69-8599

PEARSON, David William, 1927-
THE EFFECTS OF STRESS ON PERFORMANCE AND AUTONOMIC RESPONSES AS A FUNCTION OF INDIVIDUAL DIFFERENCES IN ATTITUDE TOWARD A SPECIFIC STRESS SITUATION.

The University of Oklahoma, Ph.D., 1969
Psychology, experimental

University Microfilms, Inc., Ann Arbor, Michigan

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

THE EFFECTS OF STRESS ON PERFORMANCE AND AUTONOMIC RESPONSES AS A FUNCTION OF INDIVIDUAL DIFFERENCES IN ATTITUDE TOWARD A SPECIFIC STRESS SITUATION

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

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Norman, Oklahoma

1968

THE EFFECTS OF STRESS ON PERFORMANCE AND AUTONOMIC RESPONSES

AS A FUNCTION OF INDIVIDUAL DIFFERENCES IN ATTITUDE

TOWARD A SPECIFIC STRESS SITUATION

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ACKNOWLEDGMENTS

My most sincere thanks go to Dr. William E. Collins for serving as Chairman of the Dissertation Committee and to Dr. Richard I. Thackray for having directed the dissertation which was conducted at the Civil Aeromedical Research Laboratories of the Federal Aviation Administration. I am deeply grateful to them for contributing immeasurably to the development of my professional career.

My thanks are given also to Dr. J. R. Morris, Dr. Clayton Feaver, and Dr. Robert Hood, the other three members of my Dissertation Committee, for their continued support, encouragement, and wise counsel throughout my graduate program.

I also appreciate the invaluable technical assistance with the equipment by Mark Touchstone; the kind comments and support from Dr. Roger Smith; the typing assistance of Barbara Thurman and Dene Lacy; the very fine illustrations prepared by Mr. William E. Flores; the help provided by Ruth Ann Mertens and David Schroeder in preparing portions of the manuscript material, and the fast and efficient typing of the entire dissertation by Mrs. Fred Wettengel.

I am particularly indebted to Diane Terry who made all arrangements for administering test materials, scored the test material, contacted and scheduled subjects, and proofread the entire manuscript. Her assistance was of immense value.

Finally, I wish to reserve special thanks for my wife, Enika, whose patience and encouragement made this dissertation a reality.

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CHAPTER I

INTRODUCTION

An understanding of the effects of psychological stress upon performance is of considerable theoretical and practical importance. Humans are often required to perform tasks under conditions they consider extremely stressful. These conditions exist not only during times of war, catastrophic earthquakes, floods or fires, but also in the stresses encountered in day-to-day activities.

Interest in the concept of stress during the last quarter of a century derived much of its impetus from military concern over the effectiveness of performance during combat conditions. Although a great deal of research on the effects of stress on performance has resulted from this concern, many problems still remain unanswered (Horvath, 1959), the foremost of which is undoubtedly the problem of individual differences in stress susceptibility (Harris, Mackie, & Wilson, 1956).

Harris et al. (1956), in commenting upon the studies concerning the effects of stress upon performance reported earlier by Lazarus, Deese, & Osler (1952), observe that "... most have found that performance suffered under stress, some have found that performance improved, and a few have found that failure stress had no effect upon performance" (p. 28). Not only were these apparent inconsistencies present for "failure stress" conditions, but they were also present for "distraction," "fatigue" and "bodily threat" e. g. electrical shock stress situation. Continuing, Harris et al. (1956) note that "Of all the stress and fatigue studies cited, only one finding appears sufficiently consistent to be generalized: <u>Some people are better able to withstand stressful conditions than are others--there are wide variations in individual reactions to stress</u>" (p. 28). Further, "... it is clear that if the variability of individual performers is not taken into account, inconsistent results could readily be obtained from study to study" (pp. 28-29). Although the importance of the individual differences problem was considered as the greatest source of error variance (Lazarus et al., 1952; Harris et al., 1956; Horvath, 1959), identification of variables responsible for this variance continued to be elusive. Harris et al. (1956) felt that this was due to "Lack of adequate measures ... and (lack of) knowledge about which variables are relevant (p. 16).

