PROBLEM SOLVING AS A FUNCTION

OF FIELD DEPENDENCE IN MEN AND WOMEN

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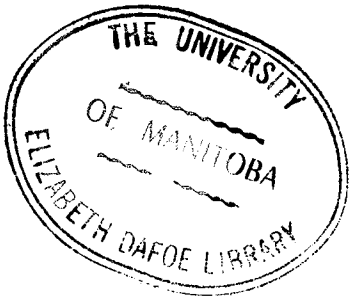

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ABSTRACT

Individual differences in analytical ability have been found in perception, and have been referred to as field dependence-independence by Witkin and his associates. The dimension of field dependence-independence has been reported to bear some relationship to problem solving ability. Various studies have shown that males tend to be more field independent than females, and corresponding sex differences have been reported on some problem solving tasks.

In a study by Harris (1962) it was reported that the ability to solve "insight" problems was positively related to field dependence, as measured by the embedded figures test. As the sex of the subjects was not specified, this relationship might have been confounded with sex differences.

The purpose of the present study was to provide a test of Harris' findings, while controlling for sex differences in both problem solving and field dependence. Two measures of field dependence (embedded figures test and rod and frame test) were employed, as well as two Duncker problems and an anagram solving task. Sex differences on the two problem solving tasks were investigated, and an attempt was made to determine the relationship between problem solving and field dependence, while controlling for sex of the subjects.

It was concluded from the results that the type of problem solving involved in the anagram task bears some relationship to field dependence, while the relationship between anagrams and Duncker problems was slight. Solution of Duncker problems was found to be related to field dependence. Sex differences were found only for the Duncker problems, with men being superior in problem solution.

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CHAPTER I

INTRODUCTION

It is common knowledge that individuals differ in their physical and psychological characteristics; yet, despite the obviousness of this fact, it was not until the early part of the nineteenth century that scientists became aware of the widespread significance of individual differences.

In 1796, Maskelyne, who was the astronomer royal at the Greenwich Observatory, dismissed Kinnebrook, his assistant, because Kinnebrook consistently measured the times of stellar transits almost one second later than did Maskelyne. It was assumed by Maskelyne that his assistant's observations were "errors" due to the use of some irregular and confused method, and it was not until some forty years later that Bessel, another astronomer, challenged the view that Kinnebrook's observations were "in error". Bessel showed that there were highly consistent differences between individuals in reaction times and that, indeed, one could calculate "personal equations" for individual observers (Boring, 1957). Within this notion of a personal equation lay the germ of the present day concept of perceptual style.

The realization of the prevalence of individual differences in behaviour triggered off intensive work on the part of psychologists in the area of measurement of abilities. This widespread emphasis on abilities, however, resulted in the fact that individual differences in perception were overlooked. But there were some scattered attempts to define consistencies of perceptual functioning and to relate these to the personality of the individual. For example, in 1906, Wiersma investigated the critical flicker frequency (CFF) in normal, manic and melancholic patients by means of a rotating red and green colour disk. His results showed that manics exhibited a substantially higher CFF than normal individuals and that the melancholic patients exhibited slightly lower than normal CFF's.

Another early study which suggested distinct modes of perception was conducted by Benussi (1914). He presented the Muller-Lyer illusion tachistoscopically, and reported two types of responses. One group of Ss experienced the Muller-Lyer illusion with short exposure times, while the other group of Ss required longer exposure times. On the basis of these results, Benussi postulated an analytic perceptual mode, in which persons

reacted to parts first and required time to perceive the whole; and a synthetic mode in which the whole is perceived first, and time is required to perceive the parts. Benussi did not pursue this line of research, but other investigators, such as Kretchmer (1948) postulated a similar kind of dimension. Kretchmer proposed the concept of dissociation-integration. Dissociation refers to the ability to dissect complex material into its constituent parts, while the absence of this ability (integration) results in perceptions that tend to be more concrete.

An early investigation which provided an empirical basis for an analytic-synthetic dimension of perception was carried out by Thurstone (1944) in a factor analytic study. Thurstone included a number of perceptual measures which, on the basis of their structure, appeared to involve analytic-synthetic or dissociative-integrative abilities. These tests were the Gottschaldt Figures, Shape Constancy, Space Perception, Brightness Contrast and Hidden Digits. Analysis indicated that all these tests had high saturation on a factor representing the ability to form closure in a given presentation, especially against a background of distraction. Other tests, such as the Street Gestalt Completion, and Mutilated Words, which structurally appear to involve integrative ability, also had some saturation on this factor, but to a lesser degree. These results pointed to the presence of an underlying factor contrasting analytic and synthetic modes of perception.

The Concept of Perceptual Style

Personality develops as the child acquires percepts of the various aspects in his environment. Goals may be seen as positive or negative, and responses are developed in relation to these goals. Cattell (1950) proposed that once a percept was established, it tends to resist change. Therefore a person who has acquired a certain percept will behave consistently when this percept is evoked by a stimulus in the environment, or by similar stimuli (stimulus generalization).

Stagner (1961) criticizes this approach to personality in that it would seem that all personalities develop in the same manner. Thus the concept of personal style was proposed to account for the uniqueness of the individual.

Personal style involves a characteristic pattern of perceiving or of responding (Stagner, 1961). This paper is limited to a consideration of perceptual style, involving individual differences in modes of perceiving.

The psychologist who clearly saw the relevance of perception for personality was George S. Klein (1951). Klein recognized that personality involved both universal and unique aspects:

> " The organism continually wrestles with and seeks equilibrium between two sources of tension, its inner strivings and the demands of reality... Perception lends itself to this (use) by virtue of its 'adaptive' properties. But these properties, common to all perceivers, are employed idiosyncratically, the personal styles in using them for reality appraisal, I have called perceptual attitudes. " (p.138)

As the term "attitude" in regard to perception is rather confusing, the term "perceptual style" has been substituted, while Klein's meaning of the term is retained. From Klein's work, it can be concluded that individuals develop characteristic ways of handling sensory input, regardless of sensory modality or content. This "perceptual style" seems to be a significant source of unity and consistency within the personality. Thus a characteristic perceptual style may be considered to be a means of distinguishing between different personalities.

Klein described two major types of perceptual style, i.e. leveling-sharpening and intolerance of ambiguity. In regard to the dimension of leveling-sharpening; levelers tend to overlook changes in stimuli, while sharpeners are sensitive to changes. An early study of this dimension was that of Holzman and Klein (1956), im which Ss were required to judge the size of squares.

Initially, only squares ranging from 2 to 6 inches were presented. After several presentations of these squares, the smallest square (2 inch square) was omitted from the stimuli and a 7 inch square was added. After a few presentations of these stimuli, the 3 inch square was omitted and an 8 inch square was added. In this manner, the stimuli presented for judgement were gradually increased in size, while a constant range of stimuli was maintained. The S was unknowingly forced to deal with gradually changing sets of stimuli. Ss who developed a set for a given size and repeatedly made the same judgement even when it was no longer correct were classified as levelers. Thus when the 2 inch square was omitted, they would judge the 3 inch square as 2

inches, for it then became the smallest in the set of stimuli. Ss who were more accurate in their perception and changed their estimates as the stimuli changed were termed sharpeners.

