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The relationship between the Rod-and-Frame Test and Personality Research Form traits.

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THE RELATIONSHIP BETWEEN THE ROD-AND-FRAME TEST AND PERSONALITY RESEARCH FORM TRAITS

by

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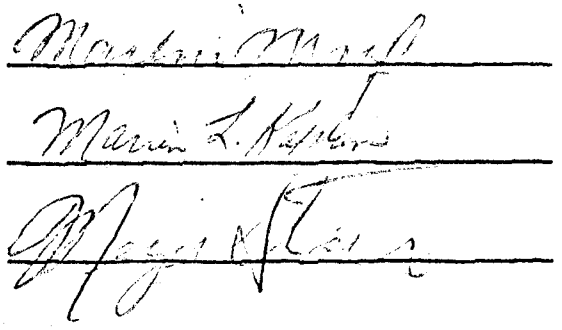

ABSTRACT

Witkin, Lewis, Hertzman, Machover, Meissner and Wapner (1954), examining the construct of "field dependence," maintain that there is a relationship between personality traits and perception.

Elliott (1961) proposes that field dependence has less to do with personality traits as it does with a tendency on the part of the perceiver to react with intellectual deficit and affective disruption in the face of an external situation lacking definite structure.

The present study seeks to contribute to the resolution of the Witkin-Elliott dilemma by investigating the relationship between RFT performance and certain personality traits, (achievement, affiliation and autonomy).

The results of this study were inconclusive but supported the Witkin position at least partially. A discriminant function analysis was performed on the data. The resulting two criterion groups, high (field dependent) and low (field independent) RFT scorers, did not differ significantly on their Personality Research Form profiles; however, the correct classification rates of the subjects into the two criterion groups were statistically significant.

The weakness of some trends detected suggest the need for replication with a larger number of subjects.

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INTRODUCTION

Historical development of field dependence and the Rod-and-Frame (RFT)

Three theoretical approaches to perception. Witkin (1949) summarized the research on perceptual processes under two broad headings. The first approach focused on the structure of the prevailing field and is exemplified by the research of Benary (1924), Gottschaldt (1926) and Duncker (1929). Duncker (1929), for example, showed that as far as psychophysical dynamics are concerned there is no difference between stroboscopic and "real" motion, i.e. perceived motion produced by actually moving objects. Duncker's (1929) research setting was a homogeneously darkened room with the experimental stimuli providing the only light source. This approach focuses on a perceptual process common to all subjects and ignores the individual differences of the perceivers.

The second approach focused on the stimulus (figure) and the past experience with the stimulus; with particular emphasis on the specific sense organs and associated neural structures mediating the stimulus. Witkin does not specifically refer to any particular author in this connection but an example might be found in the work of Hess (1956). Hess resolved the issue as to whether a chick's visual perception of space as measured through its accuracy in pecking a grain depends on learning or upon maturation of an innate ability. By fitting the chick's eyes with prismatic lenses

immediately after being hatched, for varying amounts of time; Hess found that the naive chick as well as the experienced one possess binocular depth perception and that this innate organization for depth perception requires neither learning nor continued use in the adult animal.

Witkin et al. (Witkin, Lewis, Hertzman, Machover, Meissner & Wapner, 1954) emphasize that both of the approaches above ignored the motivation and emotions of the perceiver. They urged that the "overall psychological organization of the perceiver" and individual differences should be considered. (Witkin et al., 1954, p.2). Bruner and Goodman (1947) have shown that poor children tend to over-estimate the size of coins more often than do rich children. The experimenters stated "the reasonable assumption was made that poor children have a greater subjective need for money than rich children." (Bruner & Goodman, 1947, p.39). The experimenters also pointed out that the greater the value of the coin the greater is the deviation of the apparent size from the actual size.

The RFT. Asch and Witkin (1948a, 1948b) examined those factors which determined the means by which a given impression of the upright was formed. At that time 'body position' and the 'visual framework' were thought to be the two main contributors. Although it was known that both 'body position' and the 'visual framework' contributed to a given impression of the upright it was not known what they contributed singly or in combination (Müller, 1916; Koffka, 1922).

Wertheimer (1912) first attempted to investigate these factors in his classic mirror experiments in which a subject stood erect and looked through a tube into a tilted mirror. The reflected scene was 45 degrees from the vertical and Wertheimer's subjects perceived the scene as tilted on first looking into the mirror. With continued inspection however, the scene appeared to be upright and everything within it looked normal. Wertheimer concluded that the perceived upright was mainly determined by the visual framework rather than by body position.

Gibson and Mowrer (1938) repeated the experiment with fewer subjects and discovered that although the subject experienced the mirror scene as less tilted, they did not come to perceive it as fully upright. This led them to support the argument that perception of the upright is based mainly on body impressions.

Asch and Witkin (1948a, 1948b) in their efforts to resolve the argument, to what extent body cues and to what extent the visual framework determined the perceived upright, introduced a new piece of apparatus. A movable rod was included in the scene reflected by the mirror and the subject while standing erect, looked at the mirror scene tilted 30 degrees. The subject was then required to adjust a movable rod whose average initial setting was 21.5 degrees. This new technique made finer measurement possible.

A second innovation was the replacing of the mirror by a large tilted box in a furnished room with a rod pivoted on

the back wall of the room. The adjustment of the rod was then carried out by the subject, standing erect or sitting in a tilted chair.

With the subject standing erect, the results were similar to those found with the tilted-mirror situation. But in the tilting-chair situation, the visual framework took on much greater importance with many subjects orienting themselves almost completely with respect to the visual field.

Subsequently, the furnished room in which the apparatus was contained was darkened and the frame and rod made luminous. This "weak visual framework showed that the effect of the visual field on perception of the position of items within this field tended to be greater and more consistent in proportion to the degree of articulation of the field" (Witkin et al., 1954, p.6).

Witkin and Asch (1949a) also investigated how the direction of the body itself and the field as a whole affected the perceived upright. In these studies, a subject sat in a chair which could be tilted right or left, situated in a room that could be tilted right or left. Subjects required to straighten their body within a tilted framework, based their adjustment on both postural experiences (body pressure caused by the tilt) and on visual impressions (whether or not the body appeared straight in relation to the surrounding framework. Thus the perception of the position of one's body in addition to an external object such as a rod is greatly influenced by the body's relation to the field of

which it is a part.

In order to determine the effect of altered forces on the body in determining the perceived upright, Witkin (1950a) asked subjects to try to adjust the rod while seated in a small, fully enclosed room propelled around a circular track. Thus the forces acting on the body were both lateral and centrifugal. The vehicle could move at one of two speeds and the room was either darkened or lighted.

The results of these experiments indicated that under everyday circumstances when a strong visual field is present, the upright is determined with relation both to the axes of the visual field and to impressions received from the body. Visual field factors tend to play a dominant role. Thus the Wertheimer (1912), Gibson and Mowrer (1938) argument was resolved by concluding that the visual framework provides the dominant source of information in perceiving the upright with body cues also contributing but to a lesser extent.

Various other generalizations emerged from this purely perceptual as opposed to personality research on field dependence.

(1) There was so great a variation among subjects that no conclusion about the nature of perception under a particular condition derived from average values for the group held true for all members of the group.

(2) To try and determine the extent of variation among individuals in perception, the rod-and-frame situation (RFT) (Witkin, 1948), the tilting-room-tilting-chair (Witkin, 1948)

situation and the rotating-room situation (Witkin, 1952) were employed as standardized tests with large numbers of subjects. The results showed "a strikingly wide range of performances; ... the extremes of this variation featured at one end those individuals who relied totally on the visual field in perceiving the upright and at the other end extreme those individuals who relied totally on body position," (Witkin et al., 1954, p.9).

(3) Witkin et al. (1954) further state that under a given test condition each person performed in a consistent way, and there was some evidence to support the idea that a certain consistency of performance could be found across different test conditions.

(4) Witkin (1948) also pointed out the deep-seatedness of each individual's manner of perceiving by trying to effect changes in their mode or orientation through training. Witkin et al. (1954) concluded that in terms of immediate impressions, a person's mode of perception is not subject to change.

(5) Lastly, women tend to be more dependent on the visual field and use body cues less effectively than men (Witkin et al., 1954, p.9).

Using three related techniques, the rod-and-frame test or RFT (Witkin, 1948); the tilting-room-tilting-chair test (Witkin, 1948); and the rotating-room test (Witkin, 1952), Witkin set about to study personality as correlated with various perceptual tasks. Witkin et al. (1954) suggests

that each person's mode of perception is deeply rooted and associated with that person's psychological structure in three ways:

1. The nature of the individual's relation to his environment which includes other people. Two more or less opposite trends represented by passivity associated with field dependence and activity associated with field independence emerge as indicators of a person's personality make-up. The passive person is described as being unable to function independently of the environment, unable to initiate activity and submissive in the face of authority.

