inter-part correlations. The tests used were amenable to this approach for

⁴ Maureen O'Sullivan, J.P. Guilford and R. DeMille, "The Measurement of Social Intelligence," Reports from the Psychological Laboratory, University of Southern California, No. 34, June 1965, p. 15.

obtaining coefficients of correlation because of the instruments' split-half characteristics.

On the Match Problems, a coefficient of reliability of $+0.61$ ($P < .01$) was obtained. This approximates the reliability data reported for this test.^{5,6}

A coefficient of $.41$ based on communality as a lower-bound estimate of reliability is reported for the Gestalt Completion Test.⁷ When a reliability coefficient was computed with the Spearman-Brown technique a coefficient of $+0.46$ ($P < .01$) was obtained.

A reliability coefficient of $+0.62$ ($P < .01$) was obtained on the Word Combination Test. This represents a fairly large difference from the coefficient of $+0.62$ reported by Guilford et al.⁸ Again, the difference may be attributed to sample differences. Guilford's subjects were naval air personnel

⁵ J.P. Guilford, R.M. Berger and P.R. Christensen, "A Factor-Analytic Study of Planning," Reports from the Psychological Laboratory, University of Southern California, No. 12, May 1955, p. 7.

⁶ Ralph Hoepfner and J.P. Guilford, "Figural, Symbolic, and Semantic Factors of Creative Potential in Ninth-Grade Students," Reports from the Psychological Laboratory, University of Southern California, No. 35, June 1965, p. 9.

⁷ Guilford, et al., Op. Cit., p. 16.

⁸ J.P. Guilford, P.R. Merrifield, P.R. Christensen and J.W. Frick, "An Investigation of Symbolic Factors of Cognition and Convergent Production," Reports from the Psychological Laboratory, University of Southern California, No. 23, April 1960, p. 12.

whose background and training cannot be assumed to be the same or similar to a "co-ed" group of college students.

On the Wide Range Vocabulary Test, a coefficient of reliability of $+0.92$ ($P < .01$) was obtained. No direct comparison of reliability data can be made on this test since none was found. However, the obtained reliability coefficient compares favorably with similar vocabulary tests which load on Guilford's CMU factor.^{9,10}

On the Additions Test, a reliability coefficient of $+0.92$ ($P < .01$) was obtained. This closely approximates the reported reliability coefficient of $+0.90$.¹¹

On the Identical Pictures Test, a reliability coefficient of $+0.90$ ($P < .01$) was obtained. No direct comparison can be made since statistical data on this test was not found.

A reliability coefficient of $+0.63$ ($P < .01$) was obtained for the Finding A's Test. As indicated earlier no statistical data directly bearing on this test was found. On a similarly

⁹ J.W. Frick, J.P. Guilford, P.R. Christensen and P.R. Merrifield, "A Factor-Analytic Study of Flexibility in Thinking," Educational and Psychological Measurement, Vol. 19, No. 4, 1959, p. 469-496.

¹⁰ Benjamin Fruchter, "The Nature of Verbal Fluency," Educational and Psychological Measurement, Vol. 3, No. 1, 1948, p. 33-47.

¹¹ Russel F. Green, J.P. Guilford, P.R. Christensen and A.L. Comrey, "A Factor-Analytic Study of Reasoning Abilities," Psychometrika, Vol. 18, No. 2, June 1953, p. 135-160.

constructed test, Findings U's, Guilford et al. report a coefficient of reliability of $+ .81$.¹² Again, however, the sample subjects in the reported study are considered to reflect significant differences in age, training, and range in intelligence from the present subjects, which may effect a reliability coefficient difference.

Finally, on the Nonsense Syllogisms Test, a reliability coefficient of $+ .69$ ($P < .01$) was obtained. This approximately the reliability data on this test.^{13,14}

In summary, the reliability coefficients obtained are considered to reflect adequate reliability of the instruments for research purposes.

2. Results on the Male Subjects.

As indicated in the previous chapter the basis on which mode of field approach was determined was by dividing

12 Mary L. Tenopyr, J.P. Guilford and R. Hoepfner, "A Factor Analysis of Symbolic Memory Abilities," Reports from the Psychological Laboratory, University of Southern California, No. 30, December 1966, p. 11.