Klein found that levelers performed poorly on the Gottschaldt figures, which involve finding a simple figure embedded in a complex design. Levelers also reported less contrast in judging figures varying in brightness, and they had difficulty finding hidden faces in puzzle pictures.

In regard to personality traits, Stagner (1961) suggests that levelers tend to overgeneralize from past to present situations. Stagner noted that patients described by therapists as passive, dependent and self-abasive frequently behaved like levelers in perceptual tasks.

The leveling-sharpening dimension is similar to the concept of rigidity. Related to Klein's work are studies cited by Luchins (1951) using the Einstellung test. The S is given a number of problems which may be solved by a far simpler method. The S who persists in using the more complex method would appear to be related to Klein's levelers.

Another dimension of perceptual style which Klein postulated was referred to as "resistance to instability". This was studied using the apparent-movement phenomenon, in which two lights are flashed in succession, and the light appears to move through space. Some Ss resist the perception of movement in this situation, and also when different visual stimuli are used. It was also demonstrated that Ss resisting instability in this experiement also resisted perception of movement on the Rorschach test (Klein and Schlesinger, 1951).

Witkin's Dimension of Field Dependence - Independence

The relationship between personality and perception has been subjected to extensive study by Witkin and his associates (1948, 1949, 1950, 1952, 1954, 1959, 1962). Witkin initiated his research with the problem of determining factors responsible for the maintenance of proper orientation to the upright in space. Witkin and Asch (1948) found that when a strong visual field is present, the perceived upright is determined with relation both to the axes of that field and to impressions received from the body, with visual factors playing a dominant role. Most striking were the wide and highly consistent individual differences observed in the extent to which Ss depended on

visual rather than kinesthetic functions when the two sources of information were in conflict. At one extreme, the Ss relied almost exclusively on the visual field; while at the other extreme, Ss relied almost entirely on bodily experiences, disregarding the visual field. Witkin termed the former Ss "field dependent" and the latter "field independent", and thereafter directed his research to the problem of determining why such marked individual differences occurred in field dependence.

A series of experiments were carried out with three major problems in mind. The first was to determine the pervasiveness of field dependence and its stability through time. The second was to ascertain the sequence of factors entering into spatial orientation as the individual develops; and the third, to study the relationship between an individual's characteristic way to perceiving and his general personality organization.

Tests Of Field Dependence. A number of tests of field dependence were employed in Witkin's research. They included the embedded-figures test (EFT), the tilting-room-tilting-chair tests (TRTC), and the rod and frame test (RFT). The EFT, developed by Witkin (1950) was an elaboration of the figures originally developed by Gottschaldt (1924). It consisted of 24 complex figures and 8 simple figures. Each complex figure contained one of the simple figures, which was embedded so as to be perceptually obscured. All but one of the complex figures were coloured in a manner which reinforced a given pattern and further obscured the simple figure. The simple figures were all uncoloured. Witkin and his colleagues argued that successful performance depended on the ability to deal with a given configuration analytically, i.e. to separate the item from the field.

The TRTC tests evaluated the S's perception of the position of his body and of the surrounding field in relation to the upright. This test was composed of two parts; the room adjustment test (RAT) and the body adjustment test (BAT). The RAT consisted of 8 trials, 4 in which the room and chair were tilted to opposite sides and four where they were tilted to the same side. On each trial, E moved the room according to the S's instructions to a position which the S perceived as upright. The BAT involved 3 trials in which the room and the chair were tilted to the same side and 3 in which they were tilted to opposite sides. The S moved the chair to the apparent

upright position.

The RFT evaluated the S's perception of an item within a limited visual field in relation to the upright. In this test the S was placed in a darkened room facing a luminous frame which surrounded a moveable luminous rod. With the frame tilted, he was required to bring the rod to a position which he perceived as upright. For successful performance of this task, the S was required to extract the rod from the tilted frame with reference to body position. On some of the trials, the S was sitting erect, while on other trials he was tilted, making it more difficult to use the body. A field dependent S reported the rod to be straight when in reality it was considerably tilted.

Reliability Of Tests. Subsequent research showed that the tests cited above are highly reliable. Test-retest correlations were obtained by Bauman (1951) and Dana and Goocher (1959). With a three year interval between test-retest, Bauman's correlations were as follows: RFT, r = .84 for males and .66 for females; BAT, r = .77 for males and .74 for females. Dana and Goocher reported a correlation of .92 for the EFT, with an interval of one week. Split-half reliabilities were still higher. Linton (1952) and Loeff (1961) reported correlations between .84 and .90 for the BAT. Corrected odd-even correlations between .88 and .92 were obtained for the EFT by Linton (1952), Longnecker (1956), Gardner, Jackson and Messick (1960) and Loeff (1961), respectively. These correlations are sufficiently high to indicate that the tests used by Witkin and his associates to measure field dependence yield consistent results.

Intercorrelations Among Tests. Early work by Witkin and his associates, as well as other investigators, established the fact that the various measures of field dependence described above were correlated with each other. In 1962, Witkin et al., summarized the research on the intercorrelations among the tests of field dependence. The intercorrelations were reported by Witkin et al. (1954); Gruen (1951, 1955); Linton (1952) and Epstein (1957). The correlations among the scores for the RFT, EFT, and BAT were predominantly significant, suggesting the generality of the field dependence dimension among these measures. However, correlations of the RAT with other measures

were lower, and frequently insignificant. Witkin et al.(1954) explained this by stating that the perceptual processes involved in the RAT differ from those involved in the BAT, RFT, and EFT. The latter tests require separation of elements from the field in which they are embedded; whereas the RAT requires the S to evaluate the position of the field itself. Because of these considerations, Witkin and his colleagues did not use the RAT in deriving an index of field dependence.

In summary, it can be stated that the RFT, the EFT, and the BAT are all reliable tests which appear to measure a factor which involves the ability of a person to overcome an embedding context in a perceptual situation.

Field Dependence and Problem Solving

One question that immediately arises is whether the ability to overcome an embedding context is limited to perceptual tasks, or is a more general cognitive ability. The possibility that field dependence is a more general ability is raised by a consideration of Wertheimer's (1945) conception of the processes involved in problem solving. Wertheimer suggested that intellectual problems which call for a high degree of creative activity may often involve the ability to separate parts from the context in which they are embedded, and to bring these parts within new relationships. Witkin et al. (1954) went on to argue that if a person possesses the basic ability to "break up" a configuration, it will probably be manifested in problem solving situations, as well as straightforward perceptual situations.