2. The way in which he manages his impulses and strivings. The field dependent personality could be characterized by lack of inner awareness, fear of aggressive and sexual strivings and poor control of his own sexual impulses.

3. The kind of conception of himself he has. The field dependent person has low self-esteem, difficulty in accepting himself and low evaluation of his body.

The field independent person is pictured as being just the opposite i.e. analytical, active and independent in relation to his environment.

Witkin's interpretation of field dependence as a broad and stable perceptual style. Stagner (1961) describes "perceptual style" much the same way Klein (1951) speaks of "perceptual attitude." Stagner (1961) mentions that "individuals develop characteristic ways of dealing with material presented to the senses, irrespective of content and sensory

modality. This perceptual style is apparently an important source of unity and consistency within the personality; it cuts across specific expectancies, specific defense mechanisms and complexes. It is consequently a factor making for a characteristic way of dealing with the environment which comes to be an identifying feature of the unique personality." (p.138).

Witkin et al. (1954) found that the personality dimension of coping as reflected by an index of Rorschach indicators, (combining whole, popular and colour responses), bears a close relation to perceptual performance. For example, empirical findings showed that the coping score reflects the nature of the individual's relation to the environment and his manner of handling his impulses and strivings. Active coping involves a high level of activity, the capacity to initiate and organize responses to the environment. A central factor in performance in the RFT situation is the ability to break up a configuration to work against the structure of the prevailing field in order to keep an item separate from the field. The ability to treat the field analytically is thus logically related to active coping with or passive submission to the environment. Witkin et al. (1954) state that coping is related to all three types of a person's psychological structure. Coping is related to how a person manages his impulses and strivings. As an example of the preceding Witkin et al. (1954) maintains that one frequent outcome of severely blocked aggression is the development of

a masochistic pattern of dealing with aggressive impulses. This inward turning of aggression was seen in many hospital patients. These patients either turned the aggression inward or took on the role of a non-assertive, passive individual. This handling of aggressive impulses is related to the kind of conception a person has of himself. Again in a hospital setting, when a patient in the face of his own aggressive impulses rejects any self-assertive role, and turns to passivity as an alternative, he fosters feelings of inferiority and dependency. Coping also relates to how a person functions in respect to his environment. If a person feels that he is not confident and has low self-esteem, he cannot be expected to take an active and independent attitude toward the environment.

Witkin et al. (1954) point out more generally that a person's performance on these tests is related in varying degrees to most major aspects of personality. The fact that performance in one relatively limited task should prove to be related to broad aspects of personality is undoubtedly due to the interrelatedness of the different aspects of personality itself. Thus, a particular way of perceiving usually occurs in association with congruent personality characteristics. Witkin et al. (1954) feel that this line of theorizing is in keeping with the most basic propositions of such theorists as Allport (1937), who maintained that perception and memory and other mental functions were embedded in personal life; and Freud (1909), who considered ways in

which an obsessive-compulsive neurosis leads to obsessive thinking.

Various studies have sought to elaborate or verify Witkin et al.'s (1954) findings with mixed results. Wertheim and Mednick (1958) found a high positive correlation between need achievement (coping) and field independence when the measure of field dependency was the Embedded Figures Test (EFT) and the measure of need achievement were stories written by subjects in response to four slides shown previously.

However, when Marlowe (1958) tried to find a similar relationship between field dependence and need achievement, autonomy, dominance and introception (as measured by the Edwards Personal Preference Schedule [EPPS]). The results did not support the Witkin position. Only introception and succorance as measured by the EPPS yielded significant correlations in the expected direction. Marlowe (1958, p.334) stated, "Most noteworthy is the failure of autonomy and dominance to yield significant correlations." These needs may be considered similar to Witkin's active coping and mastery of environmental forces. The fact that need achievement and field independence were not highly correlated was explained by Marlowe as being due to the differences in measuring instruments - "In particular need achievement as measured by fantasy materials may not be equivalent to need achievement as measured by the EPPS" (p.334).

Holtzman (1955) in his critical review of the Witkin

et al. (1954) work made two specific points concerning methodological weaknesses of the Witkin position. First, he states there was a lack of concern for the reliability of the personality measures used in the Witkin studies. No estimates of interscorer agreement were present nor were intra-test or retest consistency data. Second, the protocols used in the Witkin studies were first examined for pertinent variables and only then included in the sample on which correlations between perceptual scores and personality indices were obtained.

Young (1959), in response to the Holtzman (1955) criticisms, attempted to replicate Witkin et al.'s (1954) essential findings. He found (1) a common factor of field dependence reflected by the RFT, Jackson's short form of the EFT, and the Chair-and-window test, (Barron, 1953); (2) self-attitudes of passivity, dependence, distrust of one's own feelings and bodily experiences as revealed projectively in drawings of humans, are significantly related to field dependent perceptual performance; (3) responses to inkblot materials suggesting a lack of effectiveness in coping with environmental demands and one's own needs are significantly related to perceptual performance; and (4) responses to inkblots implying a lack of introspectiveness, an impoverished inner life and self-distrust are related to field dependent perceptual performance. The discrepancy, in terms of magnitude of results between this study and the Witkin study, has been explained by Young as being due to the dif-

ferences in measuring instruments, e.g. the Holtzman Inkblot test and the Chair-window test vs. the Rorschach Inkblot test and the RFT. Young also states agreement with Gruen (1955) in that the dimension of field dependency is not as factorally pure as Witkin believed. Goldbloom and Silverman (1964), using a small sample found that in looking at the 5 most field dependent and 5 most field independent subjects, that the former had higher deviations on the F scale and all clinical scales of the Minnesota Multiphasic Personality Inventory (M.M.P.I.) with the exception of the Ma scale. Of these scales, four exhibited statistically significant deviations (D, Pt, Sc and F). Also, a correlation of .36 between the size of RFT error and manifest anxiety as measured by the Taylor Manifest Anxiety Scale (MAS) was obtained. When this study was replicated by Goldbloom and Silverman (1962) using 44 male college students, only one of the results of the Goldbloom and Silverman (1962) study was replicated. The only differentiating score separating field dependent and field independent subjects was the F scale. The greater elevation of the F scale of field dependents in both studies may suggest, for these young adults, more uncertainty about personal identification and hence more of a need on their part to exhibit nonconformity in an attempt to define themselves. This is similar to what Carlson (1960) calls the beard-and-sandals variety of personality. However, additional information concerning the personality of high F scale scorers coming from Block (1957); Bailey, Hustmyer and

Kristofferson (1961); Gough, McKee and Yandell (1955) suggests that these people are more changeable, restless, unstable and moody. According to Adevai, Silverman and McGough (1968), this description fits that of Witkin, Dyk, Ruth, Faterson, Goodenough and Karp (1962) of the field dependent individual, in that this person has a less adequately developed sense of separate identity and shows more frequent shifts in emotional attitude. The fact that the correlation between the MAS and field dependency as measured by magnitude of deviation on the RFT did not occur in the Adevai et al. (1968) study was partially explained by the point that there is considerable disagreement as to what the MAS really measures. There is sufficient evidence to show it does not demonstrate strong dependable relationships with clinical ratings of overt anxiety (Siegman, 1956; Rubin & Townsend, 1958; Bitterman & Holtzman, 1952).

Adevai et al. (1968) explained the inability of the M.M.P.I. to distinguish between the high and low field dependent groups in these ways: (1) the M.M.P.I. requires either affirmative or negative answers and does not exploit the perceptual processes involved in projective techniques used previously by Witkin et al. (1954); (2) it may be that projective techniques suffer from perceptual contamination and that the M.M.P.I. being an independent criterion for personality assessment, has demonstrated that in terms of personality, there are few differences between the field dependent and field independent college groups used in this

study; (3) it could also be that the M.M.P.I. is geared to picking up pathological signs and is less effective with normals.

Looking at Table 1 and the description of the high scorer on the achievement scale, Witkin's description of the field independent person would suggest a high positive correlation between anxiety and field independence.

Autonomy would also seem to be logically related to the idea expressed by Witkin as passivity. Here we would expect that the person low on self-esteem and self-acceptance would necessarily be low on independence of action and thought and therefore swayed by the environment. Looking at the description of the trait of autonomy in Table 1 we would expect a high positive correlation between field independence and autonomy.

Finally, affiliation as described in Table 1 would also seem to be related to field dependence. The description of the high scorer on this scale would lead us to expect a high positive correlation between the personality trait of affiliation and field dependence.