13 J.P. Guilford, N.W. Kettner and P.R. Christensen, "A Factor-Analytic Investigation of the Factor Called General Reasoning," Reports from the Psychological Laboratory, University of Southern California, No. 14, August 1955, p. 9.

14 K. Nihira, J.P. Guilford, R. Hoepfner and P.R. Merrifield, "A Factor Analysis of the Semantic-Evaluation Abilities," Reports from the Psychological Laboratory, University of Southern California, No. 32, December 1964, p. 11.

the ranked order of RVT mean error scores in half. The lower-half scores were considered to reflect a more field independent mode of approach, while the upper-half scores that of a more field dependent approach. Table I shows the difference between the two groups with respect to their performance on the RFT. Also included in this table is the difference in age between the two groups. Education was not considered in any of the analyses since all subjects had a background of grade twelve or thirteen. As can be seen from this table, age does not appear to be a contributing factor in the significant difference between the two modes of field approach.

On the basis of this division comparisons were made between the two groups on each of Guilford's tests and the Otis. Table II shows the means, standard deviations, ranges, and the t values for the two groups. An inspection of the table shows that with the exception of the Additions Test, the field independent subjects tended to perform at a higher level (better scores) than the field dependent subjects although none of the differences reached significant levels. On the Additions Test the field dependent group performed significantly better than the field independent group ($P < .05$), which was not expected. A point bi-serial correlation was

Table I.-
Means, Standard Deviations, Ranges, and t Values for
Field Independent (FI) and Field Dependent (FD)
Male Subjects for Age and the HFT.

	FI			FD			t Value
	Mean	S.D.	Range	Mean	S.D.	Range	
Age	24.4	5.61	17 - 39	26.25	9.46	17 - 40	.75
<u>HFT</u>	2.21	.79	1.1-3.1	5.93	1.60	3.4-7.5	3.06*

N = 40

* - $P < .01$

Table II.-

Means, Standard Deviations, Ranges, t and r_p bis Values for
Field Independent (FI) and Field Dependent (FD)
Male Subjects for All Tests of Mental Ability.

Test	FI		FD		t Value	r
	Mean	S.D.	Mean	S.D.		
<u>Otis</u>	113.05	10.94	112.20	8.10	.28	
<u>Ard. N.S.</u>	8.95	2.11	8.95	2.96	.00	
<u>Watch P.</u>	10.50	3.20	9.25	2.65	1.34	
<u>Find. A's</u>	61.90	14.12	57.30	12.26	1.10	
<u>Nons. Syll.</u>	14.95	3.38	13.90	3.14	1.02	
<u>Ident. Pic.</u>	71.50	10.81	67.35	10.51	1.23	
<u>Additions</u>	42.55	13.66	50.75	11.18	2.08*	.32
<u>Hidden Fig.</u>	10.35	5.56	7.40	4.92	1.77	
<u>W-R Vocab.</u>	27.60	7.07	24.95	9.46	1.19	
<u>Word Comb.</u>	13.75	6.61	10.90	4.93	1.55	
<u>Gestalt C.</u>	15.10	3.98	12.35	5.65	1.79	

N = 40

* = $p < .05$

estimated from the t value using Cohen's formula.¹⁵ The formula was:

$$r_{p \text{ bis}} = \sqrt{\frac{t^2}{t^2 + df}}$$

where df = degrees of freedom for the t test.

This computation resulted in a point bi-serial r of +.32 which indicates the size of effect.

In view of the trend of the results it was deemed desirable to investigate extreme scores. This time the field dependent and field independent subjects were grouped by utilizing only the extreme 25% on both ends of the RFT ranked scores. Table III shows the means, standard deviations, ranges, and t values for the two groups for age and performance on the RFT. Although the field independent group tends to be younger, this difference did not reach significance. Among the field dependent subjects, two of them, aged thirty-eight and forty-six, inflated the age mean of the group. Otherwise, the general cluster of ages did not appear to markedly differ from the field independent subjects.

Table IV shows the differences between the two groups on each of the Guilford tests and the Otis. Point bi-serial

¹⁵ Jacob Cohen, "Some Statistical Issues in Psychological Research," in B.B. Wolman, (ed.), Handbook of Clinical Psychology, New York, McGraw-Hill, 1965, p. 5.