Insight Problems. One of the earliest investigations which showed a relationship between field dependence and problem solving was carried out by Guilford et al. (1952, 1955a, 1955b, 1957) in a series of factor analytic studies. Guilford identified a factor which he called "adaptive flexibility". The types of tests that loaded highly on this factor were: insight problems similar to those used by Duncker (1945); match problems, involving the extraction of triangles or squares from a lattice design; an adaptation of Thurstone's Hidden Pictures Test; and an adaptation of Thurstone's Gottschaldt test.

What is of major interest here is the fact that the Thurstone Gottschaldt and the EFT (a measure of field dependence) both use a modification of

Gottschaldt's original figures, with S required to locate a simple figure embedded in a complex one. A high relationship between these tests would therefore be expected, and, indeed, such a relationship has been demonstrated. Witkin et al.(1954) Phillips et al.(1957) and Goodman (1960) all assessed that relationship between the EFT and the Thurstone Gottschaldt and reported correlations ranging from .46 to .77. Further evidence that the Thurstone Gottschaldt provides a measure of field dependence is provided by the finding that the RFT (another measure of field dependence) is also related to the Thurstone Gottschaldt. Correlations ranging from .27 to .55 between these two tests have been reported by Rudin and Stagner (1958), Crutchfield et al. (1958) and Goodman (1960). Finally, it was noted that Goodman also obtained a correlation of .42 between the Gottschaldt and BAT scores. Thus, it appears reasonable to argue that the ability to solve insight problems is related to the dimension of field dependence.

Additional evidence that problem solving is related to field dependence comes from a study reported by Witkin et al.(1962). These investigators administered nine tests, five of which are important for the relationship between field dependence and problem solving. The five tests included the EFT, the RFT, the BAT, 12 of Guilford's insight problems and 18 of Guilford's match problems. Thirty-one college men served as Ss. The intercorrelations obtained by Witkin are shown in Table 1.

Table 1

Intercorrelations Among Measures

of Field Dependence and Problem Solving

Test	EFT	BAT	Match Problems	Insight Problems
RFT	.86**	.75**	.55**	.40*
EFT		.74**	.60**	.58**
BAT			.27	.37*
Match Problems				.51**
Insight Problems				

* significant at .05 level
** significant at .01 level

It is clear from this table that there was a substantial relationship between the measures of field dependence and the two tests of problem solving ability. It is of interest to note that the EFT provided the highest correlation with the problem solving tasks, while the BAT produced the lowest correlations.

A study by Harris (1962) provided evidence that field dependence is related to one measure of problem solving. Harris employed two of the problems Duncker (1945) developed in his study of functional fixedness. Duncker selected his problems so that Ss used familiar objects in unfamiliar ways. Two examples of Duncker problems are the box problem and the pliers problem. In the box problem, S is given 3 candles and asked to affix them to a door at eye level. In the experimental room are located various objects, some of which are irrelevant to the solution of the task. The objects included three small cardboard boxes filled with matches, thumb tacks, and paper clips. Correct solution involves tacking the boxes to the door to serve as a platform for the candles.

In the pliers problem, a shelf must be constructed consisting of a board resting on two supports. Two boards, nailed together, and a pair of pliers are on a table in the room. To solve the problem, S must use the pliers to remove the nail, and employ the pliers and one board as supports for the remaining board.

It appears that the familiar function of an object provides a context which interferes with finding and utilizing an unfamiliar function for solution of the problem. Presumably, those Ss who can quickly overcome the embedding context of familiar solution would solve the problem more readily. Harris put this hypothesis to a test. She administered the EFT, the Kohs' Block Design Test, the pliers problem and the box problem to a sample of Ss. She then classified Ss in two ways. Ss were classified into the 13 most field dependent and the 13 most field independent. A similar classification was carried out into those Ss solving both Duncker problems and those solving neither Duncker problems. The results were quite striking, for of the 13 most field independent Ss, 12 solved both problems and one failed both problems. Of the 13 most field dependent Ss, 11 failed both problems and 2 solved both problems.

Einstellung Problems. A second type of problem solving situation which has been related to field dependence is Luchins' Einstellung or water-jar problem. As outlined by Luchins (1951), the task involves three jars (A,B, and C), for each of which the volume is specified. The problem is to obtain a specified quantity of water in one jar. For example, A may contain 21 quarts; B, 127 quarts; and C, 3 quarts. The problem is to obtain 100 quarts of water in one jar. For solution, one must fill the 21 quart jar once and the 3 quart jar twice from the jar containing 127 quarts of water. Thus there remains 100 quarts of water in one jar. The correct solution is designated B-A-2C.

The entire test includes 5 successive problems which induce the set solution B-A-2C. Two critical problems are then presented which may be solved either by the set method or by a more direct method (A-C or A+C). Finally, an extinction problem is presented which is solvable only by the direct method.

The 5 set inducing problems could be considered as an experiential context in which the extinction problem is presented. Thus it seems reasonable to contend that those Ss who can overcome the experiential context would grasp the solution more readily. Thus a relationship would be expected between field dependence and speed of solving the extinction problem. Studies by Fenchel (1958) and Goodman (1960) are directly relevant here. These investigators assessed the relationship between speed of solving the extinction problem and one of the traditional measures of field dependence.

Fenchel (1958) tested 63 outpatients in a Veterans' Administration Clinic on the extinction problem of the Einstellung test and the EFT. He found a significant correlation of .36 between the two scores. Goodman (1960) administered (among other tests) the EFT, the RFT, the BAT, and the Einstellung Test to college students. The performance of Ss on both the critical problem and the extinction problem was analyzed. Results indicated that there was no difference in performance on the 3 measures of field dependence between Ss who solved the critical problem by the long method, and those who solved it by the short method. However, time to solution of the extinction problem was related to field dependence. The correlation between the EFT and extinction problem was significant, while correlations

between the extinction problem and the BAT and RFT were in the expected direction, but were not significant.

Anagram Solving. Ammons and Ammons (1959) stated that anagram tasks appear to be one of the most satisfactory methods of studying the processes involved in problem solving. In a typcial anagram task, S is given a letter combination such as "MDEA" and asked to construct as many English words as he can. Various restrictions (e.g. no proper nouns) are placed on the Ss. Thus, in the letter combination "MDEA", the words "a", "mad", and "dame" would be correct, while "Mae" would be incorrect.

An early study which assessed the effects of a field dependent style on anagram solution was that of Bloomberg (1965). Ninety-two undergraduate males were administered a short version of the EFT. They were also presented with 2 sets of anagrams, each containing 15 scrambled words. Each anagram had 5 letters, and formed only one correct English word. Two scores only were derived: the total number of correct solutions, and the total number of incorrect solutions. The Spearman rank-order correlation between EFT time and correct words was - .14, indicating a tendency for Ss who solve the EFT in a short time to produce more correct solutions. The correlation between the EFT and number of incorrect solutions was .28 ($p < .01$), which indicates that those Ss who solved the EFT quickly produced fewer errors. As the correlation between EFT and anagram solution was not significant, Bloomberg concluded that field dependent persons are as capable of solving anagrams correctly as field-independent persons.