In the most recent review of stress research available, Horvath (1959) notes that the problem of individual differences is still of considerable importance in most stress research. In the conclusions of part one of a two-part review, Horvath makes the observation that, "Finally, there is the large problem of individual differences in response to potential stressors" (p. 210). Then he raises the question, "What are the appropriate tests for measuring personality traits which could predict these differences?" (p. 210). He concludes by offering what he believes to be three major problems attending psychological stress research in need of attention: "The sensitivity of testing instruments to the response manifestations of stress, the sensitivity of measures of individual differences to responsivity to stressors, and the stressor potential of stimulus conditions" (p. 210). Although he was primarily concerned with finding suitable tasks that would differentiate or reflect the effects of psychological stress, since "Such a task may thus preclude the subject's masking the disruptive effects of stress by some compensatory mechanism" (p. 210), Horvath also selectively reported studies which he felt may have been effective in reducing, in part, some of the variance found in individual differences. These were in keeping with the concept amplified earlier by Harris, et al. (1956), i.e., "Some people are better able to withstand stressful conditions than are others" by attempting to differentiate subjects prior to performance comparisons on motoric, perceptual, reaction-time and cognitive type tasks.

Measures of Individual Differences

Some of the methods of classification which have seemed most promising, in terms of differentiating subjects, have been: questionnaire measures of anxiety such as Taylor's (1953) Manifest Anxiety Scale (Wenar, 1954; Farber & Spence, 1956; Castaneda, 1956), classificatory assignment of normals versus abnormals (Huston & Singer, 1945; Tizard & Venables, 1956; Knehr, 1954), drug reactivity indices (Abramson, Jarrik & Hirsch, 1955), and intelligence level (Lantz, 1945). These approaches to classifying stress susceptibility, along with the discouraging report by Horvath (1959) concerning hoped-for stress differentiating tasks, were considered only slightly better than no prior classification whatsoever in predicting responses to stress. "... findings in experiments using measures of individual differences have been very inclusive. The Taylor Manifest Anxiety Scale (TMAS) has received the greatest amount of attention ... (but) most of the promising results in these experiments have been counter-balanced by negative or even contrary findings" (Horvath, 1959, p. 225). Again, in a report by Deese (1962), attempts to relate individual difference in stress susceptibility to personality variables have generally not been too successful despite the fact that a large number of investigators found correlations between personality measures, such as the TMAS and performance. "... the obtained correlations are almost without exception small, and in some cases, contradictory evidence concerning both their direction and magnitude is available" (Deese, 1962, p. 201).

Recently, further evidence of no relationship between performance under stress and the classificatory index of high-anxious versus low-anxious subjects on the basis of TMAS scores was reported by Hodges & Spielberger (1966) and by Thackray & Pearson (1968). Thus, the general findings of low relationships between global personality variables, such as those indicated by TMAS scores, and performance (Spielberger, 1966) have led Opton & Lazarus (1967) to suggest that this problem may be partly due to the fact that level of general anxiety is only one of many possible personality variables operating at the moment when a stressor is presented. In a typical shock stress situation for example, some subjects may (1) view the threat as a source of pain and something to be feared; (2) some may perceive the threat as symbolizing a "punitive father" situation; (3) some may simply be reactive to the feeling of helplessness as a result of what they perceive to be unwarranted manipulations on the part of the experimenter; or (4) some may not perceive the threat of shock as threatening. In other words, given a specific stress situation wherein all subjects are classified as manifesting anxiety traits, individual differences may be a function of one's attitude toward the object of stress, irrespective of an "anxiety" label.

The hypothesis that a subject's cognitive appraisal of a situation may determine, to a considerable degree, his response pattern was suggested more than a decade ago by Lazarus, et al. (1952), when it was noted that, "A situation will be more or less stressful for the individual member of the group and it is likely that these differences in the meaning of the situation will appear in terms of performance" (p. 294). Adding further support to the "cognitive appraisal" concept, Ax (1964) states that physiological responses as well as psychological responses are partly a function of the subject's perception of the stress situation. Again, Opton & Lazarus (1967) suggest that a subject's cognitive appraisal of a situation determines the degree of responsivity to psychological and physiological measures employed.