Table III.-

Means, Standard Deviations, Ranges and t Values for the Extreme Groups of Field Independent (FI) and Field Dependent (FD) Male Subjects for Age and the BFI.

	FI			FD			t Value
	Mean	S.D.	Range	Mean	S.D.	Range	
Age	22.90	3.46	17 -26	26.60	9.08	17 -46	1.05
<u>BFI</u>	1.61	.56	1.1-2.4	7.25	.88	6.5-9.5	17.09*

N = 20

* = P < .01

Table IV.-

Means, Standard Deviations, Ranges, t and F_p bis Values
for the Extreme Groups of Field Independent (FI) and Field Dependent (FD)
Male Subjects for All Tests of Mental Ability.

Test	FI		FD		t Value	r	
	Mean	S.D.	Mean	S.D.			
<u>Otts</u>	117.20	7.54	104-126	7.36	101-123	2.37*	.49
<u>Aud. N.S.</u>	9.00	1.94	6-12	3.22	4-14	.17	
<u>Match P.</u>	11.30	3.65	4-17	1.84	5-11	2.17*	.45
<u>Find. A's</u>	60.70	15.68	41-98	10.25	35-64	1.27	
<u>Nons. Syll.</u>	15.40	3.89	11-20	3.20	7-19	.63	
<u>Ident. Pie.</u>	76.40	10.67	65-95	7.48	51-73	4.03**	.69
<u>Additions</u>	44.00	14.77	25-69	13.36	34-74	1.13	
<u>Hidden Fig.</u>	11.10	6.14	4-22	3.13	1-11	2.80*	.55
<u>W-R Vocab.</u>	29.00	7.51	16-41	9.55	13-39	1.20	
<u>Word Comb.</u>	16.10	6.26	7-25	4.11	2-16	2.32*	.48
<u>Gestalt C.</u>	17.40	1.90	14-20	5.77	3-19	2.92**	.57

N = 20

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

coefficient of correlation is reported when it is significant. Again, with the exception of the Additions Test, the field independent subjects obtained higher scores than the field dependent subjects. Significant differences were obtained on half of the Guilford tests and on the Otis. Besides the three tests on which the field independent subjects were expected to obtain significantly higher scores (Match Problems, Hidden Figures, and Word Combinations) two other tests, namely Identical Pictures and Gestalt Completion, significantly differentiated the two subject groups. On the latter two tests the differences between the means reached the $P < .01$ level of significance while for each of the three tests "weighted" with analytic ability, the level of significance was $P < .05$. On the Additions Test the significant difference previously obtained by grouping the subjects in halves on the basis of the RFT rank order was not duplicated, although the direction still reflected better scores for the field dependent subjects.

On the Otis the field independent subjects significantly differed from the field dependent subjects at the $P < .01$ level. This result generally parallels previous reports of positive relationships between tests of intelligence and field independency.

The results reported thus far will be discussed at length later in the chapter.

3. Results on the Female Subjects.

Table V shows the means, standard deviations, ranges, and t values for age and RFT on the field independent and field dependent female subjects. The results generally parallel those of the male subjects in that the age factor does not appear to influence the significant difference between the modes of field approach.

Table VI shows the means, standard deviations, ranges, t and point bi-serial coefficients of correlation (when t is significant) for the two female subject groups for each of Guilford's tests and the Otis. An inspection of this table shows the field independent group obtained higher scores on all tests although only two (Otis and Gestalt Completion) reached significant levels. A comparison of the female subjects' performances with that of the male subjects (Table II) suggests general similarities with regard to the direction of the mean difference. The two exceptions in the differences between the sexes are on the Auditory Number Span and the Additions Test. On the Auditory Number Span, the means for the two modes of field approach for the male subjects were identical while for the female subjects the direction of the difference between the means favored the field independent group. On the Additions Test the direction of the differences between the means for the male subjects favored the field

Table V.-
Means, Standard Deviations, Ranges and t Values for
Field Independent (FI) and Field Dependent (FD)
Female Subjects for Age and the RFI.