Elliott's interpretation of field dependence in terms of momentary state of disruption

Elliott (1961) has challenged the Witkin interpretation of field dependence as being related to dependence in personality and behaviour. Elliott hypothesized that field dependence is the "tendency to react with affective and in-

Table 1

Personality Research Form Scales

SCALE	DESCRIPTION OF HIGH SCORER	DEFINING TRAIT ADJECTIVES
ACHIEVEMENT	Aspires to accomplish difficult tasks; maintains high standards and is willing to work toward distant goals; responds positively to competition; willing to put forth effort to attain excellence.	striving, accomplishing, capable, purposeful, attaining, industrious, achieving, aspiring, enterprising, self-improving, productive, driving, ambitious, resourceful, competitive.
AUTONOMY	Tries to break away from restraints, confinement, or restrictions of any kind; enjoys being unattached, free, not tied to people, places, or obligations; may be rebellious when faced with restraints.	unmanageable, free, self-reliant, independent, autonomous, rebellious, unconstrained, individualistic, ungovernable, self-determined, non-conforming, incompliant, undominated, res-

Table (Continued)

SCALE	DESCRIPTION OF HIGH SCORER	DEFINING TRAIT ADJECTIVES
		istant, lone wolf.
AFFILIATION	Enjoys being with friends and people in general; accepts people readily; makes efforts to win friendships and maintain associations with people.	neighbourly, loyal, warm, amicable, good-natured, friendly, companionable, genial, affable, cooperative, gregarious, hospitable, sociable, affiliation, good-willed.

tellectual disruption when the subject's situation is marked by unusualness, incongruity, confusion or lack of structure in general" (p.34). This disruption lasts until some system or order is imposed upon the situation either by the subject or some external agency such as the luminous frame. Elliott relies on the work of Gross (1959), Block (1957) and Linton (1955) in his interpretation of field dependence. Additional support for his position is provided by Hustmyers and Karnes (1964); Cohen, Silverman and Shmavonian (1963); Shipman and Heath (1967); and Morf and Howitt (1970).

Physiological evidence. Block (1957), using Galvanic Skin Recordings (GSR), separated a group of 70 male medical students (applicants) into groups he called reactors and non-reactors. The reactors were described in terms of an adjective check list as cautious, dependent, dreamy, idealistic, mannerly and suggestible. Non-reactors were described as clever, cool, evasive, independent, ingenious, leisurely, opportunistic, practical and realistic. The reactors performed more poorly on the RFT, i.e. were more field dependent. Block (1957) adds that the reactors were more open to outside influence than the non-reactors who relied on proprioceptive cues. These two groups did not differ in the Asch type situation in terms of yielding.

Lacey and Lacey (1958) related spontaneous autonomic nervous system (ANS) activity logically to cortical electrical activity and experimentally to motor impulsivity. G.S.R. spontaneity, as measured by Lacey and Lacey (1958), did not

relate to frame dependency. Silverman, Cohen and Shmavonian (1960) suggest that Lacey and Lacey's (1958) measure was perhaps more concerned with gross fluctuations in autonomic rhythms which are related to individual autonomic system characteristics. This idea is reinforced by the fact that Lacey and Lacey's (1958) measure of ANS spontaneity was obtained under resting conditions as opposed to Block's lie detection measure.

Using more sensitive equipment in a situation similar to Block's; Silverman, Cohen, Shmavonian and Greenberg (1961) selected the 6 most field dependent and the 5 most field independent subjects from a group of 109 subjects using successive selection based on the Machover figure drawing and the RFT. GSR recordings under a condition of sensory deprivation showed that the field independent subjects had significantly fewer spontaneous bursts. The subjects in the Silverman et al. (1961) experiment could not be differentiated under the pre-experimental "at rest" condition. Silverman, Cohen and Shmavonian (1960) in a previous paper, suggested that their measures may very well be more related to transient changes in central nervous system arousal.

Hustmyers and Karnes (1967) decided to test Lacey and Lacey's (1958) ANS spontaneity measure in a setting similar to the lie detection situation that Block (1957) used. Their results further established the link between a physiological variable, ANS spontaneity, and a perceptual personality dimension. Hustmyers and Karnes (1967) conclude that their data

in conjunction with those of Block (1957), and Silverman et al. (1960) indicate a physiological basis for the field dependence-independence continuum. Lacey and Lacey's (1958) neurological model can be thus interpreted as supporting the hypothesis that there is a physiological substrate to the field dependence-independence continuum.

Shipman and Heath (1967) conclude from their data on heart rates, that the field dependent person, in order to avoid the anxiety of an unstructured situation, seeks out a clearly defined situation and role, then settles down to a very relaxed if not sluggish stage where even the heart beat is slower.

Subject's reports. Linton (1955) reported that design dependence (field dependence as defined by the EFT) related positively with increase in reported autokinetic movement in the presence of influence exerted by a confederate. In a post-experimental interview, the subjects were rated for degree of negativism defined as a deliberate decision to avoid being influenced by him. Both of these variables correlate to a significantly higher degree with the EFT, than to autokinetic changes. The relationship between design dependence and autokinetic change vanishes when either interview variable is partialed out. It seems possible according to Elliott, that field dependence is related more to some kind of disruptive emotional response than to the conforming situation per se.

Block (1957) showed that the groups which differed

significantly in frame dependence did not differ in degree of yielding in the Asch-like conformity task; but were markedly different in the degree of self-rated confidence with which they made their decision.

Gross (1959) found that she could increase the frame dependence of all her subjects using a fake lens. The author stated that this occurred because of the increased uncertainty in the use of external cues. Highly frame dependent subjects tended to check themselves as feeling uncertain significantly more often than frame independent subjects who in turn checked themselves as feeling expectant.

Experimental manipulation of presumed disruption. The Gross (1959) study showed that it is possible to increase the frame dependence of all subjects using a bogus distorting lens. The subjects in this study were led to believe that a special lens was being used to increase the ambiguity of the stimulus; in reality clear glass was used.

Morf and Howitt (1970) using solvable and unsolvable anagrams, and pre and post anagram RFT and palmar sweat differences scores, found that within a narrow range of intermediate arousal or disruption levels, the greater the physiologically measured disruption, the greater the decremental effect on RFT performance.

Objectives of the study and hypotheses

As the Witkin-Elliott controversy indicates, there is still some debate about what the RFT measures. The present

study has two objectives pertaining to this question: (1) to explore the relationship between personality traits as measured by a reliable test, the PRF (Personality Research Form, Jackson, 1967), and RFT performance; and (2) to examine in detail the relationship between need achievement and RFT performance.

The relationship between PRF traits and RFT performance. Since the personality traits of autonomy and affiliation as measured by the PRF are thought to be stable and general, Witkin's cognitive style theory suggests there should be a high positive correlation between performance on the RFT and scores on these two scales. It is hypothesized that subjects can be classified accurately on the basis of their PRF profile and that the PRF profiles of high and low RFT scores will differ significantly, particularly in the scales of autonomy and affiliation.

Need achievement, disruption and RFT performance. If the results do indicate a high positive linear correlation between need achievement as measured by the PRF and field independence in the RFT situation, then this will be interpreted as support for the Witkin position. However, it is hypothesized that a curvilinear relationship as shown in Figures 1 and 2 will result because this would be in keeping with the Elliott position of momentary disruption.

Morgan (1965) states that the reticular activating system (RAS) and the cerebral cortex form a closed loop in which impulses in the RAS arouse the RAS. The RAS is, as