Although the individual differences problem in terms of how a subject perceives or evaluates a situation was becoming the center of attention as the greatest possible source of error variance residing in most, if not all, psychological and/or physiological stress studies, Hodges & Spielberger (1966) noted that, "...despite this growing concensus concerning the importance of cognitive factors and mediating physiological responses to stress, many investigators continue to ignore individual differences in S's interpretation of the stressor situation" (p. 288).

To summarize briefly, several areas of concern seem to dominate the individual differences problem inherent in psychological and physiological stress research. First, there is a growing awareness of the need to recognize the fact that an individual's perceptual evaluation of a potential stressor may be a source of considerable error variance. Second, more accurate methods or techniques are needed for predicting a subject's response to a perceived stressor such as shock.

Attitudes as a Measure of Individual Differences

The subject's definition of a stress situation, and how this may influence his response, creates a source of variance that few investigators have successfully controlled (Lazarus & Opton, 1966). Recently, Hodges & Spielberger (1966) emphasized the importance of considering the subject's attitude toward a stress situation as a crucial variable that may mediate autonomic responses. They reported that a significant relationship exists between a subject's cognitive appraisal (i.e. the subject's expressed attitude) of a stress situation and his autonomic (heart-rate) response to that situation. The technique reported is not necessarily unique except in terms of providing an objective approach to the problem of further controlling a subject's response as a function of his attitude toward the induced stress situation. The technique used was a questionnaire similar to other wellknown attitude scales (Thurstone, 1937; Likert, 1932). Using a pencil-and-paper attitude type questionnaire, Hodges & Spielberger (1966) found significant response differences (heart rate) between subjects reporting a "high fear of shock" from those reporting a "low fear of shock" in an experimental situation in which threat of shock was employed. In this experiment, naive subjects (college population) were given an opportunity to express their attitude toward the idea of receiving an electrical shock prior to the experiment. The subject simply indicated his response to the question by marking one of five possible choices ranging from "not stressful" to "extremely stressful." The questionnaire was partly disguised in that the particular test item under consideration by the experimenter, i.e., "fear of shock," was included in a 25-item pool of similar type questions. Their finding provided the basis for inferring that response differences were a function of how a subject perceives the stress situation, in this case a threat of shock.

Recently, Thackray and Pearson (1968), using a similar questionnaire technique for ascertaining how one perceives a specific stressor, found a relationship between the subject's cognitive appraisal of "threat of shock" and his performance on a perceptual-motor task in addition to the heart-rate relationship reported by Hodges & Spielberger (1966). Again, naive subjects from a college population were selected on the basis of their response position on a multi-item questionnaire. Those responding to a "fear of shock" item above the mid-point were classified as being "high fear of shock" subjects (HFS) and those below the mid-point were classified as being "low fear of shock" subjects

(LFS). The results indicated that HFS subjects performed significantly below the level attained by the LFS subjects under threat of shock on a rotary pursuit task. Heart rate was significantly higher for the HFS subjects than for the LFS subjects during performance under "threat of shock."

The results obtained from the experiments of Hodges and Spielberger (1966) and Thackray and Pearson (1968) demonstrate that how a person evaluates a stress situation can determine, in a measurable way, his response to that situation, but only to the degree that the situation conveys meaning (relevancy) for that person. In other words, if a "threat of shock" situation conveys no threat at all insofar as a particular person is concerned, his responses will most likely be correspondingly manifested, i.e., when an individual expresses no fear toward a threat of shock situation, then his concomitant physiological reactions or response patterns should be similar to those prior to the introduction of threat of shock. The converse should obtain for those expressing a fear of shock, i.e., a faster than normal heart rate and lower than usual performance.

Problems and Precautions in Measurement of Attitude

In using an attitude type questionnaire, it should be recognized that not all subjects will report their true or honest feelings with respect to some object under investigation by an experimenter for a number of reasons: (1) Some subjects may not have an attitude[1] toward

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[1]Attitude is here defined as an enduring, learned predisposition to behave in a consistent way toward some object that includes an affective component (feeling) as well as a cognitive component as distinguished from "opinion" (Sherif, Sherif & Nebergall, 1965).