A second experiment which bears on the relationship between field dependence and anagram solving was conducted by Mendelsohn, Griswold and Anderson (1966). Ss were administered the Crutchfield adaptation of the Gottschaldt Figures Test. Their task was to locate and trace a simple figure embedded in a larger, more complex figure. Twenty complex figures were presented, with a time limit of 4 minutes. The score was the total number of simple figures correctly located. Ss were also given 30 anagrams, with the score being number of correct solutions. The authors reported a significant correlation of .39 between performance on the Gottschaldt and number of correct anagram solutions. Since the Crutchfield adaptation of the Gottschaldt figures appears similar to the EFT, this study supports the

hypothesis that anagram solving ability is related to field dependence.

Analytical Functioning and Intelligence

Wertheimer (1945) stated that intellectual problems calling for a high degree of creative activity, although not involving perception directly, often require that parts be separated from the context in which they are embedded, and brought into new relationships. Thus Witkin et al.(1954) felt it probable that if a person has this ability to "break up" a configuration, it will be manifested in problem solving situations as well as straightforward perceptual situations.

Woerner and Levine (1950) found a significant relationship in a group of 12 year old children between scores on Witkin's perceptual battery and scores on the Wechsler Intelligence Test for Children (WISC). However, as perceptual measures were more related to WISC performance scores than to verbal scores, it appears likely that aspects of intelligence involving analytical ability contribute heavily to the relation between perception and intelligence.

Working with a group of ten year old boys and girls, Witkin et al. (1962) reported results supporting those of Woerner and Levine using the 1937 Revised Stanford-Binet Intelligence Scale. Witkin also reported a significant relation between WISC I.Q. and perceptual index scores for boys at ten and 12 years. For a group of 12 year old girls, the relation was in the expected direction but was not significant.

Witkin et al. carried out a factor analysis between scores on the perceptual tests and WISC subtest scores, and derived a factor termed analytical field approach. Tests with high loadings on this factor included 3 measures of field dependence; RFT,EFT, and Bat, and 3 performance subtests on the WISC (Block Design, Picture Completion, and Object Assembly). A "job analysis" of the 3 subtests suggested that effective performance on all of them requires the overcoming of an embedding context. The high loadings of the subtests on the same factor as the perceptual tests led Witkin et al. to conclude that:

> " There is a general cognitive style which runs through perceptual and intellectual functioning. This finding also suggests that this common cognitive style underlies the observed relation between extent of field dependence and performance on standard tests of intelligence." (p. 69)

Support for Witkin's conclusions is provided by Karp (1962) in a factor analytic study. Karp used 150 male college students as Ss, and administered the BAT, EFT (short form), RFT, and 7 subtests of the Wechsler Adult Intelligence Scale (WAIS). An analytical ability factor was derived which loaded on BAT, RFT, EFT, Block Design and Object Assembly.

In another study reported by Witkin et al.(1962), the following tests were administered to 31 college men: BAT, RFT, EFT, Guilford's Match Problems, Guilford's Insight Problems, and 4 WAIS subtests (Block Design, Picture Completion, Vocabulary and Comprehension). The 3 measures of field dependence correlated significantly ($p < .01$) with the Picture Completion and Block Design subtests of the WAIS, while correlations with the verbal subtests were low. Insight problems and Match problems correlated significantly with the two performance subtests ($p < .05$).

Rosenfeld (1959) found a significant negative correlation between field dependence measured by the EFT and mathematical ability i.e. the poorer mathematics Ss were more field dependent and the better Ss were more analytic and independent in their perception.

Sex Differences in Field Dependence and Problem Solving

The evidence outlined above strongly supports the conclusion that tasks which involve the perceptual ability to extract relevant information are predictive of performance in tasks which require the ability to solve problems. In many of the studies cited, however, there is a complicating factor which has not been adequately considered. This factor is the sex of the Ss.

There is considerable evidence to indicate that sex differences in both field dependence and problem solving exist. In his early studies with the RFT and EFT, Witkin found women to be more field dependent than men. For example, on the RFT, if the frame was tilted to the left of true verticality, women Ss tended to set the rod further to the left of true verticality than men. In addition, women took longer to complete the EFT than men. A number of studies with the RFT and EFT (or Thurstone Gottschaldt) have confirmed the finding of Witkin and his associates that women tend to be more field dependent than men (Newbigging,1952, 1954; Miller, 1953; Wit, 1955; Gump, 1955; Andrieux, 1955; Franks, 1956; Bennet, 1956; Zukmann, 1957; Seder, 1957; Young, 1957; Carden, 1958; Bieri, Bradburn and Galinsky, 1958;

Chateau, 1959; Gross, 1959; Fink, 1959; Pollack, 1962; Korchin, 1962; Goodnow, 1962; and Kato, 1965). Research on sex differences on the BAT, another measure of field dependence, has been minimal, possibly due to the complexity of the equipment. However, Witkin (1954) reported that young women were more field dependent than men on this test.

Several studies also indicate that men differ from women in problem solving ability. In 1933, Maier tested both men and women on 3 types of insight problems; the two string problem, the hat rack problem, and the candle problem. In the two string problem, one string was fastened to the ceiling and reached the top of a table. Another string, which reached to the floor, was attached to a wall about 6 feet above the floor. The problem was to tie the 2 strings together, although when one string was held, the other was out of reach. The correct solution was to convert one of the strings into a pendulum.

The hat rack problem required the S to construct a hat rack strong enough to support a heavy coat. The only available useful materials were two poles, 6 to 7 feet in length, and a table clamp. The problem could be solved by clamping the 2 poles together and wedging them between the floor and the ceiling. The clamp could be used as a coat hook.

The candle problem involved 3 lighted candles which had to be put out from a distance of 8 feet. Glass and rubber tubing, varying from 6 to 12 inches long, was available. The tubing could be fastened together and attached to a pole to extinguish the candles.

One of the major findings reported by Maier were large and consistent sex differences. Men were superior to women in problem solving ability. These results were subsequently confirmed by Judson (1956) and Staats (1957). Staats employed the two string problem and Judson used both the two string problem and the hat rack problem. In both studies, it was reported that women produced fewer correct solutions than men. Billings (1934) also reported large sex differences. Ss were given problems to solve in the fields of geometry, arithmetic, mathematics, physics, economics, sociology, geography, and history. They were also tested on general intelligence and information. Billings reported that the men ranked only slightly higher in information and general intelligence, than women, but the problem solving scores of the men were, on the average, 48.7 per cent higher than those of women.

Guetzkow (1951) utilized Maier's two string problem and Luchins' Einstellung problem. On the former problem, the author found that 60 per cent of the 180 males gave the correct pendulum solution, but only 25 per cent of the women gave the correct solution. In regard to the Einstellung problem, Guetzkow found that 59 per cent of the men and 42 per cent of the women solved the extinction problem. This difference was significant at the .02 level of confidence. Guetzkow concluded that although men and women were equally susceptible to the development of set, men were better able to overcome the effects of set.