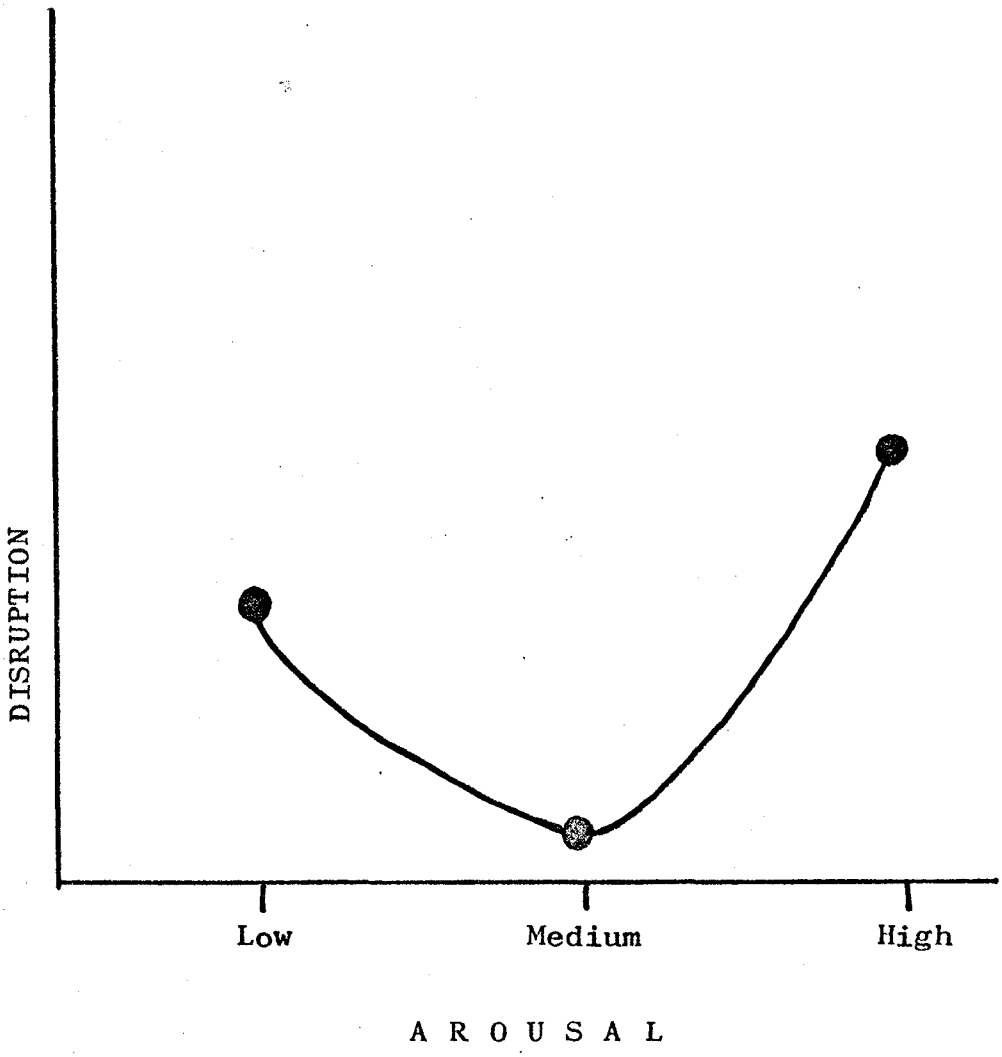


Figure 1. A graph showing the hypothesized relationship between arousal and disruption

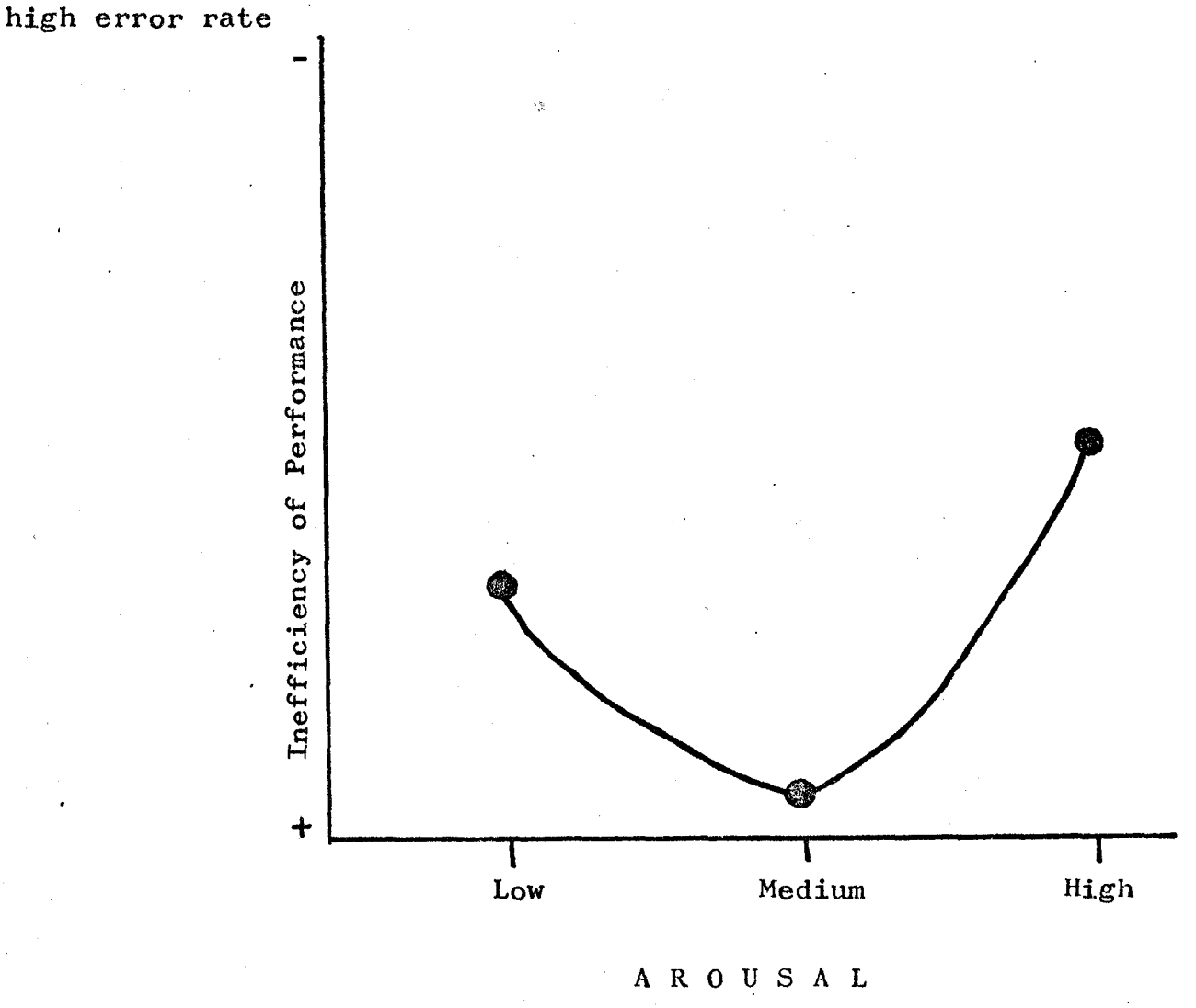


Figure 2. A graph showing the hypothesized relationship between arousal and inefficiency of performance in the RFT situation

its name implies, responsible for arousal and sleep. During periods of arousal the cerebral cortex is bombarded with impulses from the lower areas in the brain stem.

The physiological data of Block (1957); Silverman et al. (1960, 1961); Cohen et al. (1963); Hustmyers and Karnes (1964); and Lacey and Lacey (1958) suggest, in the Elliott (1961) framework, that those subjects who are high achievers will be disrupted the most in an ambiguous situation such as the RFT. The fact that high achievers do strive more continuously in ambiguous situations is verified by Clark and McClelland (1950). The high achiever is disrupted the most because in a situation such as the RFT where he enters the RFT in an aroused state to begin with, having higher expectations (Clark & McClelland, 1950), the added anxiety elicited by the unstructured test situation results in over stimulation of the cortex by the RAS. Because he is unable to impose order on the situation autonomously, and the only frame of reference he has is the luminous frame; he uses this as an orienting point. Consequently his performance in the RFT situation suffers the most in terms of deviations off-centre. The low achiever is also disrupted but to a lesser degree. Thus he adheres to the luminous frame as an orienting point also, but because his level of arousal is not as great to begin with as the high achiever he is less disrupted. Consequently, his RFT performance suffers but not to the same extent as the high achiever's performance. The medium achiever feels neither expectant nor uncertain

but is optimally aroused by the situation and makes the smallest amount of errors because he is disrupted the least.

The second hypothesis thus follows: The relationship between need achievement as measured by the PRF and RFT performance will be curvilinear with those subjects scoring highest on need achievement, exhibiting the poorest performance in the RFT situation in terms of degrees off-centre. Those subjects who are lowest on achievement as measured by the PRF will exhibit intermediate performance in the RFT situation in terms of degrees off-centre. Those subjects medium on achievement as measured by the PRF will be accurate in the RFT situation displaying little deviation in terms of degrees off-centre.

METHOD

Subjects

The sample consisted of 22 males and 22 females, all undergraduates at the University of Windsor. Their median age was 20 with a range of from 18 to 27 years.

Apparatus

The RFT apparatus used was an adaptation of that described by Witkin et al. (1954). Correlations ranging from .74 to .89 with the Witkin RFT (Witkin et al., 1954) have been obtained with similar, portable RFT's of the type used here (Kato, 1964; Morris, 1968; Oltman, 1967). The apparatus consisted of a metal cylindrical tube 35.6 cm. in diameter, fitted at one end with external, adjustable and independent positioners of an internal square frame and rod. At the other end of the closed tube was a scuba diving face mask (glass removed) surrounding two apertures 2.9 cm. in diameter for viewing the inside of the tube. The length of the tube from internal luminous rod and frame to the viewing mask was 72.3 cm. The rod and frame were illuminated by a concealed bulb emitting black light controlled by an on-off switch. The entire apparatus was placed on a table 76.2 cm. high and a subject seated in front of the apparatus had to place his head into the face mask to see the rod and frame. Diagrams showing the essential features of the apparatus are presented in Appendix A.