the object under study. For example, it would be difficult to categorize those who are seemingly detached, impersonal or neutral. "Complacency, amusement, tolerance, and openmindedness are not easily reduced to 'affect for or against' an object" (Allport, 1967, p. 9). However, caution should be exercised in excluding "neutral" findings since these positions have been found to have a positive and measurable attachment to the "ideal" of neutrality (Diab, 1965). (2) Some subjects, even though they may have an attitude toward the object under study, may attempt to evade, avoid or alter their evaluation of the object by (a) giving the experimenter answers which the subjects think are demanded; (b) attempting to inhibit their own feelings in preference to what they perceive as the social norm for their "reference group" (Sherif & Sherif, 1956), i.e., "no one in this group is afraid of shock!"; or (c) reacting against what subjects consider the questionnaire to represent such as invasion of privacy, exploitation, intimidation or manipulation by the experimenter. Most of these can generally be categorized as "experimenter effects" (Rosenthal, 1966).

The problems frequently present under the conditions set forth above are summarized in the following statement:

> Rationalization and deception inevitably occur, especially when the attitudes studied pertain to the moral life or social status of the subject. The difficulty of obtaining reliable information concerning attitudes toward sex is a case in point. So great is the tendency to protect oneself that even anonymity is not a guarantee. Lack of insight, ignorance, suspicion, fear, a neurotic sense of guilt, undue enthusiasm, or even a knowledge of the investigator's purpose may invalidate an inquiry. (Allport, 1967, p. 12).

An example of Allport's (1967) statement that "knowledge of the investigator's purpose" may affect attitude questionnaire results has been demonstrated a number of times (Vinacke, 1954; Kerrick, 1954; Kerrick, 1958; Osgood & Suci, 1955). All of these studies found significant differences between informed versus naive subjects in terms of their response positions. More recently Kerrick & McMillan (1961), in replicating and extending two of Kerrick's earlier studies (Kerrick, 1954; Kerrick, 1958) related to this problem, found significant differential effects between subjects who were informed as to the purpose of an attitude questionnaire and those not informed of the purpose. "These results clearly indicate that the investigator ... should make every attempt to mask the purpose of his experiment" (p. 119).

Precautions an investigator should take to reduce inferential error in terms of the meaning of a subject's response to an attitude question are: (a) use of clear, unambiguous, understandable and rather simple questions (Green & Stacey, 1966); and (b) questions that are relevant in terms of the subject's "frame of reference" and that are ego-involving; e.g., "The point of view to which a person is committed (ego-involved) influences the way he judges the item" (Sherif, Sherif & Nebergal, 1965, p. 60). Thus, if a person is neutral about a statement or situation, it would be expected that his response would fall within a neutral range circumscribed by the attitude questionnaire. Conversely, if a person is highly committed to a position or has strong feelings about a situation, it would be expected that his response position on an attitude questionnaire would be correspondingly indicated, i.e., toward the extreme ends of the questionnaire scale.

Despite all precautions for ensuring "true" or "honest" responses, it must be recognized that most people possess many contradictory attitudes and that their mental "set" at the moment of taking an attitude test may be quite different at a later time. Attitudes change, and an investigation made under one set of conditions may not remain constant when tested later under the same conditions. However, the more highly committed or ego-involved the person is toward an item under investigation, the less variable the attitude (Allport, 1967).

Although the above problems are inherent in most, if not all, subjective evaluation (attitude) scales, it seems reasonable to suggest that the direct approach of asking a subject to evaluate an object or situation in terms of his feelings and perception about it offers more of an opportunity for controlling error variance in individual differences than has been true of methods using an indirect, inferential technique such as the TMAS (Taylor, 1953). Devising an attitude questionnaire, however, that adheres to the precautionary measures suggested above does not necessarily eliminate other possible invalidating pitfalls. For example, attitudes are generally "inferred from behavior" but the behavior referred to is the response consistency of the individual toward an object or class of objects that is identifiable solely by means of verbal reports such as attitude questionnaires. These verbal reports, however, are merely indicants of a person's "preparedness" or "readiness" to act (English & English, 1958, p. 50) or as LaPiere (1967) notes, they represent "verbalized reactions" to a symbolic situation. A possible "pitfall" exists when it is assumed that a relationship is present between symbolic behavior (verbal reports) and non-symbolic behavior. The assumption of a relationship may or may not be correct and becomes a crucial factor whenever predictability of future behavior based on attitude questionnaires is the primary concern. Reliability of responses may be demonstrated following each administration of an attitude questionnaire, but validity can be demonstrated only if a subject's subsequent, non-symbolic, behavior corresponds with his earlier evaluative (symbolic) responses. "Only a verbal reaction to an entirely symbolic situation can be secured by the questionnaire. It may indicate what the responder would actually do when confronted with the situation symbolized in the question, but there is no assurance that it will" (La Piere, 1967, p. 31).

