FIELD-DEPENDENCE-INDEPENDENCE, ANXIETY AND STRESS:
RELATION TO PERFORMANCE ON A COGNITIVE-PERCEPTUAL TASK

by

SUSAN DOROTHY BRITAIN

M.A. SAN JOSE STATE COLLEGE, 1966

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

in the Department

of

Psychology

We accept this dissertation as
conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

April, 1971
In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the Head of my Department or by his representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of PSYCHOLOGY

The University of British Columbia
Vancouver 8, Canada

MARCH 1971
Date
The major purpose of this study was to explore the moderating roles played by cognitive style and anxiety on the effects which stressful events have on cognitive performance. This was attempted by experimentally testing certain hypotheses derived from a cognitive-attentional analysis of the relationship between cognitive styles, anxiety and performance. An integration of certain theoretical notions of Witkin (1965), Wachtel (1968) and Spence and Spence (1966) led to the position that predictions of the effects of stress on complex problem solving could be made effectively if cognitive styles (field-dependence — FD, field-independence — FI) were used as indicators of the effectiveness of habits activated during stress. It was argued that an individual's cognitive style was more influential than his level of anxiety in biasing the responses activated during stress. The cognitive styles of field-dependence and field-independence were related to activation of dominant perceptual-defensive habits during stress. FI perceptual-defensive habits were characterized as compatible with behaviors involved in the solution of certain complex tasks. In contrast, FD perceptual-defensive habits were characterized as incompatible with adequate performance on these tasks. The different perceptual-defensive habits were related to different distributions of attention to task-relevant or irrelevant stimuli during stress. It was hypothesized that activation of these dominant habit patterns would lead to the exaggeration of habits associated with cognitive styles. It was expected that activation of FI habits would result in improved performance on a measure of field-independence; activation of FD habits would result in deteriorated
performance. In neutral conditions, less differentiation of performance should result since perceptual-defensive habits would not be activated.

A second purpose of this study was to obtain an index of differentiation between FD and FI individuals independent of performance measures but related to the attentional level of analysis described for FI and FD habit patterns. An integration of Witkin's (1965) theory of field-dependence-independence (FDI) and Lacey's (1967) hypothesis about the relationship between cardiac activity and orientation to the environment provided the basis for several predictions. It was hypothesized that FI individuals would show cardiac deceleration during exposure to threatening visual stimuli reflecting an attitude of environmental acceptance. In contrast, it was predicted that FD individuals would show cardiac acceleration, reflecting rejection of the same stimuli in the environment.

Degree of field-independence and level of anxiety were determined for female university student volunteers with the Hidden Figures Test, the Rod-Frame Test and the Activity Preference Questionnaire. High anxious-FI subjects (Ss), low anxious-FI Ss, high anxious-FD Ss and low anxious-FD Ss comprised four experimental groups. In order to determine the effect of the activation of FD and FI perceptual-defensive habits during stress, half of each group was given a modified test of FDI in stressful, half in neutral conditions. The stress condition was defined by the interjection of noxious slides of murder victims in-between slides of items of the test of FDI. The neutral condition was defined by interjection of neutral slides.

The findings generally supported the hypotheses about performance
and cardiac activity. Although FI Ss tended to perform at a higher level, FI and FD Ss did not differ significantly from each other in performance or in cardiac activity in the neutral condition. Only under the stressful condition was there any significant difference between FI and FD Ss in either performance or cardiac activity. The tendency for FD performance to deteriorate while FI performance improved on complex items significantly exaggerated the differences in their performances. There was also a marked difference in performance variability. First, FD Ss were more variable in both conditions. Second, the variance in the performance of FI Ss decreased during stress while that of FD Ss did not. Level of anxiety alone affected neither average speed nor variability of performance. The major difference in cardiac response to the task was the occurrence of greater acceleration to simple items for FD Ss. Cardiac response to noxious slides was different for FD and FI Ss and for high and low anxious Ss. High levels of anxiety were related to initial acceleration to noxious slides while low levels were related to initial deceleration. Field-dependence was related to continued acceleration, field-independence, to continued deceleration.

It was concluded that the differences in cardiac activity during stress supported both Lacey's notion of the relationship between cardiac activity and environmental orientation and Witkin's theory about the defensive habits of FD and FI individuals. Further, it was concluded that the increased performance differences between FD and FI Ss during stress supported the argument that the cognitive styles of field-dependence and field-independence are exaggerated by the activation of dominant habit patterns during stress.
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>A. Theoretical Considerations</td>
<td></td>
</tr>
<tr>
<td>B. Experimental Hypotheses</td>
<td></td>
</tr>
<tr>
<td>II. Method</td>
<td>18</td>
</tr>
<tr>
<td>A. Experimental Design</td>
<td></td>
</tr>
<tr>
<td>B. Subjects</td>
<td></td>
</tr>
<tr>
<td>C. Selection Criteria</td>
<td></td>
</tr>
<tr>
<td>D. Apparatus</td>
<td></td>
</tr>
<tr>
<td>E. Procedure</td>
<td></td>
</tr>
<tr>
<td>F. Procedure for Terminating Subjects</td>
<td></td>
</tr>
<tr>
<td>G. Dependent Measures</td>
<td></td>
</tr>
<tr>
<td>H. Analyses of Dependent Measures</td>
<td></td>
</tr>
<tr>
<td>III. Results</td>
<td>31</td>
</tr>
<tr>
<td>A. Behavioral Measures</td>
<td></td>
</tr>
<tr>
<td>B. Physiological Measures</td>
<td></td>
</tr>
<tr>
<td>IV. Discussion</td>
<td>50</td>
</tr>
<tr>
<td>A. MEFT, The Effects of Stress</td>
<td></td>
</tr>
<tr>
<td>B. Perceptual Task, Cardiac Activity</td>
<td></td>
</tr>
<tr>
<td>C. Noxious Visual Stimuli, Cardiac Activity</td>
<td></td>
</tr>
<tr>
<td>D. Post-Stress Observations</td>
<td></td>
</tr>
<tr>
<td>E. Limitations of the Study</td>
<td></td>
</tr>
<tr>
<td>F. The Stress Problem</td>
<td></td>
</tr>
<tr>
<td>G. Summary</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1A. Mean scores on HFT for all groups
Appendix 1B. Mean scores on the RFT for all groups
Appendix 1C. Mean scores on APQ for all groups
Appendix 2. Description of independent measures
Appendix 3. Slides of MEFT instructions
Appendix 4. Detailed task instructions and clarification of procedure
Appendix 5. Sample Post-Stress questionnaire
Appendix 6. ANOVA: Solution Latency - MEFT
Appendix 7. ANOVA: Basal heart rate
Appendix 8. ANOVA: Cardiac response - MEFT
Appendix 9. ANOVA: Cardiac response - homicide and control slides
Appendix 10. Cardiac response - control and homicide slides: means and levels of significance of the differences
Appendix 11. ANOVA: Standard deviation of the MEFT solution latency
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MEFT - Solution Latency for all Groups</td>
<td>32</td>
</tr>
<tr>
<td>2.</td>
<td>MEFT - Solution Latency for FI &amp; FD, Two Conditions</td>
<td>33</td>
</tr>
<tr>
<td>3.</td>
<td>MEFT - SL for FD &amp; FI, Simple and Complex items</td>
<td>35</td>
</tr>
<tr>
<td>4a.</td>
<td>MEFT - SL for FI &amp; FD in both Conditions - Complex Items</td>
<td>36</td>
</tr>
<tr>
<td>4b.</td>
<td>MEFT - SL - Simple Items</td>
<td>37</td>
</tr>
<tr>
<td>5.</td>
<td>MEFT - SL for all Groups, Both Conditions</td>
<td>38</td>
</tr>
<tr>
<td>6.</td>
<td>Beat by Beat Cardiac Response of FI &amp; FD, Simple and Complex Items</td>
<td>41</td>
</tr>
<tr>
<td>7.</td>
<td>Cardiac Response to Simple and Complex Items of FI &amp; FD</td>
<td>42</td>
</tr>
<tr>
<td>8.</td>
<td>Cardiac Response to MEFT, all Groups</td>
<td>44</td>
</tr>
<tr>
<td>9.</td>
<td>Cardiac Response to Homicide and Control Slides of FD &amp; FI</td>
<td>45</td>
</tr>
<tr>
<td>10.</td>
<td>Cardiac Response to Homicide and Neutral Slides, all Groups</td>
<td>47</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENT

The task of advising a doctoral candidate and supporting that candidate through the creation of a dissertation can infrequently be accomplished with enthusiasm and intelligence. Dr. Robert Hare has accomplished this several times; and I am grateful to have been one of those candidates.

I am very grateful to the members of the doctoral committee who gave of their time and energy. In particular, Dr. Gerry Plum and Dr. Rava Potashin were exceedingly important in major problems of editing and in clarifying underlying issues. Both Dr. John Yuille and Dr. Charlotte David made helpful observations and comments throughout the study.

Special thanks go to three individuals not on this committee. Dr. Juan Pascual-Leone gave freely of his time in discussion of his approach to the theory of Field-dependence-independence. Janice Frazelle was tireless in helping me in statistical matters. Elsie Eccles gave of her time and energy in theoretical discussion and general support.
CHAPTER ONE: INTRODUCTION

The research and theoretical literature on cognitive, behavioral and physiological compensatory responses to stressors is massive (Teichner, 1968). Perhaps more varied than the different levels of analysis of these responses are the terms used to label them, for example, defense mechanism (Freud, 1926), coping style (Israel, 1966), defensive style (Witkin, 1965), breadth of attention (Easterbrook, 1959; Broen, 1966; Wachtel, 1967), defensive patterning of autonomic responses (Sokolov, 1962), and short circuiting of threat (Lazarus, 1966).

A major problem in this area of research and conceptualization is one of predicting the power of certain stimuli to disrupt ongoing cognitive behavior in the individual. There appears to be a tendency for task-oriented cognitive activity to be totally disrupted for some individuals, subtly disrupted for others and facilitated for still others during the same stressful conditions.

The purpose of this study was to test certain hypotheses derived from a cognitive-attentional analysis of the relationship between cognitive styles, anxiety and performance. In order to more fully understand this relationship a parallel operation of recording cardiac activity was performed. The cognitive style variable of field-dependence-independence (Witkin, 1965) has been conceptualized at an attentional level of analysis; and the work of Lacey (1967) on cardiac activity helps to establish a link between the three factors, cardiac activity, cognitive style and attentional processes. Certain hypotheses related to cognitive style and performance were stated and tested. This allowed for discussion of the results in terms of the implications of Lacey's (1967) work on cardiac activity for the attentional position presented in this paper.

Below is a presentation of different conceptualizations of the
relationships between stress and performance. Those positions that traditionally derive from learning theory are discussed in terms of response hierarchies, relevant and irrelevant stimuli, drive stimuli, response compatibility; and they are considered first. This is followed by a discussion of the cognitive style of field-dependence-independence (FDI) and its relationship with performance during stress. Finally, a review of Lacey's (1967) work and the implications of that work are followed by the statement of a number of testable hypotheses.

Theoretical Considerations

Much of the literature concerned with the disruptive effects of stress attempts to relate the individual's emotional state and any disruption in his performance. Thus, much study was based on a common assumption that other things being equal, anxiety has a straightforward but nonlinear relationship with performance. A close approximation of the assumption is the empirically determined Yerkes-Dodson Law (Yerkes and Dodson, 1908) stated in terms of drive. It stated that the relationship was curvilinear with optimal learning at moderate levels of drive. Low levels of drive facilitated learning little while high levels disrupted learning. Of course, the optimal drive level depended on task complexity with high levels disruptive for complex but not for simple tasks (Levitt, 1967).

The Yerkes-Dodson Law conceptualized the relationship between drive and performance in a way that was compatible with contemporary learning theory. Identification of anxiety as an acquired drive (Miller, 1951) rechannelled the study onto the effects of anxiety on performance. At any rate, it is obvious from the availability of comprehensive reviews (Spielberger, 1966; Appley and Turnbull, 1967; Lazarus, 1966) that anxiety
has played a dominant role in the study of the effects of psychological stress on cognitive activity.

Influential in determining the focus was a theory put forward by Taylor and Spence (1952) which stemmed from the Hull-Spence position about the motivational components of drive in classical conditioning. Basically, the theory assumed that a learned factor (habit strength) combined with a drive factor (generalized drive) and the combination determined the tendency to respond to a stimulus. Drive was conceptualized as a function of the magnitude of a hypothetical emotional response aroused by aversive stimuli. The theory has been widely interpreted, but it can be stated as the conceptualization of a relationship between level of anxiety and interference of performance. It was hypothesized that interference depends on the number of competing responses elicited by a task. If two or more response tendencies were elicited simultaneously, the probability that the dominant response occurs was a function of the difference in strength between dominant and competing response tendencies. In other words, response tendencies elicited at the same time were hierarchically ordered. Thus, high anxiety increased differences in habit strengths between the alternate response hierarchies with the result that the probability of dominant tendencies was increased.

In order to extend the range of application of the theory to cognitive activities, Spence and Spence (1966) developed several hypotheses independent of the drive factor and focused on the notion of response interference. This formulation emphasized a different aspect of the Hull postulate, the drive stimulus, which could elicit learned and unlearned, covert and overt responses. The intensity of the drive stimulus (and therefore the number and strength of the response tendencies it elicits) was assumed to be a function of anxiety. Whether an increase of drive
stimuli facilitated or disrupted performance depended partially on whether the response tendencies elicited by anxiety were compatible or incompatible with the responses required for the task. Incompatible responses were assumed to be events such as heightened autonomic reactions and covert verbalizations (doubts, self-deprecation, anger or desire to escape). In summary, Spence and Spence (1966) hypothesized that irrelevant responses which interfere with task relevant responses should be more readily aroused in highly anxious than in less anxious individuals, especially in a complex condition. That is, performance should be worse for very anxious individuals in a complex condition.