	FI		FD		t Value
	Mean	S.D.	Mean	S.D.	
Age	28.06	11.26	27.53	9.46	.15
RFI	3.32	1.64	13.35	6.71	5.99*

N = 34
* = P < .01

Table VI.-

Means, Standard Deviations, Ranges, t and r_p bisValues
for Field Independent (FI) and Field Dependent (FD)
Female Subjects for All Tests of Mental Ability.

Test	FI		FD		t Value	r
	Mean	S.D.	Mean	S.D.		
<u>Otts</u>	117.53	9.53	109.24	7.41	2.63*	.45
<u>Aud. M.S.</u>	10.59	3.61	9.41	2.37	1.14	
<u>Match P.</u>	10.94	3.90	8.76	4.19	1.57	
<u>Flnd. A's</u>	64.47	11.13	63.29	13.05	.28	
<u>Nons. Syll.</u>	13.88	3.50	12.29	6.81	.86	
<u>Ident. Pic.</u>	68.00	12.36	64.47	15.84	.72	
<u>Additions</u>	53.53	10.47	47.94	13.27	1.36	
<u>Hidden Pk.</u>	10.24	6.29	7.94	4.63	1.22	
<u>W-R Vocab.</u>	28.76	9.89	25.35	9.41	1.03	
<u>Word Comb.</u>	15.29	8.29	12.29	1.70	1.26	
<u>Gestalt C.</u>	12.62	3.73	9.18	3.30	3.01*	.47

N = 34

* - $P < .01$

dependent group while for the female subjects, the opposite was found.

As with the male subjects' performances, the trend of the female subjects' results suggested possible differences between extreme groups. When the RFT ranked scores were re-divided to exclude the middle 50%, N of 8 in each mode of field approach was obtained.

Table VII shows the means, standard deviations, ranges and t values for the extreme groups for age and the RFT. As previously noted, when the RFT ranked scores were halved, age does not appear to be a factor in the significant difference between the two modes of field approach.

Table VIII shows the means, standard deviations, ranges, t and r_p bis values for the extreme groups for each of Guilford's tests and the Otis. Again, the direction of the difference between the means favors the field independent subjects. The magnitude of the differences is generally increased with a corresponding rise in t values although only three of the Guilford tests (Match Problems, Word Combinations, and Gestalt Completion) and the Otis reached significant levels.

The results presented in this section are discussed at length in the following section.

Table VII.-

Means, Standard Deviations, Ranges, and t Values for the Extreme Groups
of Field Independent (FI) and Field Dependent (FD)
Female Subjects for Age and the RFT.

	FI			FD			t Value
	Mean	S.D.	Range	Mean	S.D.	Range	
Age	27.38	11.16	16-46	28.13	10.86	17-52	.14
<u>RFT</u>	1.89	.59	.6-2.4	18.65	6.37	10.6-26.1	7.42*

N = 16

* = $P < .01$

Table VIII.--

Means, Standard Deviations, Ranges, t and F_p bis Values
for the Extreme Groups of Field Independent (FI) and Field Dependent (FD)
Female Subjects for All Tests of Mental Ability.

Test	FI		FD		t Value	r
	Mean	S.D.	Mean	S.D.		
<u>Otis</u>	121.25	8.41	102-130	3.66	4.09*	.74
<u>Aud. N.S.</u>	10.86	3.72	7-18	2.75	1.07	
<u>Match P.</u>	12.00	3.40	6-16	3.82	3.25*	.66
<u>Find. A's</u>	63.50	9.89	47-77	9.08	1.11	
<u>Nons. Syll.</u>	16.13	3.05	10-20	6.92	1.83	
<u>Ident. Pic.</u>	70.75	11.63	57-89	16.65	1.77	
<u>Additions</u>	53.63	11.93	38-69	16.13	1.01	
<u>Hidden Fig.</u>	11.75	7.99	2-27	4.37	2.02	
<u>W-R Vocab.</u>	33.00	8.54	20-48	9.98	1.44	
<u>Word Comb.</u>	15.00	4.28	7-22	4.43	2.41**	.29
<u>Postal C.</u>	13.38	4.10	9-19	3.25	2.64**	.33

N = 16

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

4. Discussion of the Results.

In this section the presentation will first involve the results of the male subjects followed by a discussion on the results of the female subjects.