Design

Basically, the study was designed to permit a discriminant function analysis to separate the two criterion groups, high and low RFT performers. The predictor variables were the 15 scales of the PRF. Thus, the RFT scores represented the independent variables and the PRF scales the dependent variables. A linear discriminatory analysis was used which (see Nunnally, 1967, p.391) maximized the discrimination among groups through a system of weighting according to the formula:

$$Y = a_1x_1 + a_2x_2 + \ldots + a_{15}x_{15}$$

where Y = a subject's score on the discriminant function

x_1, x_2 = raw score variables (PRF scale scores)

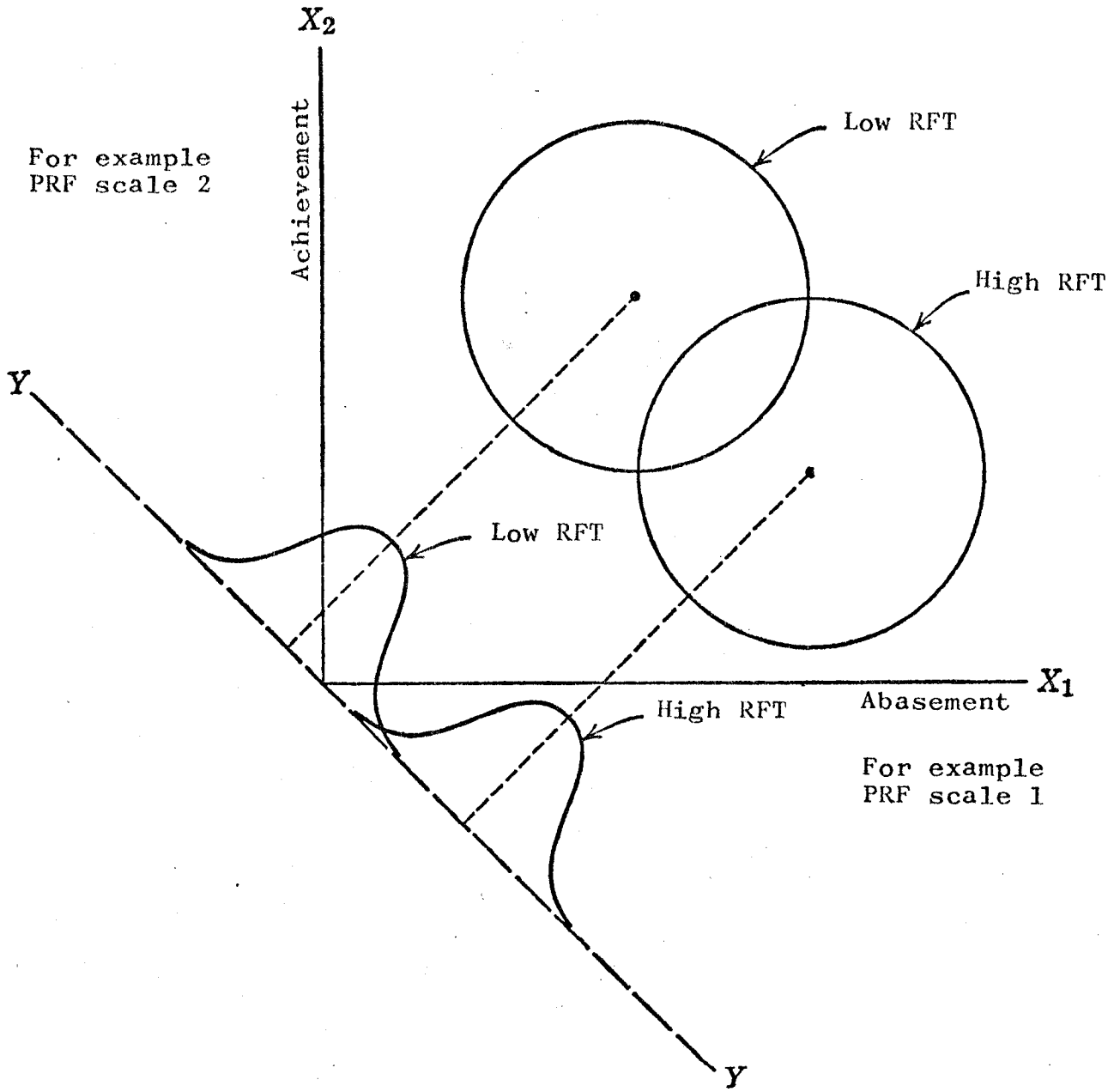
a_1, a_2 = weights for variables

The resulting new scores represent the projected locations on the discriminant function as shown in Figure 3.

The weighting of the raw scores results in the maximizing of the ratio of variance between means over the variance within means. This ratio serves the same function as the ratio of "between" to within variance in a one-way classification of the analyses of variance.

Procedure

Each subject was seated in front of the RFT apparatus. The subject was given a standardized set of instructions (see Appendix B). If there were any questions asked by the subject, the instructions were repeated verbatim from the



(The diagram indicates the discrimination between two criterion groups on the basis of 2 PRF scales. In fact, there were 15)

Figure 3. Theoretical projection of scores onto a discriminant function Y

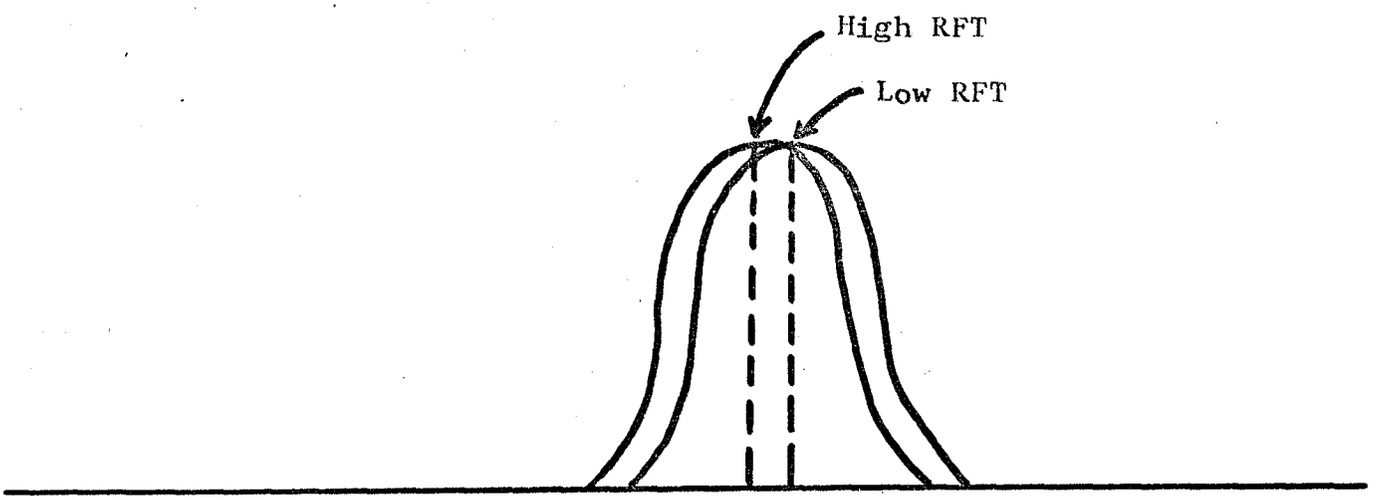


Figure 4. Projection of high and low RFT scorers onto a discriminant function Y

instruction sheet.

Upon completion of two sets of four trials with the RFT apparatus, the subject was asked to go to the University's Psychological Centre at his convenience within certain specified hours. There the subject completed Form A of the PRF (Jackson, 1967). Feedback was promised and given at the completion of the testing phase of the experiment.

RESULTS

Discriminant Function Analysis

Discrimination of the two criterion groups. The program used[1] computes the F ratio of the variance between means on the discriminant function and the variance with each criterion group (Nunnally, 1967, p.392). The F obtained was 1.02. The number of degrees associated with the numerator is 15; the number of degrees associated with the denominator is 28. With these degrees of freedom, the F ratio would have to be 2.75 to be significant at the .05 level of confidence. Thus the obtained F was not significant. The pertinent results are presented in more detail in Figure 4.