Spence and Spence (1966) reviewed the research following from their formulations and concluded that the evidence was ambiguous and inconsistent. They pointed out several limitations of the formulations including the complexity of the nature of anxiety (situational versus characteristic) and of the specification of conditions in which anxiety can be elicited. More recently, Saltz (1970) reinterpreted the experimental evidence and suggested that the phenomena central to the Taylor-Spence anxiety theory may not exist. The data following from the original work of their position indicates that high and low anxious individuals may be susceptible to different kinds of stressors (e.g., failure vs. pain). Saltz suggests that the role of manifest anxiety as a drive variable is unclear and that the Taylor anxiety scale might best serve to indicate the type of stress likely to disrupt an individual's behavior.

The conceptualization that has been discussed up to this point reflects a traditional learning theory approach which was found to be limited in predicting the effects of stress on the performance on individuals. In recent years there has been an attempt to formulate explanations of the
relationship between stress and performance within a cognitive framework. In the late nineteen fifties, Easterbrook (1959) attempted to explain the disruption and facilitation of performance under stress at an attentional level. After reviewing the empirical evidence about the effects of stress on performance he concluded that arousal consistently reduces the range of cues that an organism uses. Further, he suggested that the reduction could either organize or disorganize behavior depending on the level of arousal and the task demand characteristics, or as Easterbrook states:

On some tasks reduction in the range of cue utilization improves performance. Irrelevant cues are excluded and drive is said to be organizing or motivating. In other tasks, proficiency demands the use of a wide range of cues and drive is disorganizing... There seems to be an optimal range of cue utilization and hence an optimal level of arousal for each task (1959, pp. 197-198).

In other words, Easterbrook had formulated the Yerkes-Dodson Law in the attentional framework. He clarified that position by adding the following:

For any task... provided that initially a certain proportion of the cues in use are irrelevant..., the reduction ... will reduce the proportion of irrelevant cues employed and so improve performance. When all irrelevant cues have been excluded..., further reduction in the number of cues employed can only affect relevant cues, and proficiency will fail (1959, p. 193).

Thus, Easterbrook interpreted changes in performance as being the result of alterations in the number of relevant and irrelevant cues to which an individual attended.

Lazarus (1966) reviewed the position of Easterbrook and that of Spence and Spence. He considers these positions not so much mutually exclusive as incomplete because they fail to consider events intervening between threat and response (e.g. cognitive coping processes). Similarly, Wachtel (1967), following Klein (1954) and in response to Easterbrook, suggested that the effects of anxiety and stress cannot be described without
considering individual differences in control processes. He described the ability to maintain a span of attention "appropriate" to task demands during stress as an adaptive feature. Given Easterbrook's formulation of the reduction of cue use during stress, Wachtel suggested that individual differences in processes allowing a redistribution (deployment) of attention to different types of cues could modify the process of cue reduction. Such differences might be related to cognitive style and control of anxiety.

Both Wachtel (1967) and Lazarus (1966) implied that certain cognitive control or coping processes are related to the changes in attention and performance during stress. Others (Gardner et al., 1960, 1959) have discussed this in different terms and have pointed to the relevance of the cognitive style of field-dependence-independence (FDI) because of its relation to attention and field articulation. Following from their comments, it seems reasonable that FDI could be related to performance changes where task difficulty and stress were also being studied.

The FDI dimension was originally considered as a continuum of the degrees to which individuals have differentiated themselves from their environments (Werner, 1965; Witkin, et al., 1962). The extremes of the FDI continuum were described in a perceptual framework by Witkin as follows:

In a field-dependent mode of perceiving, perception is strongly dominated by the overall organization of the field, and parts of the field are experienced as 'fused'. In a field-independent mode of perceiving parts of the field are experienced as discrete from organized background. There is now considerable evidence that a tendency towards one or the other ways of perceiving is a consistent, pervasive characteristic of an individual's perception (1965, p. 18).

Witkin used a range of correlated perceptual tests to classify individuals along the FDI dimension (Witkin, et al., 1962). Most of the tests require the subject to break down a contextual structure and
to disembled an aspect of the organized field. The Embedded Figures Test (EFT) and its various modifications (Hidden Figures Test or HFT) require the ability to extract a simple geometric figure from an embedding context (i.e., a larger complex geometric design). Perception of the larger figure and perception of the simple one are mutually exclusive responses; each aspect of the simple figure is part of the complex one.

Another of the major tools, the Rod and Frame Test (RFT) requires the ability to determine body positions of verticality in relation to a misleading nonvertical visual field. That is, in a completely dark room, an individual must adjust a luminous tilted rod to a true vertical position when it is presented within a misleading tilted luminous frame. The only cues available to the individual are internal ones related to his body position. He must compare these internal cues with the rod. The tilted frame serves as a contextual field exerting a force to "pull" perception of verticality towards the tilt of the frame. Field-dependence implies a tendency to perceive the contextual aspect of the EFT and to be strongly influenced by the "field forces" exerted by the frame in the RFT.

A recent theoretical formulation considers FDI to be a moderator variable. Pascual-Leone (1970) presents a model of cognitive functioning in which individual differences with respect to the weight of the field effects (i.e., degree of field sensitivity) play an important part. Individual differences in "weight" appear as the relative dominance of both sensorial and structural field weightings within the individual's system. He reviews recent evidence to suggest that FD individuals are more sensitive (readily excitable or responsive) to the field with regard to sensorial qualities. Therefore, a relatively strong control of overt responding by field weightings is characteristic of field-dependent individuals. Pascual-Leone has argued that the FI individuals,
in contrast, tend to be high mediators who attend to input and process it thoroughly before overt responses occur. Thus, the position of an individual along the FDI dimension is a particular state of balance of the field and meditational processes. This formulation of a weighting process permits FDI to be described as a response-biasing factor which moderates the probability of any response.

In summary, field-independence has been defined by high levels of cognitive activity (high mediators) and ability to overcome "field effects". FI individuals tend to articulate their environment and are able to disembed cues relevant to complex tasks. They can be characterized as having the ability to inhibit or reduce response to irrelevant cues, contextual or otherwise (Gardner, Jackson & Messick, 1960).

It is possible that differences in the ability to maintain attention to articulated, task-relevant cues is related to the direction and degree of change in cognitive performance during stress. While there has been some theoretical consideration about the relationship between FDI, stress and performance, there has been little research performed in this area. Research reviewed below suggests that changes in performance during stress are a function of the moderating role of FDI.

In a pilot study, Britain and Hare found that differences in performance on the RFT between field-dependent (FD) and field-independent (FI) subjects (Ss) were greater after a stressful experiment that before it. FI Ss who had been classified as highly anxious (Lykken and Katsenmeyer, 1968: Activity Preference Questionnaire) and as sensitizers (Byrne, 1964: Repression-Sensitization Scale) improved on the RFT following stress. In contrast, the performance of FD Ss classified as highly anxious and as sensitizers deteriorated after stress. That is, individuals with similar
high levels of anxiety differed in the direction of change in performance on a measure of FDI depending on their cognitive style. No reliable change in performance was found for either FD or FI Ss who were classified as low in anxiety and as repressors. These data suggest that cognitive styles of some FI and FD individuals may be exaggerated by a stressful experience. Hill and Feigenbaus (1966) provide data which partially support that suggestion. They found that although performance of both FD and FI adults on the RFT tended to deteriorate following verbal harassment, performance of the FD Ss deteriorated more.

Another study (Steele, 1969) supportive of the above found changes in performance on the EFT during stress which were different for psychasthenics and hysteric (MMPI classification). Following Witkin (1965), Steele related hysteria to field-dependence and psychasthenia to field-independence. The direction of changes in performance found by Steele was similar to that found by Britain and Hare in the pilot study. Steele had predicted that psychasthenics would improve on a complex task during stress because their defensive style was compatible with task requirements. Hysteres were expected to do worse during stress because their defensive style was described as incompatible with task requirements. While there were no differences in performance in non-stress conditions, stressful instructions differentiated the performance of the hysteric and psychasthenics. Presumably, the stress increased the defensive habits and thereby magnified performance differences.

Each of the studies reviewed above in part support the idea that FDI may be a significant factor in predicting performance on certain complex tasks during stress. The study by Steele suggests that Ss who would have been classified by Spence and Spence (1966) as low in anxiety (hysterics)
did more poorly on the EFT during stress than those who would have been classified as highly anxious (psychasthenics). Steele's data suggest that cognitive style rather than level of anxiety is the dominant factor in the prediction of performance changes during stress. The pilot study by Britain and Hare support this suggestion in that Ss with similar high levels of anxiety differed in performance during stress due to their degree of field-dependence.

As noted in the earlier theoretical considerations, Wachtel (1967) suggested that the range of cues used by an individual during stress may be limited in a qualitative way. In contrast, Easterbrook (1959) suggested that restriction occurs in a quantitative way and in the external field. From these views and the above research, the author suggests that cue restriction is moderated by the FDI factor and therefore may not occur in the same way for FD and FI individuals. External restriction could result from a redistribution of attention to task-competing, internal or external cues activated during stress. The total range of cues (internal or external) may not change from non-threat to threat conditions. However, the range of cues might be dominated by threat-related cues for FD Ss because they cannot inhibit response to salient stimuli. Assuming that FI Ss usually attend to task-relevant cues (while inhibiting response to irrelevant ones), a different restriction of external cues could result for them during stress. Even though threat-related cues may enter the field, the FI person has a relatively greater ability to inhibit response to these while attending to a relatively more adequate range of task-related cues.

This formulation accounts for a qualitative "narrowing" of the range of cues and accounts for individual differences in the redistribution of attention. It only touches on the notion of activation of competing
responses and internally cued stimuli. It can be assumed that cognitive styles reflect enduring response tendencies (Broverman, 1960) and that anxiety activates dominant habits (Spence, 1960; Brown, 1953). Such assumptions suggest that during stress an individual will show evidence of an activated cognitive style. If this style facilitates performance on certain complex tasks, the individual should perform better on such tasks if stress results in activation of habits comprising his style. In effect, FI performance should be augmented. If several response tendencies are activated, the tendency to attend to task-relevant cues should be dominant for the FI person. Responses incompatible with performance (e.g. looking for escape route, feelings of possible failure) should occur less frequently for FI than for FD individuals.

In summary, it is suggested that during stress there is a redistribution of attention within the available range of cues. Also, threat or anxiety-related stimuli will activate dominant response tendencies during stress which may be either compatible or incompatible with performance on complex tasks. The FD or FI quality of these response tendencies should account for differences in ability to attend to task-relevant cues and to maintain an adequate performance during stress. The degree to which FI performance is facilitated and FD performance disrupted should be a function of the increased strength of dominant response tendencies balanced against the strength of threat-related cues.

On the basis of the above consideration a number of experimental hypotheses have been formulated and are presented at the end of this chapter. This study has been conceptualized in large on the basis of attentional theories. As a means of gaining collaborative information about the attentional process, cardiac activity was monitored throughout the
experimental sessions of the present study. This was done because of recent
evidence of the correspondence between cardiac activity and attention
deployment (Lacey, 1967). Some of the research and relevant implications
are presented below.

As early as the nineteen twenties a series of studies was summarized
by Darrow (1929) which indicated that attention to external stimuli
(visual and auditory) was associated with cardiac deceleration. Acceler­
ation was associated with cognitive activity and unpleasant external
stimulation. Lacey and associates (1963) replicated these early findings
by studying cardiac response to a variety of stimuli and situations (e.g.,
Flashing light, arithmetic problems).

Beyond the basic replications of the deceleration phenomena, Lacey
(1959) provided data supportive of a connection between deceleration and
certain simple responses. He found a highly significant beat-by-beat
deceleration during an interval from a ready signal to on of a stimulus
requiring a key-release response. Lacey suggested that deceleration resulted
from attention to the location of the expected stimulus. Most important is
the finding that deceleration was concomitant with faster reaction times
and sensori-motor readiness. High heart rates were associated with loss
of motor-readiness. The findings of Birren, Cardon and Phillips (1963)
supported Lacey's conclusions. They demonstrated that systematic variations
in reaction time to auditory stimuli were related to the cardiac cycle.
Fastest reaction times occurred just before the heart atria contracted.
Similarly, Calloway and Layne (1964) found fast reaction times to visual
stimuli in the slow part of the cardiac cycle.

Lacey's use of these data has been to present evidence against over­
simplification of the concept of arousal. However, the data also suggest
an extension of his interpretation within the FDI framework, Lacey (1967) states that the cardiovascular system is "...particularly...responsive to the intention...to note and detect external stimuli...attentive observation of the external environment is productive of cardiac deceleration..." In other words, cardiac response may reflect set or expectation; and further, characteristic differences in set or intent might be reflected in cardiac activity. This implication can be drawn from Lacey's description of the "decelerator" as open to the environment.

An accelerator, in contrast, might be habitually attempting to filter out impinging external stimuli. Most important here is Lacey's characterization of "intent to detect" external stimuli as the determining factor of the decelerative response. Such a process might be related to the attention deployment involved in field articulation characteristic of FI individuals.

The common element in the formulations of Witkin and Lacey is "intent", described broadly as set, tendency or habit. Ax (1967) suggested that intention is composed of an individual's interpretation of opportunities and difficulties in a situation and his abilities to handle it. The latter seems an appropriate description of a defensive style.

It is possible that intent to attend to external stimuli serves a somewhat sophisticated defensive function, allowing for the modification of disturbing cognitive processes accompanying acceleration. That is, there may be an intentional redistribution of attention from internal to external events. The shift should be reflected in cardiac response.

The defensive style of FI individuals (Witkin, 1965) appears to allow them to remain in threatening situations and modify those situations. Their basic defense may be active articulation of the field (cf. notion of isolation). The defensive style of FD individuals appears to be much less
active, centering on a simpler mode of avoidance. Their basic defense may be a failure to articulate the field (especially when it is threatening). The implication drawn from this consideration is that active articulation of the field should be associated with decelerative cardiac activity, whereas a (defensive) lack of attention to and articulation of the external field should be associated with accelerative cardiac activity.