When the two modes of field approach were based on the division of the RFT ranked scores in half, the null hypotheses could not be rejected for any of the tests with the exception of the Additions Test. In this test the field dependent subjects obtained significantly higher scores ($P < .05$) than the field independent subjects. On one other test, Auditory Number Span, the means for the two groups were identical.

On these two tests, the tasks require the subjects to respond to numerical figures and to manipulate them in concrete fashion, that is, either by repeating a series of numbers in writing or simply by adding columns of figures. There is no apparent embedded quality nor demand to get involved in higher level mental gymnastics. Furthermore, this kind of activity is fairly common to nearly everyone and might even be considered as routine. On the other hand, the other tests are by no means common to everyone's experience and certainly not routine. In fact, as mentioned by a number of subjects, many of the tests involved an element of frustration in that the solutions to the tasks were obscured, hidden, or required some higher level "figuring." If this

line of reasoning can be assumed to be true and widespread, the Additions Test and perhaps the Auditory Number Span may not have intrigued or challenged the field independent subjects, while the field dependent subjects tackled these tests with more relish, particularly when contrasted to the frustrating aspects of the other tests. Although it may be entertained that in a given series of tests the chances of reversal of direction between the means for a task may occasionally be expected, it might be argued that the test on which the field dependent group could do better would most likely be on a routine and concrete task. However, the discussion on the Additions Test must be considered, for the present, speculative. The size of effect ($r_p \text{ bis} = .32$) is not high enough to expect any significant consistent trend.

Although no statistical support for either Witkin's stand or his critics' could be stated on the other tests in the battery, an inspection of the magnitude of the t values as well as the consistently higher scores obtained by the more differentiated group suggests that the more capable performance on intellectual tasks tends to be associated with a more differentiated approach.

The lack of significant differences may be related to several factors. One obvious factor is the relative homogeneity of a "captive group" as college students. For example, although the two groups based on the division of the

RFT scores were significantly different, the obtained means represent a fairly narrow range of scores. In fact, the combined mean for both groups is only 4.07 as compared with 7.4 in Witkin's sample.¹⁶ In this regard, within does not define field dependency in terms of cut-off scores on the RFT which may lead to some confusion as to whether or not a given set of data is really a reflection of a field dependent approach. In other words, two points on a continuum may be significantly different from each other, but in terms of the continuum itself, they may both represent, in a manner of speaking, the "same side of the coin."

Another possible reason for the non-significant results may be related to motivational factors. In view of the fairly extensive exposure to testing it seems likely that some effect on motivation could be expected. As mentioned earlier, a number of the subjects felt "frustrated" by the tests and some even complained bitterly of being "used as guinea pigs." In this regard, although the reliabilities based on internal consistency of the tests were adequate, one can not help but wonder about the stability of performance over a period of time and more particularly, the possible cumulative effect of "disgruntled" subjects.

Other factors may be related to the size of the N. In dealing with a relatively small N, the size of effect

¹⁶ Witkin, et al., Op. Cit., p. 156.

must necessarily be larger in order for differences to reach significant levels. Too, by dividing the RFT ranked scores in half rather than utilizing extreme scores, it would tend to minimize the size of effect. For these reasons, by increasing N, significant levels should be reached.

Comparison of the two groups based on extreme scores shows differences in the expected direction for the tests "weighted" with analytic ability (Match Problems, Hidden Figures, and Word Combinations) at the $P < .05$ level of significance. However, two other tests, Identical Pictures and Gestalt Completion, also significantly differentiated the two modes of field approach (both at the $P < .01$ level of significance). Corresponding size of effect (degree of relationship between RFT and the intellectual task) ranges from .45 for the Match Problems to .69 for the Identical Pictures. The magnitude of these coefficients lends support to the observation that the more differentiated the subject the higher the likelihood that he would obtain higher scores on these tests. Interestingly, the possible reasons for the significance of the two tests may be argued from both Witkin's and his critics' points of view.