Classification of high and low RFT scorers. The classification of subjects into one or two criterion groups is a useful procedure even when a non-significant F is obtained (Brown, 1970). Kendall (1961, vol.2, p.159) gives three alternatives to the question whether a discriminator is significant. It could be that there is a real difference between the populations but they are so close together that a discriminator is not very effective. This point can be tested by checking the errors in misclassification, which though minimal, may still be sufficiently large to cause an insignificant F. Or it may be that the sample size was so small that the real difference existing there was obscured,

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[1]Biomedical Computer Programs, BMD04M, University of California Press, Berkeley and Los Angeles, 1968

i.e. the sample size was so small as not to produce a reliable discriminator. Kendall (1961) feels this is overcome by setting confidence intervals to the function or its coefficients. The third alternative is that the two populations are identical and discrimination is impossible. In the present study, there was adequate classification rates as shown in Table 2 and the first of Kendall's explanations appears to apply. A chi square (with Yates' correction factor) was computed on the classification rates. This value 4.45 was significant at the .05 level of confidence. Also the sample size in this study satisfied requirements for the discriminant function analysis. These results suggest that subjects can be classified as high or low RFT scorers on the basis of PRF profiles. Since the PRF profile reflects location on traits such as achievement, affiliation, abasement ... (15 in all) and since these traits are thought to be stable, enduring and relatively fixed dimensions, this finding may provide some support for the trait interpretation of field dependence as presented by Witkin et al. (1954).

Individual PRF scales in relation to RFT performance. The coefficients of the discriminant function are listed in Table 3. These coefficients represent the weights applied to the predictors in the discriminant function analysis. They are indicators of the importance of each predictor in classifying subjects as high or low RFT scorers. The product moment correlations between PRF scales and RFT scores are also presented in Table 3. These correlations are re-

TABLE 2

Classification of Low and High RFT scorers

Group Predicted	Group Entered: Low RFT	Group Entered: High RFT
Low RFT	15	7
High RFT	7	15

$X^2 = 4.45$ ($p < .05$)

TABLE 3

Discriminant Function Coefficients and Product Moment Correlations with RFT Scores of the PRF Scales (N = 44)

PRF Scales	Discriminant Function Coefficients	RFT
Achievement	-.00273	-.08
Affiliation	-.00186	.15
Aggression	.01898	.06
Autonomy	-.00879	-.19
Dominance	-.00485	.14
Endurance	.00138	-.01
Exhibition	.00617	-.04
Harm avoidance	.00282	.32*
Impulsivity	.00225	-.09
Nurturance	-.00981	.09
Order	-.00155	.01
Play	-.00002	-.04
Social Recognition	.00292	.07
Understanding	.00853	-.16
Infrequency	.00617	-.10

* $p < .05$, two tailed test

lated to but not the equivalent of the discriminant function coefficients. The only significant correlation obtained was that between the harm avoidance scale and the RFT. Neither autonomy nor affiliation, two measures of personality dependence, were correlated significantly with the RFT.

Achievement and RFT performance

Need achievement and RFT performance. The non-significant correlation of .08 between achievement and the RFT, presented in Table 3, does not necessarily mean there is no relationship between the two. It could be that there is a significant curvilinear relationship (see for example Spence, Underwood, Duncan & Cotton, 1954). A polynomial regression analysis was performed on the data. The program[2] used, computed first the linear regression effect, then assigned a portion of the error sum of squares (reflecting the deviations about the regression line) to a quadratic term, to a cubic term and finally to a quartic term.

These components are shown in Table 4. None of the effects were significant at the .05 level.

This procedure yielded a fourth power polynomial regression equation (i.e. a quadratic function) of the following type:

$$y = ax^4 + bx^3 + cx^2 + dx + e.$$

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[2]Biomedical Computer Programs, BMD05R, University of California Press, Berkeley and Los Angeles, 1968

TABLE 4

Final Analysis of Variance
for 4 Degree Polynomial (BMD05R)[1]

Source	df	MS	F
Linear Term	1	19.30	0.24
Quadratic Term	1	156.17	2.01
Cubic Term	1	48.33	0.62
Quartic Term	1	107.07	1.38
Deviation about Regression	39	77.41	
TOTAL	43		

[1]Biomedical Computer Programs, BMD05R, University of California Press, Berkeley and Los Angeles, 1968

In principle this higher order polynomial serves the same purpose of prediction as the familiar linear regression equation:

$$y = ax + b.$$

The general formula for a polynomial regression is:

$$X^1 = a + b_1Y + b_2Y^2 + \ldots b_mY^m$$ (Ferguson, 1966, p.346).

This general equation represents all the polynomial expressions from the first degree to the m'th degree. For example, if all the terms to the right of b_1Y vanish, then a linear equation remains. If all the terms to the right of b_2Y^2 vanish, then a quadratic equation or a second order polynomial remains.

Within this general framework, a represents the point where the curve intercepts the X axis; b_1, b_2 and b_m are the regression coefficients or weights which are found through the method of least squares (Ferguson, 1966, p.118); and Y, Y^2 and Y^m are the powers of the independent variable Y.

DISCUSSION

Linear analysis of the relationships between PRF traits and RFT scores

The product moment correlations between RFT scores and PRF scales (see Table 3) were all statistically non-significant except for Harmavoidance.

The fact that there was not a high positive correlation between the traits of affiliation and autonomy as measured by the PRF and the field dependency dimension as outlined by Witkin et al. (1954), may be interpreted as support for the Elliott (1961) position.

The method of measurement might also have contributed to the low correlations between those traits selected for observation and RFT scores.

In this respect the achievement scale is of particular interest in light of previous research. Wertheim and Mednick (1958) found a significant relationship between field independence and need achievement, when the measure of need achievement was based on fantasy materials.

Marlowe (1958) attempted to replicate the findings of Wertheim and Mednick (1958) using an objective paper and pencil test, the EPPS. Marlowe hypothesized a positive correlation between field independence as measured by the Thurstone adaptation of the Gottschaldt Embedded Figures Test (EFT); and achievement, autonomy, dominance and intraception as measured by the EPPS. Marlowe further hypothesized a negative correlation between field independence as

measured by the EFT and succorance as measured by the EPPS.

Of the five needs hypothesized to be correlated with field independence, only two yielded significant results, intraception and succorance. Marlowe points out that the failure of autonomy and dominance to yield significant correlations was "most noteworthy" as these needs could be considered similar to Witkin's "active coping" and "mastery of environmental forces" (1958, p.334).

Thus, the results of this study using the PRF and RFT support the results obtained by Marlowe using the EPPS and EFT.

However, these same results conflict with those obtained by Wertheim and Mednick (1958) using the EFT and projective techniques and Witkin who used EFT, RFT and Rorschach indicators. Similar results to those obtained by the present investigation were obtained by Kavanaugh (1970).

The difference between those studies just mentioned seems to be one of measuring instruments or more specifically, structured self-report tests versus perceptual assessment techniques.

In terms of the Witkin-Elliott dilemma, is it possible that structured tests such as the EPPS and PRF reflect the stable personality traits Witkin focuses on, while the perceptual techniques which Witkin actually used are more subject to Elliott's "disruption" theory? Witkin et al. (1954) are fairly specific about the consistency and stability of personality as measured by the RFT. They mention (1954) that

these dimensions are already in the formative stage at 8 years after birth in children. Witkin et al. (1954) also mention that the personality dimensions of field dependency and field independency are so deep-seated that even training is ineffective in bringing about change.

Concerning the discriminant function results, Kendall (1961, vol.2, p.159) states that there are three possible explanations for a non-significant F ratio. These were detailed in the results section. Despite the non-significant F, statistically significant classification rates were obtained in the present study and the first of Kendall's explanations seems appropriate, i.e. it is likely that there is a real difference between the two populations but it is so small that the discriminator is not very effective. This is interpreted as meaning that there is at least a trend reflecting a true difference between the criterion groups. If all the differences were purely random then no significant classification rates could be obtained.

In future research of this nature, it might be advisable to use a multiple correlation coefficient to examine the relationship between PRF predictors and RFT criteria. The multiple correlation coefficient would yield the proportion of RFT variance accounted for by all the PRF traits combined. This index can be significant when the F ratio of the discriminant function analysis is not. Cronbach (1957) has summarized the differences between the experimentalist and the psychologist who uses correlational techniques and focuses on

individual differences. "Just as individual variation is a source of embarrassment to the experimenter, so treatment variation attenuates the results of the correlator. His goal is to predict variation within a treatment. His experimental designs demand uniform treatment for every case contributing to a correlation, and treatment variance means only error variance to him" (Cronbach, 1957, p.674). In other words, it is possible that the discriminant function analysis has obscured important individual differences.

Curvilinear analysis of the relationship between achievement as measured by the PRF and the RFT performance

The results show that neither the linear (first degree) function nor the curvilinear (second order, third order or fourth order) functions are significant. When the linear model was applied, the remaining deviations about the regression line were still quite large (see Table 4). Since the possibility of a curvilinear relationship existed and was indeed hypothesized, a quadratic function was applied to the data to try to determine the composition of the deviations not due to linear components. Again the F ratio was not significant and there still remained a large portion of deviation about the regression line which might be accounted for by employing a higher order function. Consequently, a third and fourth degree polynomial was used. The F ratios in each of these cases were also non-significant. If the relationship fits any polynomial function it fits the quad-

ratic function. The few cases in the highest achievement intervals can be ignored. (See Figure 5).