It should be recalled that under normal circumstances the FI individual tends to act on the environment, articulating it and reducing it into component parts. He must attend to the environment in order to act on it. Under stressful conditions such as presentation of a noxious visual stimulus, the FI individual should attend to the stimulus in order to modify the threatening aspects of it. In other words, he may isolate or attend to less stressful aspects of the field (cf. isolation as a defense mechanism). In such a situation he could be described as Lacey's "decelerator" ready to receive specific input. The FD individual, in contrast, avoids or rejects the external field when it involves threatening aspects. His perceptual responses are biased in a characteristic way (cf. notion of dominance of field weighting). Although he is often described as "compelled" by salient stimuli (or the dominant organization of the field), the FD person may be attending to salient internal stimuli (cf. the drive stimulus); and he may never be ready to attend to some input, threatening or otherwise. Under threatening conditions, the FD individual might be characterized more by accelerative than decelerative cardiac responses.

Little research has been done to explore the above speculation. However, Cohen's (1967) interpretation of the data of Culver et al. (1964) suggests a similar hypothetical link between cardiac activity and FDI. Culver et al. found that PD and FI Ss responded differently to low sensory
input. The effect was due to the degree of certainty of the Ss about the isolation experiments. Uncertain FD Ss appeared more aroused and uncomfortable than either informed FD or uninformed FI Ss. The mean heart rate and mean number of nonspecific galvanic skin responses of FD Ss were significantly greater when the situation was left unstructured than when it was structured for them. A measure of galvanic skin response indicated that all Ss were relatively more aroused and alert when the situation was left unstructured. However, an important difference involved the cardiac response in the two conditions. FI Ss had lower heart rates in the uncertain than in the certain condition while the reverse was true of FD Ss. Cohen (1967) suggested that different cognitive processes associated with FDI accounted for the differences. In an isolation situation, the FI S who lacks information about that experiment will be alert and aroused but sufficiently comfortable to passively take in the procedure (deceleration). FI Ss given information (less uncertainty and stress) are likely to become occupied with cognitive processes (acceleration). An extension of Cohen's interpretation is that uninformed FI Ss actively attend to the procedure in order to structure it and to discover the significance of the external environment. It is the FD S who passively attends, accepting imposed external structure. Without an imposed structure he is unlikely to articulate available cues or to provide a structure by other means. In an uncertain situation lacking external, salient stimuli, acceleratory cardiac activity might be expected from FD Ss because they have few perceptual or defensive habits to deal with the situation. The stimuli that FD Ss more likely attend to in such a situation are influenced by the dominant weighting of the field factor, in this case, the internal field (feelings of uneasiness and wishes to escape the situation). In contrast,
FI Ss will more likely try to articulate the available external stimuli. Culver et al. 's data support such an interpretation. Whatever the explanation, we are left with the findings of significant differential cardiac activity for FD and FI Ss, in the uncertain situation. FI Ss characteristically decelerated compared with their response in the certain situation. FD Ss characteristically accelerated compared with their response in the certain condition.

In summary, the above theoretical considerations lead to the formulation of several hypotheses pertaining to the effects of stress on performance and on cardiac activity as a function of FDI. It should be noted that, to some extent, this study was exploratory in nature, especially in the attempt to find further evidence relating cardiac activity and FDI.

**Experimental Hypotheses**

The underlying purpose of this study is to find support for the formulation that the cognitive styles of field-dependence and field-independence act as dominant perceptual-defensive habit patterns which are activated during psychological stress. If this is the case, then during stress, performance on tasks requiring FI attentional habits should be facilitated for FI Ss but disrupted for FD Ss. Further, since attentional activity has been related to cardiac activity, differences in the attentional responses of FI and FD Ss should be reflected in measures of cardiac activity. These hypotheses can be stated more specifically as follows:

**Behavioral Hypotheses:** First, it is hypothesised that FI Ss will be more able than FD Ss to remain in a stressful situation and maintain their performance on a task requiring minimal FI perceptual habits.
Second, it is hypothesized that the performance of FI Ss should not be significantly different from that of FD Ss when the situation does not activate perceptual-defensive habits. When threat activates these habits, performance of FI Ss should improve while that of FD Ss should deteriorate. Third, the main prediction regarding anxiety is that FDI will be the dominant factor and should moderate the influence of anxiety on performance.

**Physiological Hypotheses**: First, it is hypothesized that FI Ss will be characterized by deployment of attention to any externally presented threat stimulus; and this will be reflected in cardiac deceleration. FD Ss should only initially attend to such stimuli and should show less cardiac deceleration. Second, it is hypothesized that less difference will occur in cardiac response between FD and FI Ss during presentation of neutral stimuli, when perceptual-defensive habits are not activated. Certain theoretical considerations suggested that FI Ss might show more cardiac deceleration during presentation of any stimuli. One of the purposes of the present study is to gather some clarifying evidence on this matter.

Lacey's (1967) description of the complex determinants of cardiac activity provide for no clear prediction of cardiac response of FI and FD during the presentation of simple and complex visual tasks. Another purpose of this study is to explore the relationship between FDI, cardiac activity, and perceptual task demands.
CHAPTER TWO: METHOD

Experimental Design: In order to test the experimental hypotheses, it was necessary to provide a situation in which FD and FI subjects (Ss) could be expected to solve a task similar to the EFT in either threatening (stress) or non-threatening (control) conditions during which cardiac activity could be monitored. Because of the theoretical implication of the factor of anxiety, level of anxiety (high versus low) of FD and FI Ss was determined. The factors involved were FDI, Condition, Anxiety, Trials and Difficulty level of the task.

Subjects: The Ss were 150 female undergraduate volunteers from the University of British Columbia. They were enrolled in a wide variety of academic areas and ranged in age from 18 to 45 years (mean age of 20 years).

Partly because of the lengthy experimental procedure and the nature of the stress Condition, a number of Ss did not finish the experiment. Of the original Ss, 30 did not arrange for sessions or did not keep appointments. Ten Ss were dropped from the experiment due to equipment failure. Two refused to participate in the stress Condition.

Selection Criteria: The experimental design called for 4 groups of 16 Ss. The groups were comprised of FI, low anxious Ss (FI-L), FI, high anxious Ss (FI-H), FD, low anxious Ss (FD-L), and FD, high anxious Ss (FD-H). Half of each group received a stress treatment, half a control treatment.
The Ss were tested individually with a battery of tests and were assigned to groups according to the following criteria. The FDI dimension was defined by a combination of scores. Ss with a score above 12 correct on the Hidden Figures Test (HFT) and a score of less than 4 degrees deviation on the RFT were classified as FI. Those Ss with scores of less than 12 on HFT and more than 4 degrees deviation on RFT were classified as FD. The HFT is a paper and pencil form of the EFT (French, et al., 1963).

High and low anxiety were defined by scores above or below 49 (respectively) on the Anxiety Preference Scale (APQ, Lykken and Katzenmeyer, 1968). The cutting scores were based on available norms for University of British Columbia female undergraduate students. The APQ was used because it had been previously shown to be an effective index of anxiety proneness unrelated to FDI (Hare, et al., 1970). The APQ was also of special interest because of its relationship to certain physiological indices of anxiety (Lykken and Katzenmeyer, 1968; Valins, 1967).

Determination of stress or control Condition for any S was dependent on the status of the S groups (4 groups x 2 Conditions) at the time of his participation. An attempt was made to equalize the number in each group at each session.

Apparatus: Coloured slides were used to differentiate the stress and control Conditions. Noxious slides were obtained from the police department with the understanding that they be used in research. These slides were unretouched pictures of
individuals who had been brutally murdered (Homicide slides). Control slides were pictures of individuals engaged in everyday activities such as reading.

A Beckman Type R Dynograph was used to obtain simultaneous recordings of heart rate, respiration rate, skin resistance, digital and cephalic vasomotor activity, and eye movements. Heart rate was continuously recorded in beats per minute by placing Beckman biopotential electrodes on the right wrist and left leg with a ground lead on the right leg (standard lead II, Venables and Martin, 1967) and passing a signal through a Beckman Type 9857 cardiotachometer coupler. The output was expressed in beats per minute. A strain-gauge belt secured around the lower chest was used to measure respiratory cycle. Skin resistance was measured by passing a constant current of 10μa through Beckman biopotential electrodes attached to the first and third digits of the right hand. Two specially constructed photoelectric transducers were taped to the mid forehead and the thumb of the right hand and were used to monitor vasomotor activity. The signals were fed into a Type 481B input coupler with a time constant of 0.03 seconds. Horizontal and vertical eye movements were separately recorded using the following placements of electrode pairs. Beckman biopotential electrodes, one cm. in diameter, were placed at the outside corner of each eye. The other pair was placed above the mid eyebrow and below mid-eye of the right eye. The signals were fed into a Type 481B input coupler with a time constant of 1.0 seconds. All electrodes were filled with Beckman electrode paste.
and attached to the skin with Beckman adhesive collars. Skin areas involved in the measurement of cardiac activity and eye movements were prepared with Redex paste.

The S sat in an electrically shielded, sound-dampened room equipped with an intercom system. A telegraph key was secured to the left arm of the chair. The key closure produced a mark on the polygraph recording paper. A screen approximately 8 feet in front of S allowed for the projection of 3 x 4 foot images from an adjoining room by a Kodak Carousel slide projector. A white noise (45 db) was transmitted into the shielded room in order to mask noises from the projection room.

A portable model of the RFT (see Witkin, et al., 1962 for description of original model) was adapted for use in this experiment. The 2 foot square frame and the 1 foot, 9 inch rod could be moved independently by the experimenter (E). The surfaces were coated with luminous paint. The RFT was placed beside the screen, 8 feet from S's seated position.

Procedure: The experiment consisted of 2 sessions. The first involved the administration of a battery of tests to each S individually. The HFT was administered first and was followed by the APQ. Then several other scales were administered in random order; these included the Manifest Anxiety Scale (Taylor and Spence, 1952), the Repression-Sensitization Scale (Bryne, 1964), and the Eysenck Personality Questionnaire (Eysenck and Eysenck, 1963). Instructions and a detailed description of HFT and APQ can be found in Appendix 2.
During the second session each S was told that she could be requested to do some perceptual tasks while her physiological responses were being monitored. The S was then brought into the shielded room and the RFT was administered. (Instructions and details of the RFT are also in Appendix 2.) Following administration of the RFT, S was given a brief explanation of the general procedure, task instructions and equipment involved in the study. Detailed instructions can be found in Appendix 3; however, they are summarized as follows:

The S was told that electrodes would be attached so that physiological responses could be monitored. If S was in the stress Condition she was told that as well as being asked to try to solve each item of the task, she would be required to look at some possibly disturbing slides, actual police colour slides of people brutally murdered. Each S was asked if she had any objection to seeing such slides and was told that she could terminate her participation in the experiment at any time. She was also told that she would be able to communicate with E through an intercom throughout the experiment. If S was in the control Condition she was told that as well as trying to solve the task items, she would be required to look at some slides of people engaged in everyday activities. She was also told that she could terminate at any time and could communicate with E during the experiment. The differences in instruction and in the slides presented constituted the only differences between the treatments of the stress and control Conditions.
Following these introductory statements, E attached electrodes to S and briefly explained their function. At this point E also explained the perceptual task. Each S was told that it was a simplified version of the HFT which she had done previously, that it would be presented by slide and that she was to answer by means of a telegraph key on her left. The latency of her answer (the time from onset of a task item to the electrical impulse caused by depression of the key) was recorded on the polygraph paper along with the indices of physiological response. The S was shown slides of detailed instructions about the task and sample items to accustom her to slide presentation and to answering by means of the key. These can be found in Appendix 4. When it was apparent that S understood what was expected of her, she was asked to rest while E took recordings of her resting levels of physiological activity. Following this rest period, a warning slide stating "ONE MINUTE" was presented informing S that the first task item would be presented in one minute. Twenty items were then presented with simple and complex items alternated. Depending on the S's group, homicide or control slides were interjected in this series of 20 items in the 4th, 5th, 8th, 10th, 18th and 24th positions of the 26 slide series. The order was constant across subjects. Homicide or control slides preceded and followed approximately equal numbers of simple and complex items while having the appearance of randomization to Ss. Each task slide was shown for 20 seconds. The intertrial interval (ITI) between offset of any slide and onset of the next varied from 20 to 35 seconds. A slide followed stating "REST TWO
MINUTES", indicating that the major part of the experiment was over. Following this period in which resting levels of physiological response were recorded, E entered the room, administered the RFT, removed the electrodes and debriefed the Ss in an unstructured interview situation. All Ss in the stress Condition were asked to fill in a questionnaire concerning their reactions to the experiment and to other threatening events. This questionnaire is in Appendix 5.

Procedure for Terminating Subjects: If during the experiment S spoke to E (via the intercom), E acted with consideration of the type of slide presented at that time. If it was a homicide slide and if S sounded as if she wanted to terminate, E manually advanced the programme to an ITI until a decision was made. If the problem occurred during any other phase, the time was noted and the issue of S's continuing was discussed. If S wanted to continue after a brief pause or after removal of the remaining homicide slides, she was encouraged to attempt the remaining items as a means of securing as much data as possible on terminating Ss.

Dependent Measures: The task designed to test the behavioral hypothesis was a modification of the EFT for slide presentation. The new test (MEFT) involved new items which were less complex than, but similar to, EFT items. The MEFT consisted of 10 simple items which had an average solution latency of 5 seconds and of 10 complex items which had an average solution latency of 15 seconds. Latency of solution for all items had been determined in a pilot study using an unselected sample of
university students.