It will be recalled that the Identical Pictures Test requires the appropriate selection from several pictures of objects that match the reference picture. Although it was initially considered by Thurstone to tap the ability

to overcome embeddedness, Guilford considered perceptual speed to be more appropriate to this test rather than embeddedness since the items were so easy that if the subject had sufficient time he would be expected to complete all items with almost no mistakes. From this point of view it may be argued that perceptual speed is indeed separate from the ability to overcome embeddedness. Furthermore, from a "general ability" standpoint, it could be expected that the more capable subjects would be expected to do better on most intellectual tasks as witnessed by the consistently higher scores on nearly all tests obtained by the more differentiated group. Additional support of the "general intelligence" approach may be reflected in the significant differences in Otis I.Q.'s. On the other hand, Witkin's camp may offer the argument that perceptual speed in overcoming embeddedness, simple as it may be is part and parcel to the analytic ability. In view of the longer time required by the field dependent subjects to "pull out" the embedded figures in the EFT analytic ability does seem to involve a spontaneous or relatively quick response to the test stimulus. If this line of reasoning was followed, it seems that the Identical Pictures Test does have an embedded quality incorporated into the perceptual speed factor.

With regard to the Gestalt Completion Test, it will be recalled that it requires the subject to identify as

quickly as possible objects or words presented in silhouette figures with parts of objects or words blotted out. It was previously stated in chapter one that "speed of closure" differed from "flexibility of closure." Where Gestalt Completion-type tests emphasized speed, no significant relationship existed between the test and RFT, but on tests where "flexibility" was primary, a significant relationship was demonstrated. On this basis it was proposed that this test with its time element did not tap "flexibility." However, it was observed that nearly all the subjects had time to ponder over the solution and even to go back over some of the items. For this reason, it is suggested that Witkin may very well have a point if he should insist that the Gestalt Completion does, in fact, emphasize flexibility rather than speed of closure.

On the other hand, it may be argued that higher scores on the Gestalt Completion, as with most of the other tests, reflect "general intellectual abilities." In view of Guilford's¹⁷ statement about the factorially complex nature of mode of field approach, this argument may be tenable.

The significant differences obtained with the split-half RFT scores for the Additions Test were not reached with the extreme groups' comparison, although the direction is the

17 J.P. Guilford, The Nature of Human Intelligence, New York, McGraw-Hill, 1967, p. 180.

same. The lack of significance in this instance may be due to the relatively small N. If the comments regarding the routine and concrete aspects of this test are tenable, particularly as related to the response style of field dependent subjects, further research is needed to clarify this issue.

Finally, from an over-all inspection of Table IV, it would appear that although extent of differentiation is related to certain intellectual tasks more than others, there is an undeniable consistency in the field independent subjects to obtain higher scores not only on tests of "general intelligence" but on specific intellectual tasks as well. The evidence, however, is not definitive and requires further research. In particular, the size of N may have contributed to the lack of significance for some of the tests. Too, a more heterogeneous group of subjects with respect to range of differentiation and intelligence may give more definitive results.

The following discussion will be devoted to the results obtained for the female subjects. When comparisons between means were based on the division of the ranked RFT scores in half, the null hypotheses could not be rejected except for the Otis and the Gestalt Completion. On these two tests, significant differences ($P < .01$) were obtained with the direction of the differences favoring the field

independent subjects. In fact, on all tests, the field independent subjects obtained higher scores than the field dependent subjects. In this regard, the results tend to parallel the findings obtained for the male subjects with the differences primarily being one of magnitude of the t values.

The difference of magnitude of the t values between the sexes may be a function of the factors attributable to sex differences. However, this remains highly speculative at this point since sex differences were not investigated.

In terms of the non-significant results, what has been stated for the male subjects also seems applicable here. In summary, the relative homogeneity of the subjects, particularly with respect to their AFT scores (combined group mean of 8.33 as compared with 11.00 in Witkin's sample¹⁸), the small N , and possible motivational factors may have been involved.

Comparisons of extreme groups resulted in significant differences on three of the Guilford tests (Match Problems, Word Combinations, and Gestalt Completion) and on the Otis with size of effect ranging from .29 for the Word Combinations to .74 for the Otis. The size of effect for the Word Combinations and Gestalt Completion ($r_p \text{ bis} = .33$) is not high

¹⁸ Witkin, et al., Op. Cit., p. 156.

enough to expect any significant consistent trend. In general, however, the relatively high increase in the magnitude of the t values suggests that the more differentiated approach tends to be associated with higher intellectual abilities. It seems quite possible that with a substantial increase in N the differences between the means may reach significant levels.