Milton (1957) administered 4 types of problems to 63 men and 66 women. These tasks consisted of restructuring problems, straightforward problems, numerical problems and non-numerical problems. The results showed that in every type of problem, men were superior to women.

In another study, Milton (1959) tested 24 men and 24 women on 2 types of problems. Half the problems were oriented to the masculine role and half to the feminine role. Although Milton found that the difference in problem solving ability between men and women decreased in problems oriented towards the feminine sex role, men nevertheless produced significantly more correct solutions in both kinds of problems.

While the above evidence suggests that men are more efficient than women on a wide variety of problem solving tasks, Rhine (1957) found no sex differences in anagram solution. These findings are surprising in view of the widespread sex differences reported on other problem solving tasks, and requires confirmation.

Statement of the Problem

The literature suggests that individuals who are field dependent, i.e. less capable of overcoming an embedding context in perceptual tasks, are less proficient on problem solving tasks. However, this relationship is complicated by the presence of sex differences in both field dependence and problem solving. This complication can be illustrated in the following manner: Suppose one attempts to assess the relationship between field dependence and problem solving, using a chi-square design. Further suppose that the number of Ss who score high on the first test and also score high on the second test is calculated. If, for example, men score higher on both

tests, then the selected group would predominantly contain men. Likewise, the group consisting of those Ss who score low on both tests will consist mainly of women. If a significant chi-square was obtained, it might be due to nothing more than the presence of sex differences between the tests. Hence, any conclusions in regard to the relationship between the two tests would be inconclusive.

One study purporting to establish a relationship between field dependence and problem solving, and utilizing a chi-square design, is that of Harris (1962). This author administered the EFT and 2 Duncker problems to a sample of Ss. The data was analyzed by selecting the 13 most field independent Ss, and the 13 most field dependent Ss. A corresponding classification was carried out for the Duncker problems, containing those Ss solving both problems and those solving neither problem. The results showed that of the 13 most field independent Ss, 12 solved both problems and one failed both problems. Of the 13 most field dependent Ss, 11 failed both problems, and two solved both problems. However, Harris did not specify the sex of her Ss, and thus the results may have been confounded by this variable. The major aim of the present investigation was to assess the relationship, between solution of Duncker problems and field dependence in a design controlling for the sex of the S. In addition to the EFT, and the 2 Duncker problems employed by Harris, the RFT was administered. The latter test provided an additional measure of field dependence. It has been reported to correlate highly with the EFT.

Anagram solution was also included in this study, as conflicting results have been reported in 2 studies on the relationship between anagram solving and field dependence. Mendelsohn et al. (1966) found a significant correlation between anagram solving and a measure of field dependence, while Bloomberg (1965) did not report a significant correlation between these measures. Thus an attempt was made to determine the relationship between field dependence, as measured by both the EFT and the RFT, and anagram solution.

In summary, the present study involved a replication of Harris' study including additional measures of field dependence and problem solving, and controlling for the sex of the Ss.

CHAPTER II
METHOD

Subjects

Ss were 62 students enrolled in the introductory course in psychology at the University of Manitoba. These students were required to serve as Ss for psychology experiments as part of their course requirements. The Ss were divided into two groups of 31 women and 31 men. The mean age for men was 20.3 years, and for women was 19.4 years.

Apparatus

Rod and Frame Test (RFT). (See Figure 1). A vertical rod and frame apparatus, designed by the Polymetic Company (model V-1260 M2) was employed. The dimensions were as follows: square frame, 42" x 42"; upright rod, 39"; width of luminous strip, 7/8". The colour of illumination was white. The apparatus allowed independent angular rotation of the square outer frame and of the inner rod by means of levers on a remote control panel. Rotation of the rod was also possible by means of a lever independent of the control panel. An angle scale and index points were provided on the control panel to indicate the amount of angular offset of the frame and the rod.

The luminous outlines of the frame and of the rod were made of electroluminescent strips, white in colour. Their brightness could be varied down to complete extinction. The framework of the apparatus was rigid, lightweight aluminum, finished in dull black to reduce reflected light. The apparatus was mounted on a sturdy base, on casters. The brightness was adjustable from 0 to 1 foot lambert.

A flashlight, a black blindfold, and a revolving chair were also employed.

Embedded Figures Test (EFT). The first 12 figures of Witkin's (1950) embedded figures test was used. These figures were individually encased in transparent plastic, and a rubber-tipped pencil was employed by S to indicate his response. Time to solution was measured by a stop watch.

Duncker Problems. Apparatus for the two Duncker problems consisted of the following: three candles; three cardboard matchboxes containing matches, thumbtacks, and paper clips; a bulletin board; a pair of pliers; a board and a wooden support nailed to the board.