The relationship between HFT and MEFT in this study should be clarified. Although the HFT was used to select FD and FI Ss, it was advantageous to use as the main dependent measure a simple indicant of FDI which required minimal FI perceptual skills. Ss were selected as FD and FI on the basis of the more complex measure of FDI; complex items was assumed to differentiate FD and FI Ss more readily than simple ones. Differences in performance on a similar but much simpler measure of FDI can more easily be attributed to an interaction between FDI and treatment effects. The simpler test alone should fail to differentiate FD and FI Ss unless a situation activates FD and FI perceptual-defensive habits. Therefore, it was advisable to test each S on a standard index of FDI in order to determine his position along the FDI dimension and, further, to test her on the simpler MEFT with the assumption that a stress condition would either disrupt or facilitate the performance of certain subjects.

Each S was required to try to solve the 10 simple and 10 complex items of the MEFT. Several scores derived from this test were available. The time interval from onset of a task slide until the initiation of an answer is referred to as Solution Latency (SL). SL was measured from polygraph pen deflection marks on chart paper travelling at a speed of 1 cm. per second. The distance from a mark instigated by the projector to a mark instigated by the telegraph key used to answer was converted into time to the nearest half second. The SL could vary from 0 to 30
seconds - although items were presented for only 25 seconds, Ss were to answer after slide offset. However, answers given after the 30 second maximum were scored as 30 seconds. Since answers given more than 5 seconds after offset would probably be guesses, allowing a longer maximum would have only spuriously decreased the latencies of those who correctly guessed and increased latencies of those who did not guess.

Items had been preselected so that there would be no significant overlap in the distribution of SL for simple as compared with complex items. Simple and complex items were alternated in the procedure with 10 trials of each type.

In addition to SL the number of correct, incorrect and omitted responses was scored. Incorrect and omitted items were assigned the maximum score. Data from a terminated S were included in analyses of SL only if she had completed 14 of the task items. Two such Ss were included in the analyses. A total of 8 Ss terminated at some point during the experiment, the majority after seeing 2 or 3 homicide slides. Those who terminated early provided little reliable data. Inclusion of these Ss would have biased the results in favour of the hypothesis because all were field-dependent Ss. It had been hypothesized that such Ss would perform more poorly in stress than in control conditions in contrast to FI Ss. That FD Ss tended to terminate tends to support the hypothesis at a gross level of analysis; however, to give these Ss maximum scores on each item not attempted and to include them for analysis would have weighted the data favourably. For those terminated Ss included, a mean SL for simple
and for complex items attempted was determined. These means were assigned to the task items not attempted because of termination. Although these scores were assigned mean SL, they were scored as omitted items.

Several measures of cardiac response were taken. Other indices of physiological response were also recorded. However, failure of the Biomedical Data Acquisition System used resulted in the loss of much of the electrodermal data; and since cardiac activity was the variable of major interest in this study, only it was scored and analysed.

In order to compare Ss and groups on measures of resting level heart rate, tonic heart rate was monitored before and after the experimental treatment. Measures were taken after approximately 10 minutes of rest following attachment of electrodes. For each S the mean rate of 30 heart beats during the first rest period was determined. A similar measure was taken during the second rest period following experimental treatment.

In an attempt to clarify the remaining measures of cardiac activity, it is necessary to explicate the system used to derive the scores. A scoring system was designed* to moderate certain distortions within grouped heart rate data engendered by non-treatment individual differences in heart rate and beat to beat variability. This procedure considers the heart rate of a S in response to a particular stimulus in relation to his own resting level heart rate and to his beat to beat variability.

* by Janice Frazelle, Psychology Department, U.B.C.
The resultant standardized scores avoid some of the difficulties in analysis of grouped heart rate data.

The procedure can be briefly explained as follows: a slide presented for a given interval is preceded and followed by an ITI where no slide is shown. Heart rate is continuously recorded on a beat to beat basis. Mean heart rate (Pre $\bar{X}$) and standard deviation (Pre SD) of the 10 beats immediately prior to slide onset are determined, providing 2 measures for each pre-slide ITI. Then the rate of each of the first 10 beats ($B_{1-10}$) during slide presentation is determined. Pre $\bar{X}$ is subtracted from each beat ($B_{1-10}$) individually and the difference ($D_{1-10}$) is divided by the Pre SD. Therefore, for any slide-on beat

$$D_n = \frac{B_n - Pre \bar{X}}{Pre SD}$$

For any slide there are 10 individual scores derived from the above formula. Each represents a slide-on beat in terms of its acceleration or deceleration from the pre-slide ITI mean rate. The degree of change is stated as a standard score, i.e., in units deviation from the pre-slide ITI. A positive sign indicates acceleration, a negative, deceleration. For example, if S has a Pre $\bar{X}$ of 70 with a Pre SD of 10 and the rate of the first beat during slide presentation is 65 beats a minute, $D_1$ is equal to $-5$. The $D_1$ divided by Pre SD is equal to $-0.50$. This score indicates that the first slide-on beat is $0.50$ standard deviation units away from (decelerated from) the pre-slide mean.
This technique was applied to all types of slides.
Each S had 10 scores for each of 26 slides (260 total scores).
A sample of each slide type presented at the beginning of the experiment was taken since cardiac records of terminated Ss were much shorter and often showed numerous artifacts caused by muscle tension and voluntary arm and leg movement. In general, records of FD Ss in the stress Condition tended to show an increase in such artifacts over time making such records difficult to score reliably for later trials. Therefore, the first 2 slides of each slide category provided a sample of initial cardiac response.

In summary, 10 scores for each of 6 slides were available for each S. Data reduction was accomplished by taking a mean of the two scores available for each beat for the 2 slides of each type (simple, complex, homicide or control). This reduction resulted in a total of 30 scores for each S, 10 for each slide type.

A final dependent measure involved relatively informal interview data. The nature of the stress Condition made it necessary to debrief each S in order to ascertain the degree of stress experienced and to help each S overcome any continuing feeling of discomfort. The E made informal observations of each S in the stress Condition, during the debriefing session. Then S was asked to fill in a questionnaire regarding her specific reactions to the homicide slides and her general reactions to everyday stresses. Because of the open-ended nature of both the questionnaire and the observations, only general measures were
taken. These will be referred to only in support of the more formal dependent measures.

**Analysis of Dependent Measures:** Dependent measures were subjected to Analysis of Variance (Winer, 1962). The factors involved were Condition (control or stress), FDI (FD or FI), Anxiety (high or low), Difficulty level (simple or complex items), and Trials (1-10) for the Latency measures, or Beats (1-10) for the cardiac measures.

Due to some unexpected patterns of cardiac response within the FD groups during stress, further analysis based on new categorizations of Ss were carried out on the homicide and control slide data. These will be described in detail in the results section.
CHAPTER THREE: RESULTS

In general, analyses of variance (ANOVA) for multiple factors were computed for each dependent measure previously described. The statistical level of probability generally accepted as significant was the .05 level. Due to the exploratory nature of the study, effects approaching this level were also discussed.

Behavioral Measures

The MEFT, Solution Latency: The ANOVA of the differences for solution latencies of MEFT items is summarized in Appendix 6. The distribution of MEFT scores can be seen in Figure 1. FD Ss performed consistently slower than FI Ss with means of 13.5 and 8.6 seconds respectively ($F = 44.3$, $df = 1/56$, $p < .01$). Consistently, simple items were solved faster than complex ones. Simple items were solved in an average of 7.3 seconds, complex items in an average of 14.8 seconds. The significant FDI X Difficulty level interaction ($F = 4.6$, $df = 1/56$, $p < .04$) showed that the differences between FD and FI Ss were greater on complex items than on simple items.

Although there were no significant differences between the two Conditions, the Condition X FDI interaction ($F = 3.16$, $df = 1/56$, $p < .08$) approached significance. ANOVA of the simple effects indicated that FD and FI Ss tended to differ from each other only in the stress Condition ($F = 3.59$, $df = 1/56$, $p < .07$). FI Ss tended to perform faster in the stress than in the control Condition. FD Ss tended to perform slower in the stress Condition. The means are shown in Figure 2a.

The Condition X FDI X Difficulty level interaction approached significance ($F = 3.34$, $df = 1/56$, $p < .07$) (see Figure 2b). ANOVA of the simple effects indicated that FD and FI Ss did not differ from each other on either the simple or complex items in the control Condition. However, FD and FI Ss
Figure 1. MEFT solution latency for all groups

- ▲ = complex -- control
- ▼ = complex -- stress
- ○ = simple -- control
- ● = simple -- stress
Figure 2: MEFT solution latency for FI & FD in both conditions
differed significantly in the stress Condition for the complex items
\(F = 9.17, \text{df} = 1/56, p < .01\). They also tended to differ on the simple
items in the stress Condition \(F = 3.03, \text{df} = 9/504, p < .10\).

The significant main effect for Trials \(F = 9.07, \text{df} = 9/504, p < .01\)
indicated that there was a general decrease in the SL across trials. The
significant Trials X Difficulty level interaction \(F = 24.45, \text{df} = 9/504,
p < .01\) indicated that differences between simple and complex items increased
across trials. The significant FDI X Trials X Difficulty level interaction
\(f = 3.64, \text{df} = 9/504, p < .01\) was of more interest. The significant differ­
ences between FD and FI groups for nearly all complex and some simple items
are shown in Figure 3. ANOVA for simple effects indicated that FI and FD
groups failed to differ significantly from each other on five simple items,
but differed on all but one complex item.

The Condition X FDI X Trials interaction did not reach significance.
However, Figures 4a and 4b suggest that certain items tended to differentiate
FD and FI groups in the latter part of the stress Condition but not in the
control Condition. Performance tended to improve for FI Ss and to deteriorate
for FD Ss.

Means for Trials for FD and FI groups under the two Conditions (Figure
4) indicates that the FD group performed less consistently from trial to trial
than did the FI group. The FI group seemed more consistent in the stress than
in the control Condition. In the control Condition FD Ss occasionally per­
formed as rapidly as FI Ss.

There was a nonsignificant tendency for highly Anxious Ss to perform
faster than low Anxious Ss \(F = 2.63, \text{df} = 1/56, p < .10\). In general, level
of anxiety did not interact significantly with any other factor. Figure 5,
showing the Solution Latencies for high and low Anxious FD and FI groups
illustrates a tendency for faster performance by highly Anxious Ss.
Figure 3. MEFT SL for FD & FI, simple and complex items
Figure 4a. MEFT SL for FI & FD in both Conditions - complex items
Figure 4b. MEFT SL - simple items
Figure 5. MEFt SL for all groups, both conditions
A post hoc ANOVA of the standard deviation of SL (Appendix II) indicated that both Condition and FDI had significant effects on the standard deviations. FI Ss were less variable than FD Ss (F = 34.13, df = 1/56, p < .01). FI Ss were less variable during stress than FI Ss during control or than FD Ss during both Conditions (F = 3.73, df = 1/56, p < .06). FD Ss were equally variable during both Conditions. In each, they were more variable than FI Ss.

MEFT, Items Correct: Comparison of differences in number of MEFT items solved indicated significant differences between FD and FI Ss (F = 20.34, df = 1/56, p < .01). FI Ss solved an average of 18.7 items; FD Ss, 16.3 items.

Summary of Behavioral Data: The data indicate consistent, but small, differences in performances of FD and FI groups during stress. Only latencies of complex items were affected by stress when FI Ss tended to perform faster, FD, slower. Although FI Ss solved more items, Condition had not effect on number solved for FD or FI Ss.

FD and FI Ss differed in the expected direction in the control Condition, but neither as consistently nor as much as during stress. FD Ss tended to vary from item to item in the control Condition sometimes surpassing FI performance. Although this type of variance occurred during stress, here FD Ss were consistently worse than FI Ss. FI performance tended to be consistent in both Conditions, but slightly more consistent during stress.

Findings of small disturbances in performance for FD Ss must be considered with the observation that certain indices of disturbance were not reflected in the group latency scores. Eight FD Ss refused to continue during the stress Condition. Of these, six were dropped as Ss. Two FD Ss refused to participate when informed about the slides of homicide victims.
Physiological Measures

Beggal Heart Rate: Mean heart rate during pre- and post- treatment rest intervals was compared for all groups. The results of the ANOVA are summarized in Appendix 7. There were no significant differences in mean heart rate between any groups for either Condition.

Cardiac Response to Simple and Complex Slides: Means derived from the scoring system previously described were submitted to ANOVA. The results are summarized in Appendix 8. There were no significant main effects for Condition, Anxiety, Difficulty level, or FDI. The significant main effect for heart beats indicated that there were significant differences between some beats regardless of other factors (F = 21.45, df = 9/504, p < .01).

The significant Condition X Difficulty level interaction (F = 5.20, df = 1/56, p < .05) showed that there was more acceleration to simple items during stress, but more acceleration to complex items during the control Condition. The FDI X Difficulty level X Beats interaction (F = 2.02, df = 9/504, p < .05) was significant. Figure 6 shows that FD and FI groups differed little in response to the complex task. FI Ss tended to initially decelerate more and to peak at a higher level than did FD Ss. FI Ss also tended to initially decelerate more to the simple task; however, FD Ss reached a higher acceleratory peak and maintained the relatively higher level. The FI group differed little in cardiac response to the two difficulty levels. In contrast, the FD group reached much higher levels of acceleration to the simple task than to the complex one.

The significant Condition X FDI X Difficulty level interaction (F = 2.20, df = 9/504, p < .05) helps to clarify these findings. Figure 7 shows that the acceleratory peaking of FD Ss occurred only in the stress Condition for simple items. A return to a less-accelerative mode occurred in both Conditions for FI Ss. They showed less acceleration to the complex items in the stress as
Figure 6. Beat by beat Cardiac response of FI & FD, simple and complex items
Figure 7. Cardiac response to simple and complex items of FI & FD.
compared to the control Condition.