Although the general results of the female subjects tend to parallel the findings of the male subjects, some differences are evident. For example, in the extreme groups the Hidden Figures Test did not significantly differentiate the two modes of field approach for the female subjects. In view of the noted sex differences, it may be expected that on tasks heavily "weighted" with analytic ability the size of effect would tend to be less for the female subjects. However, because of the comparable and consistent direction of the differences, it would seem that a comparison between the sexes would be, to some extent at least, a difference of degree.

On the other hand, it seems that some allowance should be made for a difference of "kind." For example, it is commonly proposed that females tend to do better on verbal skills than males. A comparison between the sexes on the Wide Range Vocabulary and on the Otis, which is relatively

heavily weighted with verbal skills,¹⁹ tends to support this view. On both tests the female subjects obtained higher scores than their male counterparts. From a different position, Fiebert's study²⁰ also points to a qualitative sex difference. In investigating the nature of sex-related differences, he related measures of masculinity-femininity with the BFT and EFT. He hypothesized that within each sex the field independent subjects would tend toward the masculine end of the scales. While the overall relationship between cognitive style and the masculine-feminine battery was weak, particular subtests correlated highly with cognitive style, especially among the women. Inspection of the items showed that they were related to feelings of pity and disgust such as, "Do you feel sorry for a fish that is caught on a hook? Do odors of perspiration disgust you? Does it annoy you to see a person clean his fingernails in public?" From his findings he concluded that it is not femininity per se which is related to field dependent behavior, especially among females, but rather a particular dimension of the masculine-feminine scale.

¹⁹ Lee J. Cronbach, Essentials of Psychological Testing, New York, Harper and Row, 1960, p. 220-221.

²⁰ Martin Fiebert, "Sex Differences in Cognitive Style," in Perceptual and Motor Skills, Vol. 24, No. 3, 1967, p. 1277-1278.

In summary, even with the qualitative differences between the sexes, the evidence for the female subjects generally parallels the findings of the male subjects. Beyond what might be expected on the tests weighted with analytic ability the more differentiated subjects consistently perform at a higher level for the specific ability tasks as well as on general intelligence tests.

In retrospect, the findings of the present study do not allow for definitive statements either in full support of or against Witkin's position. There is evidence that perceptual differentiation is factorially complex and seems to be related to a number of diverse mental activities. There is also evidence that extent of differentiation is related to certain mental activities more than to others. Finally, there is some evidence to suggest that sex differences may be a difference of "kind" as well as degree as far as intellectual activities are concerned. Further studies relating extent of differentiation to specific intellectual tasks are needed before a more clear picture can emerge. Guilford's point that the field dependence-independence dimension appears to be factorially complex is well taken. Too, the tentative suggestions with respect to sex differences could be investigated.

SUMMARY AND CONCLUSIONS

In view of the existing controversy with regard to the relationship between intelligence and extent of differentiation it was proposed that an attempt at clarification should be made. Witkin et al. have suggested that what is common to intelligence tests and perceptual differentiation is "analytic ability" or the ability to overcome embeddedness. Others have suggested that this relationship exists because perceptual differentiation is but an extension of "general intelligence."

It was proposed that on factored tests of intelligence not weighted with analytic ability there would be no significant difference in the performance between field dependent and field independent subjects. Conversely, on tests weighted with analytic ability the field independent subjects were expected to obtain higher scores than the field dependent subjects. The following hypotheses were stated for the research:

- A. There is no significant difference between field dependent subjects and field independent subjects as rated on the RFT with respect to their performance on each of the following tests:

Gestalt Completion
Word Combination
Wide Range Vocabulary
Auditory Number Span
Match Problems
Hidden Figures
Additions
Identical Pictures
Finding A's
Nonsense Syllogisms

- B. There is no significant difference between field dependent subjects and field independent subjects as rated on the RFT with respect to their performance on the Otis Self-Administering Test of Mental Ability.

Because of demonstrated sex differences on tests of perceptual differentiation separate analyses of the female and male subjects' performances were made. The two modes of field approach (field independency, field dependency) were determined by dividing ranked RFT scores.