Another problem may be present if inferences are made on the basis of a one-trial validation. Frequently the results of an attitude questionnaire appear to have been validated as the result of subsequent behavior corresponding to previous verbal reports. Whenever this occurs, the attitude instrument utilized for predicting behavior is considered valid (Nunnally, 1959, p. 95). However, the validity that is considered present with one-trial validation under one specific set of conditions may be an artifact and such may be the case when upon future administrations of the attitude questionnaire, where the scale and design remain the same, the predicted behavioral indices are negative or contradistinctive.

To summarize the foregoing considerations, it should be clear that in order to maximize reliability and validity, an attitude questionnaire employed in stress research should: (a) contain relevant or meaningful concepts (ideas) and categories (descriptors used to evaluate concepts) as a means of enhancing a subject's ego-involvement; (b) be presented in such a way as to minimize the investigators purpose as a precaution against possible "game-playing" by a subject; (c) be presented to a subject by someone other than the experimenter in such a way as to avoid possible resentment against what may be considered an invasion of privacy, intimidation, exploitation, or manipulation by an "authority figure." This precaution may also reduce "experimenter influence" in terms of response conformity; (d) use clear, unambiguous, understandable, and rather simple questions in order to avoid connotations beyond the explicit or denotative context intended; and (e) be validated against more than one specific task or situation.

Although the attitude scale used in the previous study by Thackray and Pearson (1968) was relatively effective in differentiating subjects on the basis of fear of shock, there may have been a few deficiencies that could have increased the amount of error variance in classifying the subjects. For example, the experimenter administered the attitude questionnaire to subjects who later participated in the experiment. As a consequence of ignoring the suggestions in (b) (c) above, the results may have been biased. Also, the validity of the previous questionnaire rests upon results obtained using only one task or situation, i.e., rotary pursuit performance. Thus, the scale developed for use in the present study was constructed and administered specifically to meet the above requirements in the hope of reducing further any possibility for the presence of error variance in classifying subjects on the basis of fear of shock.

Response Consistency

To the extent that an individual's perception of threat is specific to a given stressor, it could be predicted that any performance impairment occurring under that stressor would not occur under a different stressor which was not perceived as threatening. It could also be predicted that if a given stressor is perceived as threatening, any change in performance should not be specific to the particular task employed.

Both of the above approaches involve the hypothesis of consistency (or a lack thereof) across situations or tasks. The former assumes lack of consistency of responses across stressors if the individual's cognitive appraisal of threat differs under the different stress conditions. The latter assumes response consistency across tasks if perceived threat remains constant. Although only the question of consistency across tasks will be examined in this study, both approaches will be discussed because of the common methodological problems which they present.

One of the methods of measuring the extent of response consistency (whether across stressors or across tasks) is illustrated in a study by Opton & Lazarus (1967). This method is the "ipsative" or intra-individual technique. "In contrast with the procedure of exposing two or more groups of subjects to a single stress condition each, ... (this) design calls for exposing all subjects to more than one stress condition, and for determining the extent to which their reactions to these conditions are selective" (p. 294).

In assessing the "ipsative" technique of Opton & Lazarus (1967), two possible sources for variance should be considered. One of these was reported a number of years earlier by Mech (1953) and later by Sternbach (1966) as "adaptation effects." Adaptation simply means that a subject who seems to be initially affected (adversely) by a stressor somehow "copes" (Lazarus, 1966) with the situation and subsequently improves his performance significantly. The adaptation may occur during trials under one stressor or later while performing under a different stressor. The problem presents itself, in terms of possible variance, whenever a number of sequentially presented stressors appear to produce response consistency when such may not be the case. For example, if a person perceives the first stressor as stressful and responds accordingly (performance decrement) but demonstrates improvement for the remainder of the stressors presented, what now appears as response consistency over these latter stressors may in fact be a singularly learned means of "coping" with the experimental milieu. But, if a single stressor is temporally isolated from the others, the response pattern may now be opposite from the one observed earlier. A second possible source for variance is the converse of the first. Stopol (1954), in explaining the varied results obtained while subjecting a subject to more than one stressor, stated that a " ... cumulative or summative effect of stress was operating which resulted in a more intense decrement in performance whenever the second stress was applied" (p. 21). In other words, some subjects apparently did not learn to "cope" with a number of stressors but found that each additional stressor resulted in an inability to maintain the performance level established earlier, although some subjects were observed to suffer no performance decrement across all stressors. But, again, if these subjects, who had appeared to deteriorate in performance, had been given one stressor at a time, temporally isolated from the other stressors, it may be that differential performance effects as a function of the different stressors would have been obtained.