The Condition $X$ FDI $X$ Anxiety $X$ Beats interaction did not reach an acceptable level of significance. However, Figure 8 illustrates this interaction and shows the possibility that at least the FI-H and FD-L groups tended to show more acceleration during stress. The FD-H group seemed to differ less between Conditions than did the other groups. Also in contrast to the others, is the FI-L group which tended to show more acceleration in the control Condition.

In summary, there were differences in cardiac response to the perceptual task between FD and FI groups. The differences occurred largely in response to the simple items. FD Ss showed a peak of accelerative activity to simple items during stress; and FI Ss showed more rapid returns to decelerative activity during the control Condition.

**Cardiac Response to Control and Homicide Slides:** A summary of the results of the ANOVA concerning cardiac response to the non-task slides is presented in Appendix 9. There was a significant main effect for FDI ($F = 4.32$, $df = 1/56$, $p < .05$) which can be inferred from Figure 9. For all slide-on Beats considered together, FD Ss showed less decelerative activity than did FI Ss.

A significant main effect for heart Beats ($F = 1.98$, $df = 9/504$, $p < .05$) indicated that for all Ss there were significant changes from beat to beat. Figure 9 illustrates a general initial deceleration which returns to pre-slide levels by the 4th beat. This is followed by a secondary deceleration maintained through the 10th beat.

No interaction reached an acceptable level of significance. Inspection of the raw data suggested that several low Anxious, FD Ss showed extremely erratic cardiac activity during stress. The erratic quality of the response of a few Ss might partially account for the large error variance leading to non-
Figure 8. Cardiac response to MEFT, all groups
Figure 9. Cardiac response to homicide and control slides of FD & FI
significant differences in the ANOVA. The curves of the FD and FI groups shown in Figure 9 represent individual curves fairly accurately except for the few erratic responders. Inspection of individual curves suggested consistencies not drawn out by the original analysis. The curves in Figure 10 actually illustrate these consistencies. During stress, FDI and Anxiety seemed to interact in a very complex way. High anxiety seemed to be related to initial acceleration at the onset of homicide slides; but it was not related to either a continued acceleration or deceleration. The response following the initial one did relate to FDI. In general, maintained acceleration occurred for FD Ss only. These observations led to a method of subject re-classification permitting an appropriate analysis.

Re-classification of Cardiac Response to Control and Homicide Slides:
Two major variables were determined as most useful in re-classifying all Ss. First, an attempt was made to determine whether a given S decelerated or accelerated (from pre-slide mean) immediately after a homicide or control slide was shown. There were 10 "initial accelerators" and 22 "initial decelerators" in the control group; the stress group contained 13 "initial accelerators" and 19 "initial decelerators".

Second, Ss were classified in terms of whether they maintained decelerative or accelerative activity. The latter was defined by the occurrence of at least 4 of the 10 beats being accelerated above the pre-slide mean. There were 14 Ss who could be classified as "continued accelerators" in the control group, 17 Ss in the stress group. The remaining 18 and 15 Ss (respectively) were classified as "continued decelerators".

A one way ANOVA for unequal groups was computed to analyze differences between these groups on several variables. The variables were HFT, RFT, SL of simple and complex items of the MEFT, and the sub-scales and total score of APQ. Means for all comparisons are shown in Appendix 10.
Figure 10. Cardiac response to homicide and neutral slides, all groups
In the stress Condition, the ANOVA indicated that initial deceleration was associated with FDI as measured by the RFT. Initial decelerators scored consistently lower on the RFT ($F = 9.42, df = 1/30, p < .01$). They tended to score higher on HFT, but there were no differences in the performances of initial decelerators and accelerators on any part of the MEFT in the stress Condition.

Differences on indices of anxiety were somewhat clearer. Initial decelerators scored significantly lower on the Social ($F = 6.95, df = 1/30, p < .01$), Physical ($F = 6.16, df = 1/30, p < .02$), and Total scales ($F = 9.56, df = 1/30, p < .01$) of the Anxiety Preference Questionnaire. There were no differences on the Ego Anxiety Scale.

None of the above differences was significant for the groups in the control Condition. It appears that initial cardiac response to the noxious slide of a homicide victim is statistically associated with low levels of anxiety, while tending to be associated with field-independent performance.

Similar analyses were computed on the groups, dominant decelerator vs. accelerator showing no significant differences on the indices of anxiety; however, there were differences on all measures of FDI for groups in the stress Condition. Those Ss who maintained accelerated beats for at least 40% of the cardiac response to the homicide slides appeared to be field-dependent. The accelerators scored significantly higher on RFT ($F = 4.69, df = 1/30, p < .03$), significantly lower on HFT ($F = 6.84, df = 1/30, p < .01$), and tended to have longer latencies for the complex items of the modified MEFT in the stress Condition ($F = 3.11, df = 1/30, p < .09$). These differences were not significant for Ss in the control Condition.

The combined data suggest that initial acceleration to the noxious slides was related to high levels of anxiety; however, continued acceler-
ation was related only to field-dependence. Likewise, initial deceleration was related to low levels of anxiety; and those who maintained deceleration tended to be field-independent. These tendencies also can be inferred from Figure 10 which shows the cardiac response to homicide and control slides of the original groups. Continuous acceleration occurred to homicide slides only for the field-dependent groups. Initial acceleration tended to occur only for high anxious groups.

**Summary of Cardiac Measures:** The combined data concerning cardiac activity differentiates between FD and FI groups and between high and low anxiety groups. Certain nonsignificant tendencies were taken into consideration due to the exploratory nature of the study and the need for flexible analyses.

There were obvious and consistent differences between FD and FI groups and between high and low Anxiety groups in cardiac response to homicide slides but not to control slides. Field-dependence and high levels of anxiety were related to acceleratory responses. Field-independence and low levels of anxiety were related to deceleratory activity. With reference to the task slide, similar but more subtle relationships occurred for the field-independent, low anxious Ss and the field-dependent, high anxious Ss.
CHAPTER FOUR: DISCUSSION

The data from this study provide support for the hypothesis that a threatening situation activates different classes of habits in FD and FI individuals. These differences were reflected in performance on a perceptual task, in cardiac activity and in the statements made by individuals following exposure to the stress Condition. Anxiety had a significant effect in the case of one measure of cardiac activity only. As hypothesized, FDI was found to be the more potent response-biasing factor; it was related to the type and efficacy of perceptual-defensive responses activated during stress. That is, FDI influenced the kind of habit activated and the effectiveness of the habits in facilitating or disrupting performance.

MEFT: The Effects of Stress: The kind of stress experienced in this study did not seem more or less facilitative or disruptive for either high or low anxious Ss on MEFT performance. However, there was a nonsignificant tendency for low anxious Ss to perform more slowly than high anxious Ss. The stress was disruptive to both high and low anxious Ss only if they happened to be field-dependent. Performance of FD Ss on the complex items tended to deteriorate during stress. In contrast, FI Ss maintained a high level of performance during stress as they had during the control Condition. However, during stress FI Ss tended to perform more rapidly and more consistently from item to item than did FI Ss in the control Condition.

One of the more interesting findings was that FI Ss showed only a nonsignificant tendency to perform faster than FD Ss in the control Condition. FD Ss occasionally performed as fast as did FI Ss. In effect, the MEFT failed to discriminate between FD and FI groups in the non-threatening situation. Considered in the light of the significant differences between
FD and FI performances during stress, the above finding supports the hypothesis that activation of dominant perceptual-defensive habits during stress exaggerates differences in FD and FI performance. In the control Condition, designed not to activate such habits, differences in performance were extremely small. The occasional rapid solutions of FD Ss and slow solutions of FI Ss could account for the lack of statistically significant difference, a possibility reflected by the variance of solution latencies. The MEFT data showed certain consistent differences in item to item variance between FD and FI Ss. Along with generally poorer performance, FD Ss were more variable than were FI Ss. In the control Condition, the FD group sometimes surpassed the performance of the FI group. One assumption about FI individuals is that they can inhibit response to task-irrelevant stimuli while maintaining attention to task demands. Consistency of attention to a task should be reflected in consistency in item to item performance; and consistency should increase when task-relevant habits are activated. Random fluctuation of attention to salient, task-irrelevant stimuli (expected for FD Ss) should be reflected in variable or inconsistent performance. The data indicated less variance for FI Ss; and their performance variance decreased during stress while that of FD Ss did not. It is probable that the variance of FD Ss would have been greater had not ceiling scores been assigned. These scores were the maximum values assigned to incorrect or omitted items.

The finding of relatively little variability in the performance of FI Ss and the reduction of that variability during stress supports the hypothesis that a redistribution of attention occurred for FI Ss due to activation of task-relevant habits. Attention to task-relevant stimuli may have increased during stress decreasing the variability of performance.
Equal variances for FD Ss in the two Conditions suggests that the greater fluctuation of FD attention was at least as large during stress as it was during the control Condition. Perhaps the large fluctuation of attention in the control Condition allowed for occasional attention to task-relevant stimuli because of a lack of highly salient stimuli in that Condition. Attention to task-relevant stimuli when salient (threat-related) stimuli enter the field is unlikely in FD Ss.

Anxiety had little effect on the variance of solutions of task items. The lack of statistical significance in the differences between high and low anxious Ss may be interpreted as further support for the hypothesis that FDI is the more dominant moderator variable.

It should be emphasized that the lack of large differences in performance between FD and FI Ss probably resulted from the termination of 8 FD Ss. Originally, 16 FD Ss began the stress Condition; 8 did not continue and were replaced. Thus, of a total of 24 FD Ss attempting the stress Condition, one third of them terminated. If the original 16 FD Ss had been used in the data analysis and if grosser measures of performance had been considered, the differences on the MEFT would have been highly significant. It would be valuable to explore the quality of performance and the personality of terminating Ss. Quitting responses often occur in a stressful and permissive situation. For ethical reasons Ss participating in this study were assured that termination was an acceptable response.

**Perceptual Task, Cardiac Activity:** There were few differences in cardiac activity during the perceptual task between FD and FI Ss. A significant difference between the two Conditions for simple items was due largely to a sharp increase in the heart rate of FD Ss in response to simple items during stress. This did not occur for FI Ss at either level of
difficulty. A similar increase in heart rate to simple versus complex tasks during stress was found by Kaufman et al. (1967). They related the finding to the possibility that cardiovascular augmentation occurs in proportion to a need to exclude "noise" from the cortex. They suggested that the extent to which the autonomic nervous system facilitates filtering of task-irrelevant stimuli is inversely related to the attention demands of a task — the more attention demand, the less the need to filter noise by cardiac activity. In the present study, the higher heart rate response to simple items during stress and the tendency for heart rate to be lower for simple items in the control Condition support the Kaufman et al. findings. That the differences in the present study are due to the performance of FD Ss is understandable. FI Ss probably have less need to augment the filtering of task-irrelevant stimuli during stress while FD Ss tend to be more susceptible to distraction ("noise"). During stress, the FD defensive style facilitates activation of task-irrelevant habits which, in turn, allow for attention to increasing numbers of task-irrelevant stimuli. To maintain performance on a task, the FD S would need to augment any filtering process available to him.

Another difference between FD and FI Ss in cardiac activity was the tendency of the latter to return rapidly to pre-slide heart rate levels during simple items. This tendency does not reflect faster solution latencies of FI Ss since there was no difference between groups in solution latency for simple items. An alternate possibility is that FI Ss were more confident in their accuracy and that this allowed them to discontinue task-related cognitive activity directly after solution. Several FD Ss verbalized doubt about their solutions after the experiment. Perhaps these uncertain Ss continued to explore items after they had solved them.
Greater confidence in certain judgements in FI as compared with FD Ss was found by Sangiuliano (1951) and Gross (1959).

There was only a slight tendency for anxiety to affect cardiac activity during the task. The accelerative activity during the task was intensified in the stress Condition for high anxious, FI Ss and low anxious, FD Ss. Otherwise, FDI stands as the more potent factor.

Noxious Visual Stimuli, Cardiac Activity: The data indicate that FI Ss responded differently than did FD Ss in cardiac activity during exposure to an unpleasant visual stimulus. FI Ss maintained patterns of cardiac deceleration to noxious as well as to neutral visual stimuli. In contrast, FD Ss showed some cardiac acceleratory activity to the noxious stimuli (homicide slides). There were no significant differences between groups in cardiac activity during neutral slides. Both FD and FI groups tended to decelerate slightly to the neutral slides. Individual response curves indicate that FI Ss tended to decelerate slightly more to both neutral and noxious slides than did FD Ss. These data give some support to the hypothesis that in one sense field-independence may be more strongly associated with a receptive (but independent) orientation to the environment than is field-dependence. The accelerative activity of FD Ss during noxious slides supports the hypothesis that these Ss tend to reject external threat-related stimuli and attend to internal threat-related stimuli. Post-stress interview data tend to support this speculation.

With regard to the factor of anxiety, it will be recalled that the effects of anxiety on MEFT performance were negligible thereby supporting the position that perceptual-defensive style is more important than and possibly overrides the effects of anxiety. With regard to the effects of
anxiety on cardiac activity, responses were not so clearly influenced by FDI alone. Anxiety level had a significant effect on the initial cardiac response to the homicide slides but not on the initial response to neutral slides. The most dramatic effect of anxiety was found for highly anxious, FD SSs. Their anxiety-related, initial acceleration to the homicides was maintained across the measured response to the slide. These SSs might be characterized as "accelerators". No other group had both initial and maintained accelerative activity to the noxious slides. FI SSs who were highly anxious also accelerated at onset of the homicide slides; but they did not maintain acceleration and showed deceleration across the measured response. Low anxious FD and FI SSs tended to decelerate at the onset of homicide slides. FI SSs maintained that deceleration while FD SSs tended to accelerate after an initial deceleration. The FI low anxious S could be characterized as a "decelerator".