The quadratic trend goes in the direction opposite to what was hypothesized. This is rather difficult to explain; however, the following suggestions are offered.

It is possible that the Rorschach indicators used by Witkin et al. (1954), and the Thematic Apperception Test (TAT) stories employed by McClelland and Atkinson (1953), tap a different kind of achievement than do the objective self-report techniques such as the PRF. However, it is interesting to note that Jackson based the PRF on Murray's needs theory in the formulation of the PRF.

A second possibility is that medium achievers are perhaps more conventional and sensitive to social norms and this consequently causes them to be more field dependent than was originally hypothesized in the present study.

It is possible that the medium achievers in this study are in a sort of conflict situation. They have not decided what their approach to university will be. They are not convinced on the one hand that the role of the low achiever, who does only what he has to, is correct for them; on the other hand, the role of the high achiever who must continually strive for excellence to satisfy parental expectations, may not appeal to them either.

A fourth possibility is that medium achievers feel the desire to be socially acceptable more keenly than do the high achievers or the low achievers. According to this

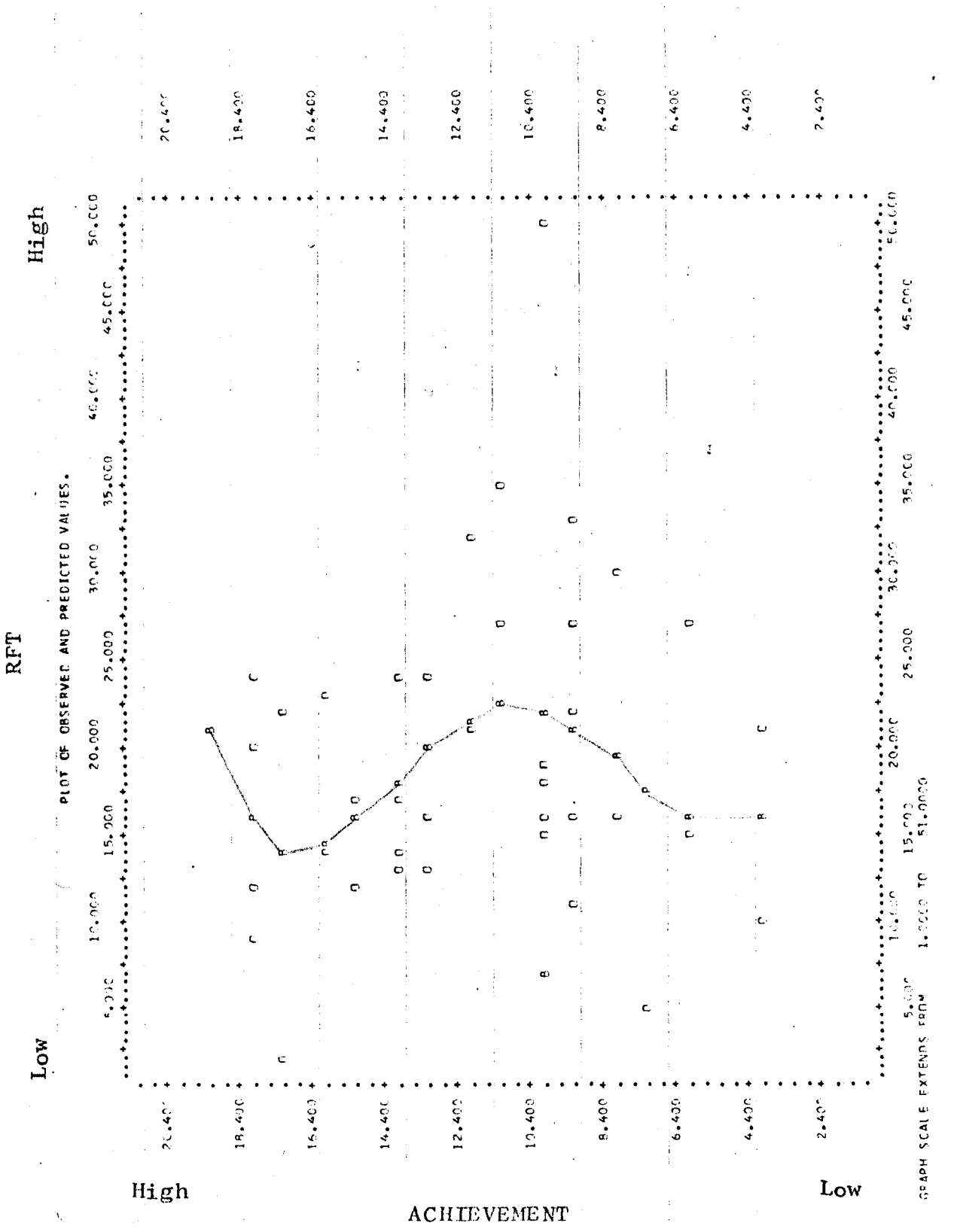


Figure 5. A graph of observed and predicted values resulting from a polynomial regression analysis of RFT performance on achievement scale

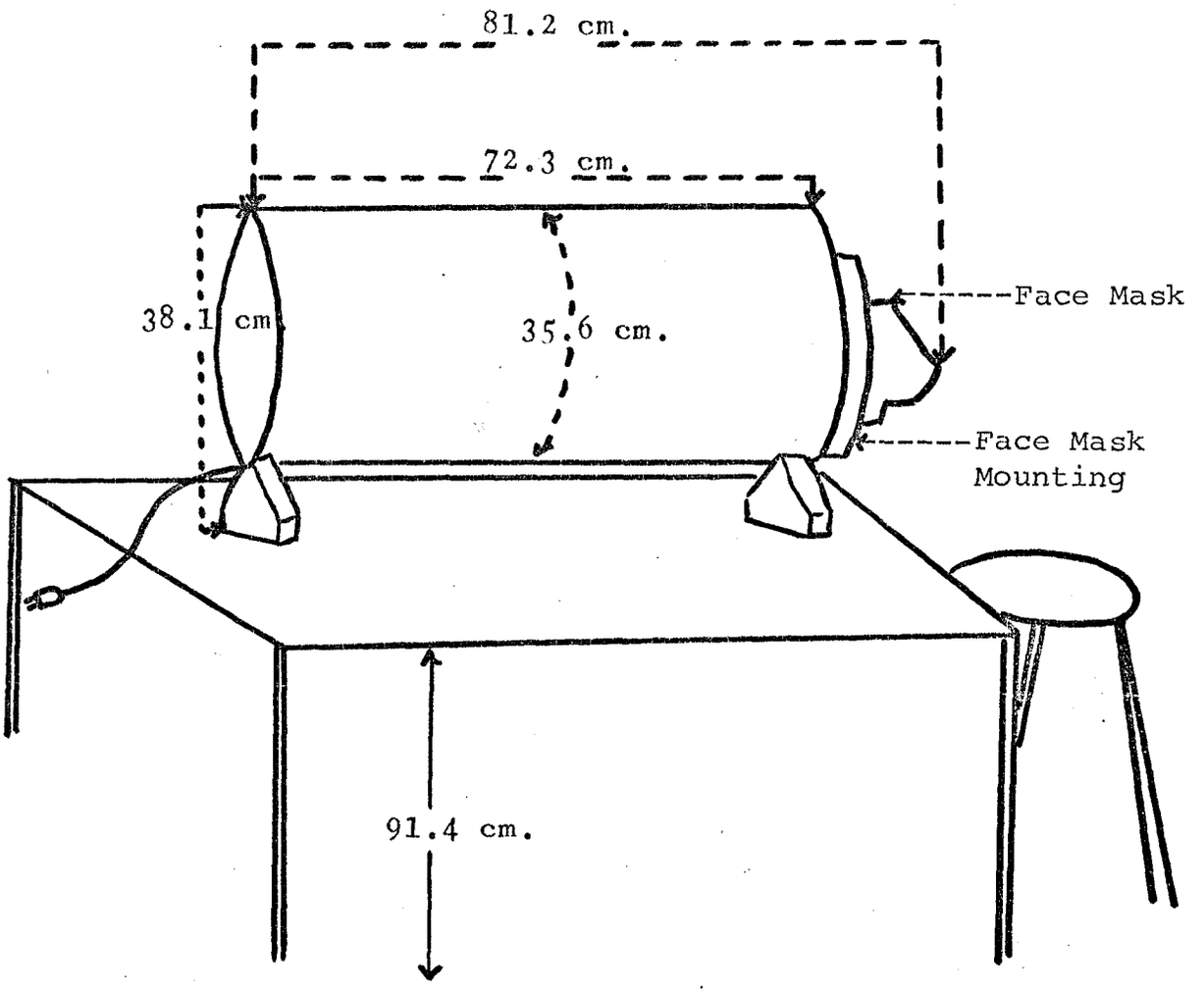
hypothesis, the low achiever might be regarded as an independent campus hippie, and the high achiever as an independent "self-starter."