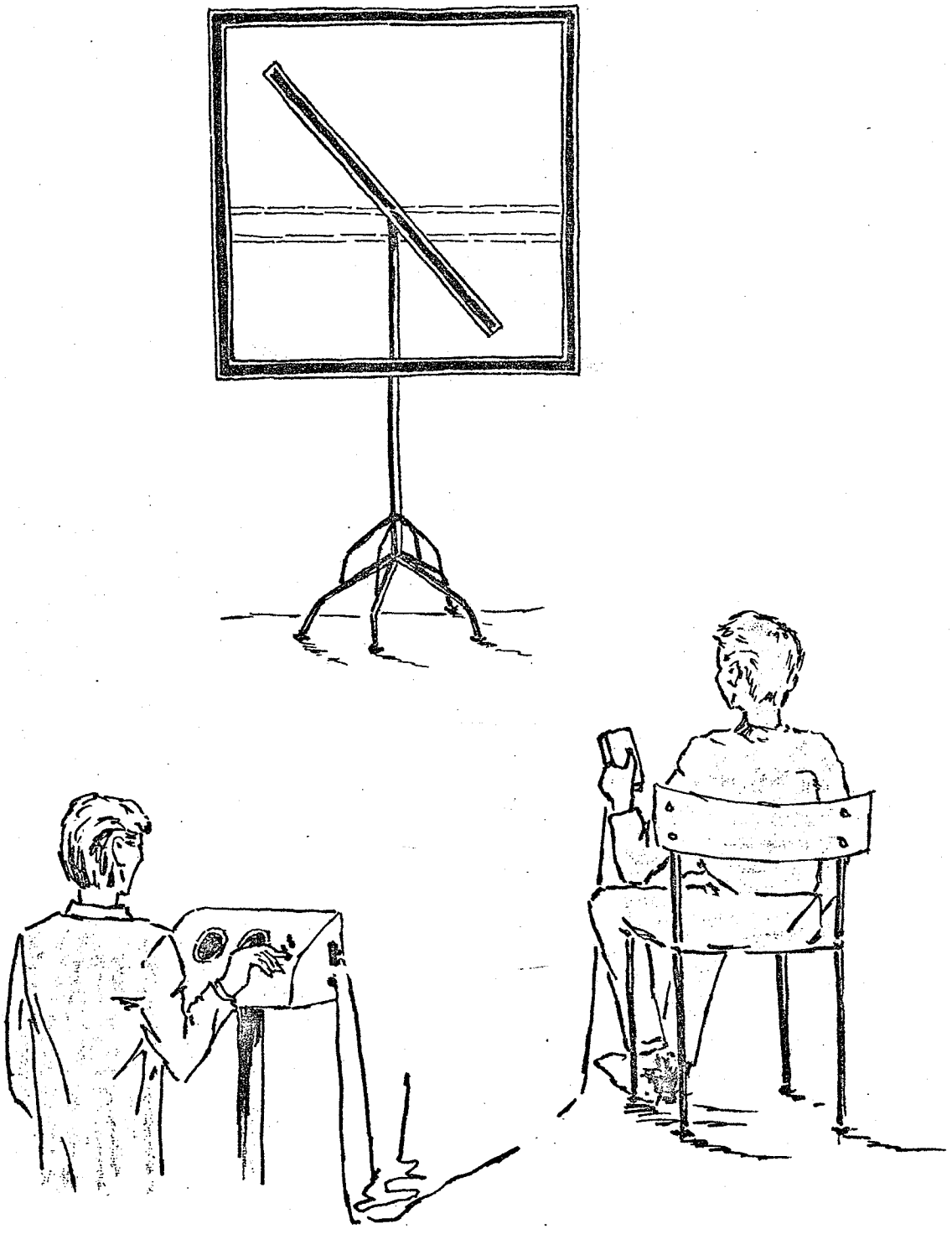

Fig. 1. The Rod and Frame Apparatus

Anagram Task. The 12 anagrams used in the experiment (listed in Appendix A) were devised by E. They were typed in capital letters, one to a page, on the upper left hand corner of 9" x 12" standard white typing paper. The sheets were stapled together, with the instructions typed on the front page. The order of the anagrams was randomized for all Ss.

A stop watch was used to determine the solution time for the EFT and the Duncker problems, and to regulate the time of the anagram task.

Procedure

Ss were divided into two groups of 31 women and 31 men. All Ss received all treatments. The anagram task was administered in groups, while the remaining tasks were administered individually.

Anagram Task. Ss were tested in groups of approximately 10 persons. They were seated in a classroom. E read the instructions (in Appendix B) aloud, and instructed Ss to follow her on their instruction sheets. After any questions were answered, Ss were instructed to turn the page and commence with the anagrams. Three minutes were allowed for each anagram, with a 30 second rest between anagrams.

Rod and Frame Test. The S was blindfolded and led into a dark room. He was seated on a revolving chair, facing the wall, away from the apparatus. S was told to remove the blindfold but remain facing the wall; three minutes were allowed for him to become dark adapted. The instructions (in Appendix C) were read to the S and any questions were answered. Eight trials were administered, including two trials under each of the following conditions: frame tilted right and rod tilted right, frame left and rod left; frame right and rod left; frame left and rod right. On all trials, both the rod and the frame were tilted at a 28 degree angle. The illumination was constant on all trials, and was set at a level which allowed all Ss to clearly perceive the target after the adaptation period; but did not allow perception of the contours of the room. During the intertrial interval, a flashlight was switched on and directed on the remote control unit in order to facilitate the readings.

Embedded Figures Test. Testing took place in a small room with normal room illumination provided by fluorescent lights. S was seated, and the instructions (in Appendix D) were read to him. On all trials, the complex design

was shown to S initially for 15 seconds; then the simple design was presented for 10 seconds, after which the complex design was again presented. The S was required to find the simple figure in the complex design, and to trace around it with a rubber tipped pencil. A practice trial was administered, but this was not scored. Five minutes were allowed for correct solution, and the time required for solution was recorded.

Duncker Problems. In the box problem, S was seated at a table and given three small candles, with instructions to affix them, side by side, to a vertical bulletin board at eye level. He was allowed to use anything on the table for this task. On the table were 3 small matchboxes, containing thumbtacks, paper clips, and matches. To solve the problem, the S had to empty each of the 3 boxes and affix them to the door with thumbtacks to serve as platforms for the candles.

In the pliers problem, S was required to construct a stand consisting of a board resting on two supports. He was allowed to use anything on the table for this task. On the table was a board, one support, and a pair of pliers. The support was nailed to the board in such a way as to require the S to use the pliers in a conventional manner to remove the nail. To solve the problem, the pliers had to also be used as a second support for the shelf.

After the problem to be solved was outlined to S, E retired to a corner of the room behind S. S was instructed to tell E when he felt he had solved the problem. A maximum of 15 minutes were allowed for each problem, and the time required for solution was recorded.

CHAPTER III
RESULTS

Criterion Scores. The score for the anagram task was the total number of suitable words produced for the anagrams within the allotted time. Time required for solution was recorded for the Duncker problems. Ss who failed to solve the problem within the allotted time were scored as requiring the maximum time. The score for the RFT was total error in degrees for the 8 trials. Total time required for solution of the 12 problems was recorded for the EFT. The raw data is presented in Appendices E and F.

Sex Differences

In order to test for significant difference between men and women, t-tests for each variable were computed between groups. These results are presented in Table 2. Significant differences between men and women were found only for the first Duncker problem and for the Duncker problems combined (Duncker 3).

TABLE 2

Results of t-tests for Sex Differences

	RFT	EFT	DUNCKER 1	DUNCKER 2	DUNCKER 3	ANAGRAMS
Unit of Measurement	Mean error in degrees	Mean time to solution in seconds	Mean time to solution in seconds		Mean of Duncker 1 & Duncker 2	Mean number of correct words produced
Mean Score for Women	23.4839	5.8552	484.8386	517.3870	501.3225	97.7419
Mean Score for Men	24.1129	7.5268	280.5483	409.8064	345.4192	96.8710
t	0.161	1.113	2.705*	1.514	2.448*	0.155

* significant at $p < .05$

Intercorrelations. Pearson product moment correlations were computed for all pairs of variables, both separately for all men and women and combined (Seigel, 1956). The correlations obtained are presented in Table 3.

Significant correlations were obtained between the RFT and the EFT for men, women and the combined group. The RFT correlated significantly with the first Duncker problem for women and the combined group, while significant correlations were obtained between the RFT and the second Duncker problem for men and for the combined group. When the scores from the two Duncker problems were combined (Duncker 3), significant correlations were obtained between the RFT and Duncker 3 for women and the combined group. Significant correlations were obtained between the EFT and all Duncker problems. The anagram task correlated significantly with the EFT for men and for the combined group. All correlations between anagrams and any other variables were in the expected direction, but were not significant.

CHAPTER IV
DISCUSSION

Sex Differences. Results of the t-tests for sex differences on the 6 variables considered in this study are presented in Table 2.