It is clear that anxiety level determined initial cardiac activity during presentation of the homicide slides; but FDI determined the maintained response. Neither factor seemed to strongly determine cardiac activity during the perceptual task. However, in most cases of the measured cardiac responses there were tendencies for FI SSs to accelerate less than FD SSs when accelerative activity occurred for all SSs. Also, there were tendencies for FI SSs to decelerate more than FD SSs when deceleration occurred for all SSs. The data tend to support the hypothesis that cardiac activity of FI SSs is associated with a more receptive orientation to the environment in certain conditions.

It was suggested that acceleration and deceleration reflect cognitive activity initiated by the threatening nature of a situation. If the
findings of physiological differences during exposure to a threatening visual stimulus are interpreted in Lacey's terms, it may be said that an intention to reject the external environment (or initiation of a crude filtering process) was activated in FD Ss. In contrast, a receptive intention to take in the environment was activated in FI Ss. That these processes differ for FD and FI Ss was related to 1) the tendencies of FI Ss to articulate experience and to redistribute attention to non-threatening aspects of stimuli and 2) the tendency of FD Ss to experience a stimulus configuration as fused and the FD inability to redirect attention to non-threatening aspects of such a configuration.

Anxiety is probably related to initiation of the facilitating or rejecting intentions. High levels of anxiety may be associated with more rapid activation of anticipatory responses which play a part in the inhibition of the intake of stimuli. Initial cardiac acceleration to homicide slides in highly anxious Ss could reflect an inhibitory process. Low levels of anxiety were consistently related to initial deceleration associated with receptivity. The simple absence of anticipatory anxiety-related processes could facilitate intake before activation of any inhibitory responses. For highly anxious Ss, proneness to anticipate threat may produce the responses which inhibit initial intake of a stimulus.

The relationship of high levels of anxiety and field-dependence to cardiac acceleratory activity might reflect some process other than an intention or a defensive activity. Acceleration could reflect increased arousal (cf. Malmo, 1966) resulting from the failure of a S to have adaptive responses available or to cope with a situation. Self-evaluation of failure or expectation of failure may increase arousal. FD Ss did report more distress during and following the stress Condition than did FI Ss. Observations indicated that for FD Ss "distress" was associated with
intentional avoidant behaviors, cognitive and overt. The relationship between distress or negatively toned arousal and avoidant behaviors was unclear. Distribution of attention to internal distress cues might function in part to filter out potentially threatening external cues. This self-induced distress could be related to hysteria, a possibility discussed with reference to the exaggeration of cognitive-defensive styles in psychopathology (Witkin, 1965; Silverman, 1964, 1967). An individual may attend to internal stimuli because they serve a defensive function. The habitual response of assuming a stimulus to be threatening and that one cannot cope with this threat before the actual stimulus is explored might be characteristic of the hysterical personality. These behaviors were characteristic of those Ss who terminated and some FD Ss who managed to continue in the stress Condition. The slides were never explored in detail and could only be considered a potential threat to these Ss. They often mentioned that the unpredictable occurrence of the homicide slides was distressing.

Statements made by Ss following the stress Condition suggested a source of variance in the cardiac data. Several FD Ss stated that they sometimes closed their eyes or looked at the edge of the slides when a slide came on. If peripheral cues (i.e. red color) suggested a homicide slide they continued avoiding a direct exploration of the slide. Such strategies may partially explain the erratic cardiac activity of certain FD Ss and the large error variance of the original analysis.

In considering the cardiac data, it should be recalled that the analyses were confined to the first two slides of each type. Therefore, the data would not reflect any differential habituation of cardiac responses. Whether the differences in responsivity between FD and FI Ss would increase
or decrease with repeated stimulation is not known.

Post-Stress Observations: Interview data and observations made by the experimenter following the stress Condition lend support to the characterization of the defensive-perceptual styles of FD and FI Ss. It was not uncommon for FD Ss to want to discuss the affective connotations of the homicide slides and concepts related to the idea of "man's inhumanity to man". Mention of any particular slide or its contents was infrequent for these Ss. They also tended to mention direct avoidance of disturbing television, film and news media content.

The following statements were common for extremely FD Ss:
"My stomach got so heavy, I wanted to faint, but I couldn't make myself because I was sitting down." "My head felt like it would burst." "I couldn't believe anyone would kill someone like that." "The only way I could accept it was to think their soul was released from their body." "I could feel my skin crawl." "I kept thinking about asking you to stop."

Statements of this sort may reflect a hysterical conversion of anxiety to bodily sensations more characteristic of FD Ss (cf. Witkin, 1965). These statements were generally absent in extremely FI Ss.

For some FD Ss minimal exposure to the homicide slides seemed to activate the kind of responses (verbalizations and thoughts) which interfered with visual exploration of the slides. The 8 FD Ss who terminated responded afterwards as if they had attended more to self-produced stimuli than to slide content. These Ss tended to show dramatic cardiac activity during stress and immediately before terminating (heart rates up to 160 beats per minute); and they tended to verbalize psychological and physical distress. The pattern of their responses seemed to proceed from attention to global affective aspects to ideas related to
direct avoidance. They infrequently reported focusing on detail or concrete content. Probably, the kind of distracting responses reported by terminating Ss also occurred in FD Ss who stayed in the stress Condition, though to a lessor degree. These latter were the Ss whose performance was somewhat disrupted and who showed accelerated cardiac activity during the homicide slides.

The comments of FI Ss frequently contrasted with those of FD Ss. It was not uncommon for an extremely FI S to mention enjoyment of the task despite the unpleasant nature of the homicide slides (cf. notion of isolation). Several FI Ss said they thought the homicide slides were upsetting but part of life with which they had to deal. It was their intention to cope with this event given the opportunity. Implicit in their intention was a degree of confidence in their ability to cope with the threatening aspects and a plan to explore the stimuli presented.

Limitations of the Study: Hare et al. (1970) indicated that there were significant sex differences in the patterns of autonomic response to homicide slides. Therefore, possibly the present results could not be replicated with a male sample. This study had a relatively select sample of adult females who tended to score at the extremes on measures of anxiety and FDI. Sampling from a university population probably influenced the range of scores. Despite wide sampling, FI Ss scoring as low anxious and FD Ss scoring as high anxious seldom volunteered. Either there are fewer of these individuals in the university population or they tend not to volunteer for experiments. In other research this sampling bias may be exaggerated by the common use of male volunteers or the use of equal numbers of male and female volunteers. Males are typically more field-independent than females (Witkin et al.,
1962); and university males may show a narrower range of FDI scores than university females (Hare et al., 1970).

With regard to the present sample, several FD Ss sometimes performed as rapidly on the MEFT as did FI Ss. Witkin suggested:

To say that a person is relatively differentiated means that he is capable of operating at a high level of differentiation. He may sometimes operate at a lower level, however, whether or not he operates at his highest possible level may depend upon motivational factors and/or upon the demands of a particular situation (1962, p. 54).

This statement casts doubt on the actual degree of field-dependence of those who scored as field-dependent (HFT and RFT). Certainly some were not particularly field-dependent since they demonstrated occasional use of FI habits. If these Ss were capable of FI perceptual activity, the relatively small disruption of MEFT performance for the FD group as a whole might be explainable. The extreme disruption of performance of the FD Ss who terminated is probably more characteristic of extreme field-dependence and related to very direct avoidant strategies (habits).

A test of the above notion could use Ss selected with an additional measure of FDI, one less subject to motivational factors than are EFT, HFT or RFT. Pascual-Leone (1970) indicated that the Water-Level Test is an adequate measure of the lower levels of field-dependence. Failure on this relatively simple task is more a function of dominance of the field factor than the sporadically low use of meditational capacity. The Water-Level Test can best be used along with the more traditional tests of FDI in order to clearly determine the position of any S along the FDI dimension. Certainly, research would benefit from the use of well selected samples.
A limitation related to the above suggests certain modifications in the interpretation of the interaction between FDI and anxiety. There was an attempt in this study to match Ss on two putatively independent factors, FDI and anxiety. If the underlying factors are independent, scores on tests designed to measure these factors may not be independent. In this study, performance on a measure of FDI was predictably changed during stress, though not as a function of self-reported anxiety. The study does not show whether performance on the independent measures of FDI (HFT, RFT) was modified by characteristic anxiety level when the tests were administered in neutral circumstances. The tendency for volunteers to score as low anxious and FD or as high anxious and FI suggests a correlation between the independent measures of FDI and anxiety for volunteer samples at least.

Possibly a minimal degree of anxiety is required for the consistent activation of FI habits; otherwise a FI S may receive scores on tests such as the HFT similar to those obtained by FD Ss. It was observed that Ss who scored as low anxious on the APQ and as FD sporadically performed at a level suggestive of the use of FI habits. These Ss were often difficult to classify along the FDI dimension with the HFT and RFT because their performance between and within tests of FDI tended to be erratic. Several extremely low anxious, apparently FD Ss verbalized boredom and irritation in the control Condition. Complaints about the long ITI may have reflected a low tolerance for moderate and low levels of stimulation shown to be characteristic of FD individuals (Cohen, 1967). Cohen reviewed evidence which indicated that "...neurosensorv characteristics were related to the ability to tolerate environments in which there was a decrease in stimulation of visual and auditory sense modalities,
or that integrate neurological and somatosensory characteristics—or other perceptual, neurophysiological or personality dimensions—were partial determinants of the subject's reaction" (Cohen, 1967, p. 81). Cohen's observations lead to further speculation. The internal responses associated with high levels of anxiety may produce sufficient cortical arousal for optimum performance (activation of FI habits) even in neutral conditions. FI, low anxious Ss tended to change more in variability of item to item performance than did high anxious FI Ss during stress. Extremely low anxious, FI Ss may require more external stimulation to maintain optimum levels of arousal (cf. Berlyne, 1960) or the stability of their psychological organization. That is, external cues may be more necessary to activate cognitive-perceptual habits regardless of the level of differentiation of these habits. These low anxious, FI Ss are probably more variable or flexible in cognitive style (cf. Witkin, 1965; the dimension of fixity-mobility of FDI) and more sensitive to the field than are highly anxious Ss. They may function at less differentiated levels (as a FD S) than they are actually capable of when FI habits are activated. The occasional FD quality of their performance possibly reflects a transitory dominance of the field factor over the mediational factor. This dominance of the field factor could result from low cortical arousal and temporary low usage of mediational capacity (cf. Pascual-Leone, 1970).

Whether this hypothetical variance in FDI is related to the factors of anxiety, flexibility, adaptability, creativity, "intention", psychopathology and so forth is unclear (cf. Witkin, 1965; Wachtel, 1967, 1968; Pascual-Leone, 1970). Certainly the factor of fixity-mobility of FDI postulated by Witkin should be considered in research focusing on FDI. Analysis of the individual's variance across several measures of FDI and
The relationship of an individual's inter-test variance to his usual level of anxiety may be another step. The measures used in this study may be susceptible to various sources of variance unaccounted for or not readily controlled. The interaction between anxiety and FDI is probably more complex than suggested by the results of this study.

**The Stress Problem**: Final comment involves use of stressors in research. The noxious stimuli used in this study may actually be less disturbing than certain mass media communications (war news, violent films). These stimuli contain aspects related to the vulnerability of life and the human potential for violence.

Despite daily presentations of stressful communications, there are individuals who avoid these but submit themselves to a novel experiment. They may avoid daily stress deliberately or be protected from them; in either case, a limited history of dealing with stressors results. They are of interest to a researcher because they have not developed adequate defensive habits other than crude avoidance. When subjected to a stress condition, they may become extremely disturbed. Despite their voluntary status, an experimenter has an ethical problem of allowing these Ss to continue. The present research is, in part, an attempt to increase the probability of identifying such individuals by determining the factors which moderate performance during stressful conditions. Field-dependence appears to be one of the dominant factors that should be considered with regard to changes in ongoing adaptive functioning during stress. Further extension of these findings may eventually be applied to the restructuring of maladaptive behaviors.
Summary: The problem of predicting the effects of stress on cognitive performance led to the identification of two important factors, anxiety and the cognitive styles of field-dependence-independence (FDI), which might act as potent moderator variables. The available experimental literature indicated that anxiety and FDI should moderate the activation of habits which could either facilitate or disrupt performance on certain complex tasks. However, recent evidence indicated that the influence of anxiety on performance was unpredictable at best. This led to a consideration of FDI as the more consistent and dominant factor biasing responses activated during stress. FDI was shown to act as a weighting factor making certain responses more probable in a situation designed to activate dominant habits.

The major purpose of this study was to find support for the theoretically derived hypothesis that during stress, the characteristic perceptual-defensive habit patterns of field-dependent (FD) and field-independent (FI) individuals are activated because they are dominant, and they appear to be exaggerated forms of those habit patterns occurring in neutral conditions. This hypothesis was derived from a cognitive-attentional analysis of the relationship between FDI, anxiety and performance which was based on an integration of the theories of Witkin (1965), Wachtel (1968), Easterbrook (1959) and Spence and Spence (1966). The characterization of FI dominant perceptual-defensive habits as being compatible with habits required for solution of certain complex task, while FD habits were characterized as incompatible, led to the following expectations. It was hypothesized that if dominant habits are activated during stress and if they are compatible with solution of a task, then an individual in which those habits are activated will show improved
performance during stress. Improvement should be characteristic of FI individuals. However, if those habits are incompatible with solution, their activation should result in deterioration of performance. This should be characteristic of the FD individual.

A second purpose of this study was to obtain a non-performance index of differences between FD and FI individuals during stress which would be related to the attentional position of the theoretical analysis. Lacey's (1967) theory regarding the relationship of cardiac activity to orientation to the environment was related to Witkin's (1965) theory of FDI. An integration of the theories led to the expectations that FI individuals would tend to be receptive to the environment during stress and would show cardiac deceleration during the presentation of a noxious visual stimulus. In contrast, it was expected that FD individuals would tend to reject the same environmental stimulus and show cardiac acceleration to some extent.