Lastly, one must consider that there simply is no relationship between the field dependence dimension and the personality traits examined.

No higher order analysis was performed on the data after the fourth order function. It was thought that further analyses would not contribute to a clearer interpretation of the results. It is also likely that if a relationship did exist, it is more likely to be a simple one as opposed to a complex one.

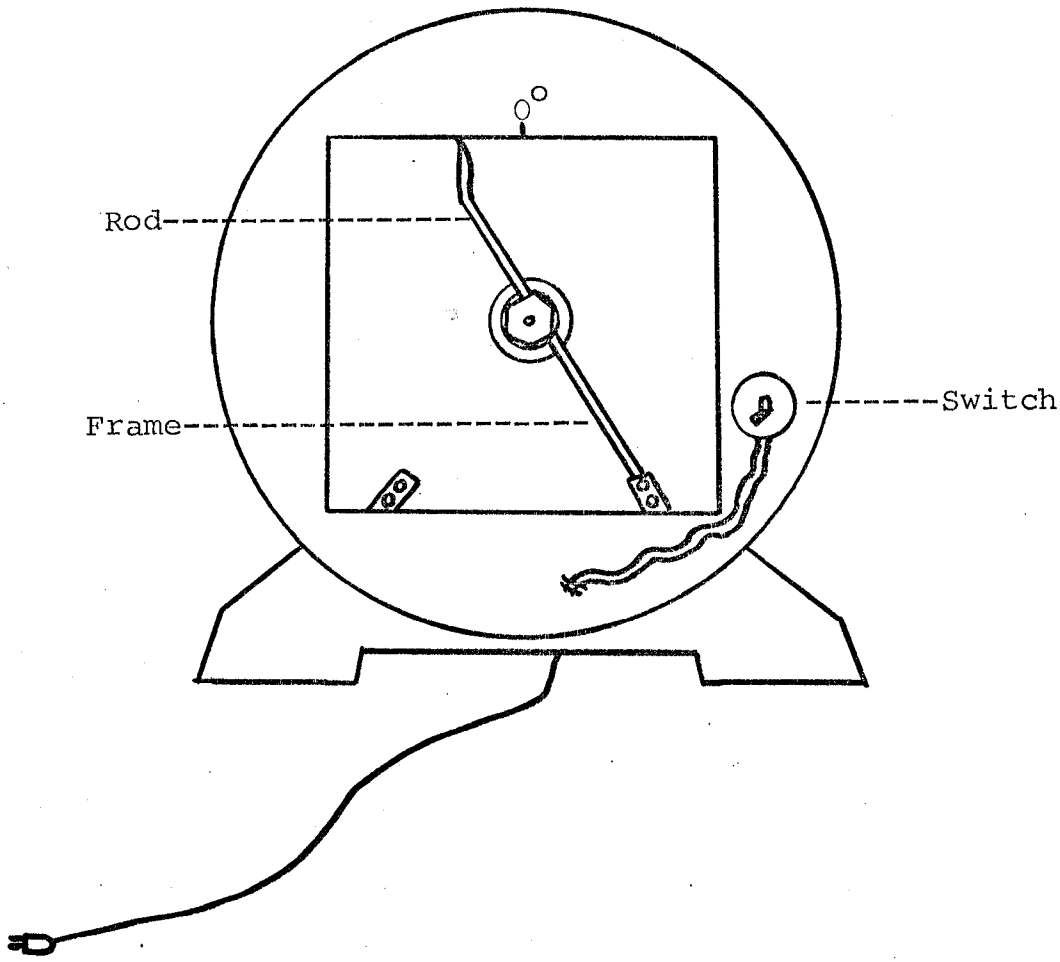
The results of this study are somewhat ambiguous but they do appear to indicate that the relationship between personality traits, especially as measured by self-report tests like the PRF on one hand and the RFT on the other, is at best a tenuous one. Further research following the lines suggested by Elliott and focusing on the processes underlying field dependence is suggested by the present study.

APPENDIX A



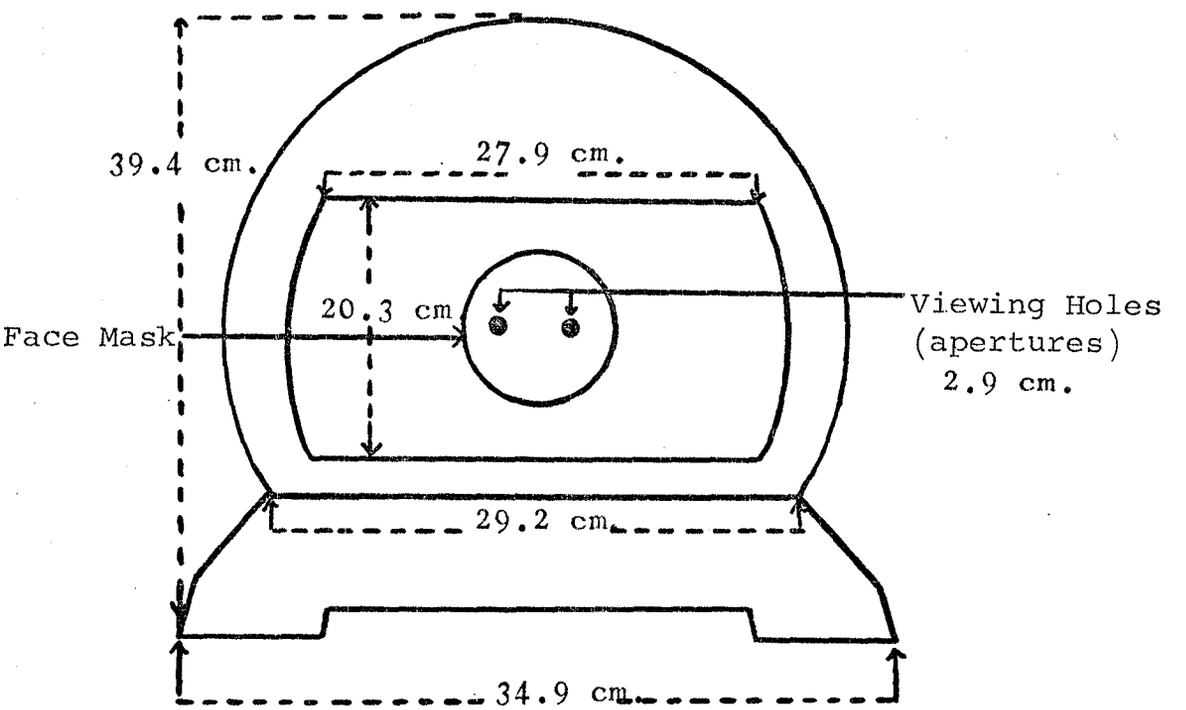
Side view of the portable RFT

APPENDIX A (Continued)



Back view (experimenter's side) of the portable RFT

APPENDIX A (Continued)



Front view (subject's side) of the portable RFT

APPENDIX B

Verbatim Instructions for the RFT

In this test we want to find out how well you can determine the upright or vertical. You will place your head in the face mask with your hands resting on the face mask keeping your eyes closed. When I tell you to open your eyes you will see a square frame and a rod. That's all you will see. It is possible for me to tilt the frame and rod to the right or left. I can tilt the frame to the right or left and I can tilt the rod to the right or left. When you open your eyes at the beginning of each trial I want you to tell me whether the rod and frame are straight up and down, vertical that is, or whether they are tilted. Then I will move the rod and your task will be to say "enough" when you think the rod has reached the vertical position, that is straight with the walls of this room.

APPENDIX B (Continued)

At the beginning of each trial the subject was asked to close his eyes and place his hands around the face mask. The subject was then asked to place his face into the face mask making sure that the face fit the mask snugly. Then the subject was given the following instructions.

> Open your eyes. Can you see the rod and frame? Are they in the vertical position? [NO!] I will move the rod slowly until you think it is straight with the walls of this room in which case you will then say "enough." Please make your decisions quickly and don't be too 'finickity.' Which way shall I turn the rod, clock-wise or anti-clock-wise?

The rod was moved in <u>one or two</u> degree intervals selected randomly from a starting position of 20 degrees. The sequence for these 2 RFT sets consisting of 4-trials was.

FRAME - left left right right

ROD - left right right left

APPENDIX B (Continued)

The direction of tilt above is expressed in terms of the subject's position. After the first set of trials, the subject was asked to close his eyes and to sit back releasing his hands from the face mask. A one-minute rest period followed. The subjects were then given a second set of 4 trials. After every one of the 4 trials composing a set, the subject was asked to close his eyes and to withdraw his head from the face mask keeping his eyes closed. After a 10 second interval the subject again positioned his face in the mask with eyes closed and hands again surrounding the face mask.

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