Significant differences were found between men and women for the first Duncker problem and for the Duncker problems combined. Men were also superior in solving the second Duncker problem, but the difference was not significant. Thus men were superior on the type of problem solving involved in solution of the Duncker problems. As the Duncker problems are reported to involve set breaking ability, these results confirm the findings of Maier (1933), Billings (1934), Guetzkow (1951), Judson (1956), Staats (1957) and Van de Geer (1957), who reported that men were superior to women in solving problems involving the overcoming of set.

It should be pointed out that while significant differences were found on 2 of the 6 variables, there is a possibility that significant differences may occur by chance alone. However, with a limited number of t-tests, it is unlikely that this would be a factor in this study.

Table 2 also shows the rather surprising result that there were no differences between men and women on either the EFT or the RFT. It might be concluded that men and women do not differ on measures of field dependence, but such a conclusion is contradicted by over 20 studies in which sex differences in field dependence were reported. Eleven of these studies were unpublished studies cited in Witkin et al.(1962). Referring to these studies, Witkin mentioned that sex differences in field dependence have been observed in the United States in groups of varied educational and socio-economic backgrounds. The research also includes studies of English, French, Dutch and Chinese adult Ss, French children, and Italian psychiatric patients.

As the data from many of the above studies was unavailable, it could not be determined how many studies also used university students as Ss. However, Witkin et al.(1962) noted the diversity of educational backgrounds in the American studies, and several of the other studies included psychiatric patients and children. Thus it is possible that the sex differences found on measures of field dependence are not as strong at the higher educational levels. It is suggested that women university students may behave more like men in regard to field dependence. A positive correlation has been reported by several investigators between scores on some subtests of the WAIS and field

independence. As a university population tends to come from the higher I.Q. ranges, one might expect university students to be more field independent, considering the relationship between field independence and some I.Q. measures.

In surveying the raw data (Appendices E and F), it is apparent that Ss 1, 6, 15 and 19 in the male group received extreme scores on field dependence. Thus it is possible that these atypical Ss had some bearing on the apparent lack of sex differences in field dependence.

The lack of sex differences on the anagram task supports the findings of Rhine (1957), who reported no sex differences in anagram solution.

In this study, men were superior in solving the Duncker problems, while no sex differences were found on the anagram task. A possible explanation for these findings is that the Duncker problems are more related to the masculine role, while anagrams are not. A relevant study is that of Milton (1957). Milton reported men to be significantly superior to women on 20 problem solving tasks. However, the scores on three masculinity-feminity scales correlated significantly with problem solving scores. Thus it seemed not simply the case that men score better on problem solving tasks, but that sex-role identification bears some relationship to problem solving skills. In a later study, Milton (1959) found that when problems are altered to make them less appropriate to the male role, sex differences in problem solving diminish.

While Milton proposed the concept of sex-role identification to account for sex differences in problem solving, Maier's (1933) findings appear to contradict this. Maier stated that the problems used in his first experiment seemed to favour the men, which could explain their superiority. However, the problems used in his second experiment did not appear to favour men, while a similar sex difference was found.

The possibility of motivation being a factor in problem solving ability and that this factor has some bearing on sex differences in problems solving, could be considered. It is possible that Ss who possess more favourable attitudes toward solving problems are also superior in solving the problems. Carey (1958) reported that men scored higher on a scale of attitudes toward problem solving than women, and that attitudes scores were positively related to performance scores. Thus a study of attitudes toward problem solving would possibly clarify the findings of the present study.

The findings of Milton (1957, 1959) and Carey (1958) have suggested that both attitude toward problem solving and sex-role identification influence problem solving ability in favour of men. However, both these variables might be related to educational level of S. The sample employed here was derived from a university population, and it is possible that this fact has some influence on attitude scores and sex-role identification. Thus women attending university might be more similar to men attending university than are their counterparts at a lower educational level. In view of this possibility, educational level would have to be controlled for in an investigation of the influence of attitudes and sex-role identification on problem solving ability.

Intercorrelations. As significant correlations were obtained between Duncker 3 and both Duncker 1 and Duncker 2, the discussion will be confined to Duncker 3. Duncker 3 represents the mean of the two Duncker problems (Duncker 1 and Duncker 2).

The only significant correlations ($p < .05$) between the measures of field dependence and anagram solution was between the EFT and anagrams for men and for the combined group. However, correlations between the EFT and anagrams, and the RFT and anagrams were in the expected direction for all groups, although they were not significant. These results may be considered in the light of Bloomberg's (1965) finding of an insignificant correlation between EFT and anagrams; and Mendelsohn, Griswold, and Anderson's (1966) findings of a significant correlation between the Crutchfield Gottschaldt and anagram solution. Thus it does not appear that there is no relationship between measures of field dependence and anagram solution. A low but consistent relationship between these measures has been found, but this relationship is not strong enough to have any predictive value.

Significant correlations were obtained between the RFT and the EFT for all groups. This confirms the findings of Witkin and his associates (1962).

Duncker 3 was found to correlate significantly with the EFT for all three groups. As the Duncker problems are considered to be measures of overcoming the set, this finding supports those of Zaks (1954), Fenchel (1958) and Goodman (1960), who found a relationship between EFT performance and performance on the Einstellung test, which measures ability to overcome set.

The positive correlation between the EFT and Duncker problems supports Duncker's (1945) hypothesis that the difficulty in identifying the possible uses of objects outside their familiar function appears to be related to the difficulty of overcoming embedded contexts.

The correlation between the EFT and Duncker 3 also confirms Harris' (1962) findings, while controlling for sex of the Ss as well.

The RFT correlated significantly with the Duncker problems for women and for men and women combined. The relationship was in the same direction for men, but was not significant. Thus a relationship was found between two measures of field dependence (RFT and EFT) and the type of problem solving involved in solution of the Duncker problems.

CHAPTER V

SUMMARY AND CONCLUSIONS

An analytical, in contrast to a global, manner of perceiving involves the tendency to experience an item as discrete from its background, and reflects the ability to overcome the influence of an embedding context. Individual differences in perception (analytical or global) are referred to as field dependence-independence by Witkin and his associates, who have studied extensively the relationship between personality and perception.

It has been found that the individual differences in analytical ability evident in perception are manifested in a person's problem solving activities as well.

Several studies have shown that males tend to be more field independent than females, and sex differences have also been found in the same direction on some problem solving tasks.

In a study by Harris (1962), it was reported that the ability to solve "insight" problems was positively related to field independence as measured by the EFT. However, as Harris did not specify the sex of her Ss, it is possible that the correlation of field dependence with good problem solving ability was confounded with sex differences.

In the present study, an attempt was made to provide a test of Harris' findings, with attention being paid to sex differences in both problem solving and field dependence. Two measures of field dependence were employed (RFT and EFT), in addition to 2 Duncker insight problems and an anagram solving task. Thirty-one men and 31 women were tested on all 4 tasks. It was hypothesized that men would be more field independent than women on the EFT and the RFT. Sex differences on the 2 problem solving tasks were investigated, and an attempt was made to determine the relationship between problem solving and field dependence, while controlling for sex of Ss.