In order to test these hypotheses, level of anxiety and position along the FDI dimension were determined for adult, female volunteers. Four experimental groups were formed using, as much as possible, extreme scores on these two variables. Half of each group was tested on a complex perceptual test of FDI in stressful conditions, half in neutral conditions. The stressful condition involved the uncertain presentation of unpleasant slides of victims of murder inbetween the slides of the perceptual task.

Only during the stressful condition were there any significant differences between FD and FI individuals in either performance or cardiac activity. FI individuals tended to improve, FD, to deteriorate in performance on the perceptual task. FI Ss were less variable in
their performance than were FD Ss in either condition; however, their variability decreased during stress while that of FD Ss did not.

Level of anxiety affected neither average speed nor variability of performance on the perceptual task. FDI stood as the more influential factor.

The major differences between FD and FI Ss and between high and low anxious Ss with regard to cardiac activity occurred during presentation of the noxious slides. High levels of anxiety were related statistically to initial cardiac acceleration at onset of a noxious slide. Low levels of anxiety were related to initial deceleration. Field-dependence was related to the maintenance of acceleration across the measured response to the noxious slide. Field-independence was related to maintained deceleration. From these findings, FI-low anxious Ss were characterized as "decelerators" while FD-high anxious Ss were characterized as "accelerators".

One of the more dramatic findings of difference in the behaviors of FD and FI Ss during stress was the high incidence of quitting responses in FD Ss. No FI S quit during stress; yet 50% of the original number of FD Ss in the stress condition ended their participation at some point. The FD individual's use of extremely direct avoidant strategies such as escape was also reflected in comments made by FD Ss after the stress condition. FD Ss who remained in the experiment throughout the stress condition tended to report physical symptoms of distress such as pressure on the head, faintness, uneasy stomach. They also reported having thoughts of escape or of asking the experimenter to stop the procedure. Much of this informal data supported the notions of Witkin (1965) concerning the primitive and often hysterical defensive style of FD Ss.
The finding of small but consistent behavioral and physiological differences between FD and FI individuals during stressful conditions but not during neutral conditions supported the main hypotheses of this study. The cognitive styles of field-dependence and field-independence were shown to be the more influential factors determining disruption or facilitation of performance when compared to high and low levels of anxiety. Anxiety became an important variable only in consideration of initial cardiac response to noxious visual stimuli. Certainly, more global measures of disruption and verbal reports of distress indicated that FD individuals were generally more disrupted in the stressful conditions than were FI individuals.

FDI, in general, was the more dominant moderator variable; that is, the individual's cognitive style tended to bias the responses activated during stress; and these responses could be characterized as either compatible or incompatible with cognitive-perceptual performance.

With concern for the validity of the conclusions, certain limitations of the sample used in this study were discussed. It was suggested that the study be replicated using a male sample and that a more thorough evaluation of the subjects' degree of field-independence be attempted. Finally, the ethical problems in the use of psychological stress in research was discussed.
REFERENCES


APPENDICES
### APPENDIX 1A

#### MEAN SCORES ON HFT FOR ALL GROUPS

<table>
<thead>
<tr>
<th>Condition</th>
<th>C</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI * FI</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>CON X FDI</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>CON X ANX</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>FDI X ANX</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>CON X FDI X ANX</td>
<td>19</td>
<td>19</td>
</tr>
</tbody>
</table>

Scores correspond to number correct on HFT

For all Appendices:

- **C** = control Condition
- **S** = stress Condition
- **FI** = field-independent
- **FD** = field-dependent
- **H** = high anxiety
- **L** = low anxiety

* = p < .01
** = p < .05
*** = p < .10
### APPENDIX IB

**MEAN SCORES ON THE RFT FOR ALL GROUPS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Scores</th>
<th>S</th>
<th>FI</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD</td>
<td>5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CON x FD</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ANXIETY</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CON x ANX</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>FDI x ANX</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CON x FDI x ANX</td>
<td>6</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Scores indicate degrees deviation from vertical
APPENDIX 1C

MEAN SCORES ON APQ FOR ALL GROUPS

<table>
<thead>
<tr>
<th>CONDITION ** G</th>
<th>S</th>
<th>49</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI</td>
<td>FI</td>
<td>48</td>
<td>46</td>
</tr>
<tr>
<td>CON X FDI C-FI</td>
<td>S-FI</td>
<td>50</td>
<td>46</td>
</tr>
<tr>
<td>C-FD</td>
<td>S-FD</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>ANXIETY * H</td>
<td>L</td>
<td>55</td>
<td>39</td>
</tr>
<tr>
<td>CON X ANX C-H</td>
<td>S-H</td>
<td>57</td>
<td>54</td>
</tr>
<tr>
<td>C-L</td>
<td>S-L</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>FDI X ANX FI-H</td>
<td>FD-H</td>
<td>56</td>
<td>54</td>
</tr>
<tr>
<td>FI-L</td>
<td>FD-L</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>CON X FDI X A C-FI-H</td>
<td>S-FI-H</td>
<td>58</td>
<td>54</td>
</tr>
<tr>
<td>C-FI-L</td>
<td>S-FI-L</td>
<td>42</td>
<td>38</td>
</tr>
<tr>
<td>C-FD-H</td>
<td>S-FD-H</td>
<td>55</td>
<td>54</td>
</tr>
<tr>
<td>C-FD-L</td>
<td>S-FD-L</td>
<td>39</td>
<td>36</td>
</tr>
</tbody>
</table>

high score indicates high anxiety level
APPENDIX 2

DESCRIPTION OF INDEPENDENT MEASURES

THE HFT: The Hidden Figures Test (form Cf - 1) is described in full by French, Elstrom and Leighton (1963). Its relationship to the Embedded Figures test was explored by Jackson, Messick and Myers (1964). In general, it can be described as a modification of the Embedded Figures Test used for group or individual testing. The HFT is timed and requires minimal S-E interaction. Sample items follow this section.

The APQ: The standardized instructions and a sample item of the Activity Preference Questionnaire follow. This test has been described in full by Lykken and Katzenmeyer elsewhere (1968).

The RFT: The procedure for the Rod-Frame Test was as follows: The S was seated and the experimental room was completely darkened except for the luminous rod and frame of the RFT apparatus. The S was told the following:

You can see that I can move the rod and the frame in either direction - to your left or your right. I am going to set both of them at different angles several times. Each time, your task is to tell me to move the rod back to an upright position. The rod has to be straight up and down (ceiling to floor). Do you understand? O.K. Then tell me when the rod is vertical as I move it slowly. Now, each time I reset this I want you to close your eyes. I'll tell you when. Open your eyes when I say "O.K." and I will begin to move the rod. You tell me when to stop - when it is vertical.

For the first 4 trials the frame was set away from vertical 20 degrees left.
For these trials the rod was set 15 degrees left, 20 degrees right, 25 degrees left, 10 degrees right. This procedure was reversed for 4 additional trials.
The entire procedure was replicated after the experimental sessions when it was administered immediately before removal of electrodes.
APPENDIX 2 (continued)

SAMPLE ITEMS AND ALTERNATE SOLUTIONS

HIT cf - 1

[Diagram of geometric shapes]
APPENDIX 2 (continued)

STANDARD INSTRUCTIONS: ACTIVITY PREFERENCE QUESTIONNAIRE

FORM A

DIRECTIONS -- READ CAREFULLY

One way of understanding a person better is by studying the kinds of activities or experiences he likes or enjoys. This test employs the similar approach of studying the pattern of your dislikes. In each of the items on the following pages -- and in the sample item below -- two activities or experiences are described which most people would consider at least midly unpleasant. Some of them are very unpleasant indeed. In some instances, you will find that similar things have actually happened to you; in the others, you can at least imagine what they would be like.

Your task is to try to imagine yourself in each of the two situations and then, pretending that either one or the other had to happen to you, to decide which one you would prefer -- which of the two you would take as the lesser of 'evils'.

SAMPLE ITEM

( ) Having to work late one night ( ) Being run over by a train.

In this case there isn't much doubt that, if one of these things had to happen to you, you would prefer the alternate on the left (working late at night) as the lessor evil than the one on the right (being run over by a train); Therefore, you would check the bracket (/) next to "having to work late one night." Check the alternate you would prefer (the lessor of two evils).

Answer every item on the test. Work rapidly but consider both alternatives in each item carefully. Imagine how you would feel about each alternative, decide which of the two would seem least unpleasant, and check the one you prefer.

--- Remember: Indicate the alternate that you prefer.

100 separate items followed these instructions
Two slides of task instructions were presented to Ss. These were followed by nine sample items which increased in difficulty in 3 levels. Three alternate solutions were presented for each sample, one being the correct solution. Alternates were the same across samples and test items. Instructions and sample items follow.

SLIDE ONE: Just relax while you read these instructions. I am going to show you some designs similar to some you have seen before. Alongside the designs are three simple figures; one of these is hidden in the design. Choose which figure it is; and press the telegraph key at your side the number of times corresponding to the number of the correct figure. If number three is hidden, press the key 3 times. If number 2 is hidden, press 2 times. Make your choice and press as rapidly as you can without guessing. If you make an error, indicate your second choice in the same way.

SLIDE TWO: The figure hidden in the design is always the same size as the figure at the side. Also, it is not turned on its side or upside down. There is always a figure hidden as in the example on the right. Remember, do not guess, but answer as rapidly as you can. When you press the key, keep all presses together in a short span of time. Try your key now by pressing once and then three times rapidly. In a few seconds I will show you some examples beginning with some easy items.

MEFT Test Samples:

The three alternate solutions were presented alongside each complex design as shown in the example above.
The following instructions were given to all Ss following the RFT.

As I told you before, we are taking physiological measures in this experiment. So I will attach electrodes to you which carry your body signals to my machine in the other room. I'll tell you what each is for as I attach them.

(To Ss in the stress Condition)
Before I do that, I want to ask you something else. You already know that you'll be seeing slides of the task. What I want to know now is how you would feel about seeing some rather unpleasant slides during the experiment. I want to be sure this is O.K. with you before I show them to you. The slides were taken by the police; and are pictures of homicide victims. Do you have any objection to seeing these? Feel free to say so. We want you to stay; but you are a volunteer and this is up to you. If you choose to continue, you can stop at any time if necessary; and you can talk to me through this intercom. I can hear you at all times.

(electrode attachment)
I want you to relax and get very comfortable while I explain the task. It is important to remain fairly still because of the equipment. Now, look at the telegraph key on your left and press it. This is how you can answer the problems you will see on the slides. The first slides you see will have more instructions.

(clarification of any questions of S)
Are you sure you understand? I'll go to the other room and shortly the first slides will come on. It will be a few minutes because I must adjust the equipment. So, just relax for a while.

(sample slides shown)
Through Intercom; Did you understand? O.K. Now would you just rest again while I record your body signals while you are resting. In about 10 minutes a slide will come on that says "ONE MINUTE". This is to let you know exactly when we will begin.

(To Ss in the control Condition)
Before I attach these electrodes, I want you to know that you will be shown some slides of people doing ordinary things as well as the slides of the task. Do you have any objection to any of this procedure? Feel free to say so. We can talk to each other through this intercom during the experiment. I can hear you at all times. O.K.?

There were no other differences in instructions to Ss in the two Conditions. Instructions sometimes varied due to questions by Ss.
APPENDIX 5

SAMPLE - POST-STRESS QUESTIONNAIRE

INSTRUCTIONS: As you can imagine, it is not easy to discover how and why individuals respond differently to the same kind of anxiety producing situation. You have already filled out some questionnaires, nonwof which asked you directly how you respond in anxiety producing situations. This one is directed mainly at the experiment. Please fill it out and add any comments about the experiment or anything else.

1. Briefly describe any plan or way of dealing with the unpleasantness in this experiment which you might have devised.

2. On a 5 point scale, rate the degree of uncertainty in this experiment.
   
   1  2  3  4  5
   predictable extremely uncertain

3. The uncertainty involved was ...
   
   1  2  3  4  5
   elation tolerable extremely distressing

4. I respond to uncertain and small crises in daily life with ...
   
   1  2  3  4  5
   elation panic, leave

5. I respond to uncertainty when it involves the possibility of future unpleasantness in general by.....

6. Did you feel any marked change in your physical responses during the experiment Describe them.

7. The worst part of the experiment was.... (choose answer from
   The next most distressing part was…….. 10 alternates)
   The least distressing was.............

   1. actually viewing the homicide slides
   2. one particular slide
   3. my own thoughts set off by the slides
   4. trying to solve the problems and worrying about slides
   5. not knowing how many slides there were
   6. waiting for the next slide
   7. fear that next homicide slide would be worse
   8. not knowing when homicide slides would be shown
   9. feeling I would have to leave
   10. other
8. Did you feel any relief during the experiment, temporarily or otherwise, from any original feeling of dread of the slides? When?

9. In general, in looking at the homicide slides I found myself (circle one answer in each set of 3 possibilities)

1. concentrating on many small details
2. looking at a few details
3. looking vaguely at the whole slide

1. thinking about details, figuring out what happened
2. thinking about some detail sometimes
3. purposefully missing details and noticing large parts

1. doing several things mentally to keep watching the slides
2. thinking about the slide and what it represented most of the time
3. finding it hard not to look at the slides by staring

1. thinking the slides were not as shocking as things I see on T.V.
2. feeling they were shocking mainly because I knew they were real
3. thinking they were more shocking than anything I had seen on T.V.

10. What happens to you in an important exam? Are you a good or poor exam taker?

11. What do you do if something unpleasant is due the next week and you need to plan how to handle the situation?

12. If there is anything common in stressful events in life that makes them anxiety producing, it can be described as follows.....