The obtained results in part supported Witkin's position in that on tests weighted with analytic ability, the field independent subjects for both males and females obtained consistently higher scores. However, evidence to support the contention that field independency seems to be related to general intellectual abilities was also suggested. The direction between the means was consistently in favor of the field independent subjects. The lack of significant differences on some of the tests was considered to be related to: (1) the small N, (2) the relative homogeneity of the subject pool, and (3) motivational factors.

In the final analysis, the results of the present study indicate the need for more research in this area, particularly with respect to the relationship between extent of differentiation and specific intellectual abilities.

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-----, The Nature of Human Intelligence, New York, McGraw-Hill Company, 1967, v-538 p.

Guilford's first major publication concerning his Structure of Intellect model of intelligence and his theoretical position regarding an informational approach to intellectual activities.

Hellkamp, David T., "Extent of Psychological Differentiation Among Hospitalized Male Schizophrenics Classified Along the Process-Reactive and Delusional-Hallucinatory Dimensions," unpublished doctoral dissertation, University of Ottawa, Ontario, 1967, vii-104 p.

The author's findings, that the RFT was positively related to general intelligence, and his pertinent questions about the relationship between extent of differentiation and intelligence, directly led to the formulation of the present study. More particularly, his section on the literature review dealing with the parameter of intelligence provided the impetus.

Witkin, H.A., H.B. Lewis, M. Hertzman, K. Machover, P.B. Meissner and S. Wapner, Personality through Perception, New York, Harper, 1954, xxvi-571 p.

The first major publication of Witkin and his colleagues. It is essentially a report of studies dealing with the field independence-dependence construct. Although much of the findings reported in this text have been summarized or updated in the more recent text, many original findings, particularly with adult subjects, are found only here.

Witkin, H.A., R.B. Dyk, H.F. Faterson, D.R. Goodenough and S.A. Kapp, Psychological Differentiation, New York, Wiley, 1962, xii-418 p.

The second major publication of Witkin and co-workers. An attempt is made in this text to unify the numerous studies dealing with the relationship between personality characteristics and field dependency under the principle of psychological differentiation.

Zigler, E., "A Measure in Search of a Theory," in Contemporary Psychology, Vol. 8, No. 4, 1963, p. 133-135.

A critical review of Witkin's 1962 text. Among other things, the author strongly criticized Witkin et al. for their explanation of the relationship between intelligence tests and field dependency. He suggested that field independency is but an extension of general intelligence.

APPENDIX

ABSTRACT OF

Extent of Psychological Differentiation
as Related to Intelligence

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ABSTRACT OF

Extent of Psychological Differentiation as Related to Intelligence

This study was initiated in an attempt to clarify the demonstrated relationship between intelligence and perceptual differentiation. On the basis of a number of studies Witkin et al. suggested the relationship between standard tests of intelligence and their measures of perceptual differentiation was due to the common denominator, analytic ability, or ability to overcome embeddedness. Critics of this view point to the relationship between Witkin's analytic ability and general intelligence, thereby suggesting that perceptual differentiation is but an extension of general intelligence. Support for both points of view was obtained from factor analyses of standard tests which resulted in some confusion since the items within these tests tended to correlate with each other as well as having a relationship with the composite I.Q. score.

In order to clarify this issue it was proposed that specific ability tests be used as well as a standard test

1 Kerry T. Yamada, doctoral thesis presented to the Faculty of Psychology of the University of Ottawa, Ontario, March 1968, viii-100 p.



of intelligence. It was suggested then that on tests weighted with analytic ability the more perceptually differentiated subjects would obtain higher scores while on tests not weighted with analytic ability no significant difference would be expected between the more perceptually differentiated and the less perceptually differentiated.

The subject pool included forty males and thirty-four females. The two sexes were studied separately because of the consistent findings of sex differences on perceptual differentiation tasks. The subjects were divided into the more differentiated or less differentiated groups on the basis of their ranked mean error scores on Witkin's Rod and Frame Test.

The results for both males and females lend partial support for Witkin's theoretical position, although evidence was cited to indicate the consistent but not always significant superiority of the more differentiated group on the selected tests of intelligence. The lack of significance was discussed in light of the small N, the relative homogeneity of the subjects, and motivational factors.