There was a significant correlation between the RFT and the EFT for all groups, which supports Witkin's findings. The anagram task correlated significantly with the EFT for men and for the combined group. Correlation between anagrams and all other variables were in the expected direction, but were not significant. Thus the type of problem solving involved in the anagram task bears some relationship to one measure of field dependence, while the relationship between anagrams and solution of insight problems is slight.

The positive correlation between the EFT and Duncker problems supports the findings of Harris (1962), while providing an additional control for sex. The RFT was found to be positively related to Duncker problem solution, although this was not significant for men.

Sex differences were found only for the Duncker problems. Thus men were found to be superior in the solution of insight problems. The lack of sex differences on the 2 measures of field dependence contradicts the findings of Witkin et al.(1962), who reported men to be more field independent than women.

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APPENDIX A

Anagram List

L B F E I O

K R E U E B

M R E A N I

V S U O E N

R B A O D A

S S L P K A

T S E O I N

B R T I N E

N C E C T A

H R E T M O

L Q M U S A

C S E I N E

APPENDIX B

Anagram Task Instructions:

Word Construction Game

This is a game in which you will construct every possible word you can find from a basic letter combination, which you will have in front of you while you work. After a short time with each letter combination, you will be given a brief rest, and then asked to turn the page and begin working on the next letter combination.

The rules you should follow are these:

1) Use any number of letters you wish out of the basic letter combination - from one to as many letters as there are in the combination.

2) Use each letter only once in a given word, unless a letter appears more than once in a letter combination. Of course, you can construct many words using the same letter once each time as a part of each single word.

3) Construct only English words. Foreign words do not count. Neither do prefixes or suffixes, e.g. "pre" or "ing".

4) Construct no proper nouns, that is, no names whose first letter would be capitalized.

5) A basic word is counted only once, e.g. "bag" and "bags" or "cut" or "cuts" would count only once. An improperly spelled word is not counted.

Try the following letter combination: MDEAS. Some of the words you could make would be: a, mad, ma, dame, sad. "De" would not be usable under the rules because it is a foreign word meaning "of" in several languages, and not an English word. "Mae" also would not count, since it is a proper noun - a name of a specific girl, whose name would always have the first letter capitalized. You could not use "madam" because that would mean that you were using the letters "m" and "a" twice in the same word.

Remember, use each letter only once in each word, use no proper nouns, use no foreign words, and use either singular or plural, but not both. These words would not count, and would just slow you down. PRINT the words you construct. Your score for each letter combination will be the number of acceptable words constructed from it in a given period.

APPENDIX C

Instructions for Rod and Frame Test

When you turn around you will see a luminescent frame and rod. Your task will be to rotate the rod to the true vertical, straight up and down like a plumb line (E demonstrates). You will adjust the rod with this switch (E demonstrates) which rotates the rod to the left or right. After you have adjusted the rod to the true vertical, give me some verbal signal and then turn around to face the wall again. Do not manipulate the switch after you have completed your judgement. Do not view the apparatus after you have made your final adjustment.

Work conscientiously but do not spend too much time on each judgement. Are there any questions? We will begin.

APPENDIX D

Instructions for Embedded Figures Test

I am going to show you a series of coloured designs. Each time I show you one of these designs, I want you to examine the overall pattern that you see in it. After examining each design, I will show you a simpler figure which is contained in that larger design. You will then be given the larger design again, and your task will be locate the smaller figure in it. We will go through one to demonstrate. (P-1 is presented for 15 seconds, then P is presented for 10 seconds). I will now show you the original figure again and you are to find the smaller figure in it. (present P, time S).

This is how we will proceed on all trials. In every case, the smaller figure will be present in the larger design. It will always be in an upright position. There may be several of the smaller figures in the same larger design, but you are to look only for the one in the upright position. Work as quickly as you possibly can, as I will be timing you, but be sure that the figure you find is exactly the same as the original figure, both in size and proportions. As soon as you have found this figure, tell me at once. If you ever forget what the small figure looks like, you may ask to see it again.

Are there any questions?

APPENDIX E

Raw Data For Men

S	RFT (total error in degrees)	EFT (total time to solution in seconds	Duncker 1 (time to solution in seconds)	Duncker 2	Duncker 3 (mean of Duncker 1 & Duncker 2)	Anagrams (number of correct words produced)
1	12.0	2499	900	900	900	67
2	23.0	691	155	330	243	86
3	16.5	133	94	206	150	155
4	40.5	986	63	127	95	122
5	40.5	910	126	527	327	92
6	60.0	1043	140	450	295	85
7	18.0	506	270	401	336	80
8	20.5	1022	497	900	699	112
9	22.5	254	290	452	371	145
10	17.0	692	152	309	231	66
11	16.0	199	218	387	303	100
12	15.5	1226	90	30	60	76
13	11.5	162	60	70	65	106
14	20.0	898	290	501	396	61
15	64.5	1608	266	423	345	52
16	11.0	180	155	45	100	113
17	44.5	368	137	829	483	89
18	11.0	520	170	120	145	79
19	88.0	3186	900	900	900	97
20	16.0	609	247	194	221	76
21	22.0	1057	900	900	900	94
22	13.0	738	78	38	58	89
23	13.0	174	601	900	751	99
24	12.0	112	32	248	140	93
25	12.0	135	155	390	273	135
26	35.0	944	136	591	364	95
27	9.0	946	80	629	355	96
28	17.0	521	70	90	80	114
29	22.0	187	900	215	558	91
30	10.5	327	325	225	275	101
31	13.5	500	200	377	289	137

APPENDIX F

S	RFT (total error in degrees)	EFT (total time to solution in seconds	Duncker 1 (time to solution in seconds)	Duncker 2 (time to solution in seconds)	Duncker 3 (mean of Duncker 1 & Duncker 2)	Anagrams (number of correct
1	15.0	526	570	235	403	78
2	41.0	586	900	614	757	109
3	28.5	276	296	130	213	84
4	53.0	1346	900	900	900	125
5	39.0	320	497	368	433	81
6	18.0	144	345	385	365	96
7	19.0	901	68	720	394	85
8	14.0	160	230	189	210	110
9	21.5	258	402	567	485	123
10	38.5	247	401	142	272	78
11	16.0	972	900	440	670	61
12	17.0	594	74	900	487	93
13	16.5	198	365	900	633	125
14	44.5	1158	900	725	813	63
15	15.5	367	900	434	667	97
16	45.5	1924	900	900	900	95
17	22.5	351	443	159	301	94
18	21.5	315	50	721	386	99
19	16.0	296	140	191	166	137
20	15.0	1141	900	900	900	102
21	20.5	666	900	900	900	61
22	20.5	851	180	391	286	115
23	38.5	1442	900	900	900	109
24	13.0	357	80	255	168	98
25	11.0	100	176	420	298	94
26	14.5	227	162	256	209	114
27	14.5	188	81	449	265	130
28	10.5	255	711	722	717	95
29	19.5	448	434	481	458	94
30	24.5	1116	725	493	609	73
31	23.5	421	500	252	376	112