13. I feel the amount and kind of violence on T.V. and films ........

14. I respond to such violence usually by...........

15. If I had to coin a phrase to describe what is expressed about our society by the degree and quality of violence which I witness, I would say...........
APPENDIX 6

ANOVA : SOLUTION LATENCY - MEFT

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDITION (C)</td>
<td>1</td>
<td>4399</td>
<td>.26</td>
</tr>
<tr>
<td>FDI (F)</td>
<td>1</td>
<td>759690</td>
<td>44.32 *</td>
</tr>
<tr>
<td>Anxiety (A)</td>
<td>1</td>
<td>45089</td>
<td>2.63</td>
</tr>
<tr>
<td>C X F</td>
<td>1</td>
<td>54249</td>
<td>3.16 ***</td>
</tr>
<tr>
<td>C X A</td>
<td>1</td>
<td>906</td>
<td>.05</td>
</tr>
<tr>
<td>F X A</td>
<td>1</td>
<td>16553</td>
<td>.97</td>
</tr>
<tr>
<td>C X F X A</td>
<td>1</td>
<td>3116</td>
<td>.18</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>17145</td>
<td></td>
</tr>
<tr>
<td>DIFFICULTY LEVEL (D)</td>
<td>1</td>
<td>1831400</td>
<td>343.03 *</td>
</tr>
<tr>
<td>D X C</td>
<td>1</td>
<td>8804</td>
<td>1.65</td>
</tr>
<tr>
<td>D X F</td>
<td>1</td>
<td>24526</td>
<td>4.59 **</td>
</tr>
<tr>
<td>D X A</td>
<td>1</td>
<td>3896</td>
<td>.73</td>
</tr>
<tr>
<td>D X C X F</td>
<td>1</td>
<td>17828</td>
<td>3.34 ***</td>
</tr>
<tr>
<td>D X C X A</td>
<td>1</td>
<td>6721</td>
<td>1.26</td>
</tr>
<tr>
<td>D X F X A</td>
<td>1</td>
<td>2962</td>
<td>.55</td>
</tr>
<tr>
<td>D X C X F X A</td>
<td>1</td>
<td>354</td>
<td>.07</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>5339</td>
<td></td>
</tr>
<tr>
<td>TRIALS (T)</td>
<td>9</td>
<td>54904</td>
<td>9.07 *</td>
</tr>
<tr>
<td>T X C</td>
<td>9</td>
<td>9230</td>
<td>1.52</td>
</tr>
<tr>
<td>T X F</td>
<td>9</td>
<td>4418</td>
<td>.73</td>
</tr>
<tr>
<td>T X A</td>
<td>9</td>
<td>6676</td>
<td>1.10</td>
</tr>
<tr>
<td>T X C X F</td>
<td>9</td>
<td>4760</td>
<td>.79</td>
</tr>
<tr>
<td>T X C X A</td>
<td>9</td>
<td>3664</td>
<td>.61</td>
</tr>
<tr>
<td>T X F X A</td>
<td>9</td>
<td>8290</td>
<td>1.37</td>
</tr>
<tr>
<td>T X F X C X A</td>
<td>9</td>
<td>2971</td>
<td>.49</td>
</tr>
<tr>
<td>ERROR</td>
<td>504</td>
<td>6055</td>
<td></td>
</tr>
<tr>
<td>T X D</td>
<td>9</td>
<td>102940</td>
<td>24.45 *</td>
</tr>
<tr>
<td>T X D X C</td>
<td>8</td>
<td>4994</td>
<td>1.11</td>
</tr>
<tr>
<td>T X F X D</td>
<td>9</td>
<td>16346</td>
<td>3.64 *</td>
</tr>
<tr>
<td>T X A X D</td>
<td>9</td>
<td>4128</td>
<td>.92</td>
</tr>
<tr>
<td>T X C X F X D</td>
<td>9</td>
<td>1802</td>
<td>.40</td>
</tr>
<tr>
<td>T X C X A X D</td>
<td>9</td>
<td>3478</td>
<td>.77</td>
</tr>
<tr>
<td>T X F X A X D</td>
<td>9</td>
<td>3463</td>
<td>.77</td>
</tr>
<tr>
<td>T X C X F X A X D</td>
<td>9</td>
<td>4889</td>
<td>1.09</td>
</tr>
<tr>
<td>ERROR</td>
<td>504</td>
<td>4496</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>1279</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .01
** p < .05
*** p < .10
APPENDIX 7

ANOVA: BASAL HEART RATE

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDITION (C)</td>
<td>1</td>
<td>124750</td>
<td>.05</td>
</tr>
<tr>
<td>FDI (F)</td>
<td>1</td>
<td>587260</td>
<td>.25</td>
</tr>
<tr>
<td>ANXIETY (A)</td>
<td>1</td>
<td>857720</td>
<td>.37</td>
</tr>
<tr>
<td>C X F</td>
<td>1</td>
<td>852490</td>
<td>.36</td>
</tr>
<tr>
<td>C X A</td>
<td>1</td>
<td>3123100</td>
<td>1.33</td>
</tr>
<tr>
<td>F X A</td>
<td>1</td>
<td>5137600</td>
<td>2.20</td>
</tr>
<tr>
<td>C X F X A</td>
<td>1</td>
<td>1741000</td>
<td>.74</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>2339600</td>
<td></td>
</tr>
<tr>
<td>TRIALS (T)</td>
<td>1</td>
<td>5100</td>
<td>.03</td>
</tr>
<tr>
<td>T X C</td>
<td>1</td>
<td>4950</td>
<td>.03</td>
</tr>
<tr>
<td>T X F</td>
<td>1</td>
<td>181350</td>
<td>.98</td>
</tr>
<tr>
<td>T X A</td>
<td>1</td>
<td>153600</td>
<td>.83</td>
</tr>
<tr>
<td>T X C X F</td>
<td>1</td>
<td>9488</td>
<td>.05</td>
</tr>
<tr>
<td>T X C X A</td>
<td>1</td>
<td>94070</td>
<td>.51</td>
</tr>
<tr>
<td>T X F X A</td>
<td>1</td>
<td>342450</td>
<td>1.89</td>
</tr>
<tr>
<td>T X C X F X A</td>
<td>1</td>
<td>138600</td>
<td>.75</td>
</tr>
<tr>
<td>ERROR WITHIN</td>
<td>56</td>
<td>184900</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>127</td>
<td>127</td>
<td></td>
</tr>
</tbody>
</table>
### SUMMARY OF ANALYSIS

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1</td>
<td>5.39</td>
<td>.48</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>1.50</td>
<td>.14</td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>.01</td>
<td>.00</td>
</tr>
<tr>
<td>C X F</td>
<td>1</td>
<td>.62</td>
<td>.06</td>
</tr>
<tr>
<td>C X A</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>F X A</td>
<td>1</td>
<td>5.93</td>
<td>.54</td>
</tr>
<tr>
<td>C X F X A</td>
<td>1</td>
<td>22.59</td>
<td>2.05</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>10.99</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>.10</td>
<td>.02</td>
</tr>
<tr>
<td>D X C</td>
<td>1</td>
<td>22.93</td>
<td>5.20**</td>
</tr>
<tr>
<td>D X F</td>
<td>1</td>
<td>2.35</td>
<td>.53</td>
</tr>
<tr>
<td>D X A</td>
<td>1</td>
<td>11.00</td>
<td>2.50</td>
</tr>
<tr>
<td>D X C X F</td>
<td>1</td>
<td>.49</td>
<td>.11</td>
</tr>
<tr>
<td>D X C X A</td>
<td>1</td>
<td>.44</td>
<td>.10</td>
</tr>
<tr>
<td>D X F X A</td>
<td>1</td>
<td>2.19</td>
<td>.50</td>
</tr>
<tr>
<td>D X C X F X A</td>
<td>1</td>
<td>12.85</td>
<td>2.91</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>4.41</td>
<td></td>
</tr>
<tr>
<td>BEATS (B)</td>
<td>9</td>
<td>28.27</td>
<td>21.45*</td>
</tr>
<tr>
<td>B X C</td>
<td>9</td>
<td>2.06</td>
<td>1.57</td>
</tr>
<tr>
<td>B X F</td>
<td>9</td>
<td>.28</td>
<td>.21</td>
</tr>
<tr>
<td>B X A</td>
<td>9</td>
<td>1.31</td>
<td>.99</td>
</tr>
<tr>
<td>B X C X F</td>
<td>9</td>
<td>.39</td>
<td>.30</td>
</tr>
<tr>
<td>B X C X A</td>
<td>9</td>
<td>.90</td>
<td>.69</td>
</tr>
<tr>
<td>B X F X A</td>
<td>9</td>
<td>2.05</td>
<td>1.54</td>
</tr>
<tr>
<td>B X C X F X A</td>
<td>9</td>
<td>1.92</td>
<td>1.45</td>
</tr>
<tr>
<td>ERROR</td>
<td>504</td>
<td>1.32</td>
<td></td>
</tr>
<tr>
<td>B X D</td>
<td>9</td>
<td>.90</td>
<td>1.31</td>
</tr>
<tr>
<td>B X C X D</td>
<td>9</td>
<td>.91</td>
<td>1.33</td>
</tr>
<tr>
<td>B X F X D</td>
<td>9</td>
<td>1.39</td>
<td>2.02**</td>
</tr>
<tr>
<td>B X A X D</td>
<td>9</td>
<td>.73</td>
<td>1.06</td>
</tr>
<tr>
<td>B X C A F X D</td>
<td>9</td>
<td>1.51</td>
<td>2.20**</td>
</tr>
<tr>
<td>B X C X A X D</td>
<td>9</td>
<td>.33</td>
<td>.48</td>
</tr>
<tr>
<td>B X F X A D</td>
<td>9</td>
<td>.92</td>
<td>1.34</td>
</tr>
<tr>
<td>B X C X F X A X D</td>
<td>9</td>
<td>.43</td>
<td>.62</td>
</tr>
<tr>
<td>ERROR</td>
<td>504</td>
<td>.43</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>1279</td>
<td>.69</td>
<td></td>
</tr>
</tbody>
</table>
**APPENDIX 9**

**ANOVA : CARDIAC RESPONSE - HOMICIDE AND CONTROL SLIDES**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1</td>
<td>15.4</td>
<td>1.19</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>56.3</td>
<td>4.32**</td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>14.2</td>
<td>1.09</td>
</tr>
<tr>
<td>C X F</td>
<td>1</td>
<td>4.8</td>
<td>.37</td>
</tr>
<tr>
<td>C X A</td>
<td>1</td>
<td>.0</td>
<td>.00</td>
</tr>
<tr>
<td>F X A</td>
<td>1</td>
<td>11.6</td>
<td>.89</td>
</tr>
<tr>
<td>C X F X A</td>
<td>1</td>
<td>1.0</td>
<td>.08</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>2.7</td>
<td>1.98**</td>
</tr>
<tr>
<td>B X C</td>
<td>9</td>
<td>1.4</td>
<td>1.65</td>
</tr>
<tr>
<td>B X F</td>
<td>9</td>
<td>.9</td>
<td>.71</td>
</tr>
<tr>
<td>B X A</td>
<td>9</td>
<td>1.3</td>
<td>.96</td>
</tr>
<tr>
<td>B X C X F</td>
<td>9</td>
<td>.3</td>
<td>.24</td>
</tr>
<tr>
<td>B X Q X A</td>
<td>9</td>
<td>1.6</td>
<td>.46</td>
</tr>
<tr>
<td>B X F X A</td>
<td>9</td>
<td>1.1</td>
<td>.77</td>
</tr>
<tr>
<td>B X C X F X A</td>
<td>9</td>
<td>.8</td>
<td>.55</td>
</tr>
<tr>
<td>ERROR</td>
<td>504</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>639</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 10

CARDIAC RESPONSE TO CONTROL AND HOMICIDE SLIDES:
MEANS AND LEVEL OF SIGNIFICANCE OF THE DIFFERENCES

<table>
<thead>
<tr>
<th>INITIAL CARDIAC RESPONSE</th>
<th>CONTINUED CARDIAC RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONTROL</td>
</tr>
<tr>
<td></td>
<td>DEC. ACC.</td>
</tr>
<tr>
<td>HFT</td>
<td>12 12</td>
</tr>
<tr>
<td>RFT</td>
<td>4 4</td>
</tr>
<tr>
<td>SL-s</td>
<td>7 8</td>
</tr>
<tr>
<td>SL-c</td>
<td>14 15</td>
</tr>
<tr>
<td>SL-C</td>
<td>10 11</td>
</tr>
<tr>
<td>MEFT</td>
<td>17 17</td>
</tr>
<tr>
<td>APQ-T</td>
<td>47 50</td>
</tr>
<tr>
<td>APQ-S</td>
<td>19 20</td>
</tr>
<tr>
<td>APQ-P</td>
<td>21 21</td>
</tr>
<tr>
<td>APQ-E</td>
<td>9 9</td>
</tr>
</tbody>
</table>

* = p. < .01  
** = p. < .05  
*** = p. < .10

HFT = the number correct on HFT  
RFT = the degrees deviation from vertical on RFT  
SL-s = solution latency in seconds on simple items  
SL-c = solution latency in seconds on complex items  
SL-C = solution latency in seconds on combined items  
MEFT = number correct on MEFT  
APQ-T = score on Total scales of APQ  
APQ-S = score on Social scale of APQ  
APQ-P = score on Physical scale of APQ  
APQ-E = score on Ego scale of APQ  
DEC. = decelerator  
ACC. = accelerator
APPENDIX 11

ANOVA: STANDARD DEVIATION OF THE MEFT SOLUTION LATENCY

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MN</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1</td>
<td>875</td>
<td>2.79 ***</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>10699</td>
<td>34.13 *</td>
</tr>
<tr>
<td>C X F</td>
<td>1</td>
<td>1168</td>
<td>3.73 ***</td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>38</td>
<td>.12</td>
</tr>
<tr>
<td>C X A</td>
<td>1</td>
<td>15</td>
<td>.05</td>
</tr>
<tr>
<td>F X A</td>
<td>1</td>
<td>00</td>
<td>.00</td>
</tr>
<tr>
<td>C X F X A</td>
<td>1</td>
<td>23</td>
<td>.07</td>
</tr>
<tr>
<td>ERROR</td>
<td>56</td>
<td>313</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>