It can thus be argued (Stopol, 1954; Sternbach, 1966) that the procedure suggested by Opton & Lazarus (1967) for exposing each subject to a series of sequentially presented stressors may make it virtually impossible to answer adequately the question of individual response consistency across stressors with repeated measures designs (Johnson & Lubin, 1967; Grice, 1966; Poulton & Freeman, 1966).

The problems inherent in investigating response consistency across stressors may also adhere whenever response consistency across tasks is the goal. The relatively few studies that have addressed the problem of response consistency across tasks, however, have tended to ignore the question of <u>individual response consistency</u> as a function of attitudes toward the stressor and have been concerned only with the question of whether different tasks reveal differing degrees of relative impairment. For example, Reynolds (1960) held the stress of "failure" constant while administering two tasks, one a mirror-star drawing task and the other Thurstones' tests of the Space factor (Thurstone & Thurstone, 1947). "The stress created no difference between the failure and control groups in the Space problems" (p. 87). But, he found differences for the second problem involving the mirror-star drawing task, i.e. both groups <u>improved</u> but the failure group to a lesser extent. Again, Broadbent (1951) found a performance decrement under a stressor of noise for a "dials" task but no performance decrement for a "lights" task under the same stressor conditions. Finally, Miller (1953), also using noise as the stressor, found no performance differences for three tasks (critical flicker fusion, cancelling C's and word fluency) but found performance decrement for a trembleometer task.

Present Study

In view of the need for better control of the irrelevant sources of variance discussed above when considering stress research, several alternative methods or techniques are considered in investigating "The effects of stress on performance and autonomic responses as a function of individual differences in attitude toward a specific stress situation." The first of the proposed alternatives relates to the problem of individual differences variance which has been considered already in terms of using attitude questionnaire techniques.

Another area of concern relates to response consistency. To the extent that a given attitude, such as a feeling of fear toward the possibility of being bodily harmed is common to more than one type of stress situation, the same behavioral changes should occur under a variety of stressors. Conversely, if attitudes are specific to particular stress situations, the resulting behavioral changes might be restricted to only certain types of stressors. Related to this kind of proposition would be one in which different tasks used under the same stress condition, such as fear of shock, exhibit the same response patterns, provided the stressor used corresponds with the subject's expressed attitude. If the effect, then, of perceived threat is performance decrement for one task, similar results for other tasks suggest situation specificity rather than task specificity. Situation specificity refers to response consistency for a particular stressor irrespective of the task (Weitz, 1966). Rather than expose the same individual to a variety of stressors, however, or a variety of tasks within a common stressor, and then attempt to determine whether differences in perceived threat are related to performance differences, an alternative would be to separate individuals in advance on the basis of differing attitudes toward specific situations they consider stressful and then expose them to only one of these situations. Between-groups comparison of subjects separated on the basis of a variable, such as an expressed attitude common to each group toward a specific stressor, with each group exposed to this single stressor, would eliminate some of the problems of a repeated measures design. Such an approach could be used to evaluate consistency of response across a variety of different tasks for subjects expressing a common attitude toward a given stressor.

Although the question of response consistency or specificity across stressors remains as an area needing considerably more research, only the question of performance and autonomic consistency across tasks as a function of attitude toward the stressor will be investigated in the present study.

The hypotheses listed below, therefore, are set forth in view of the need to examine further both the relationship of stress to performance, along with the physiological concomitants, as a function of the subjects' perceptual evaluations and feelings toward a specific stressor, and whether or not relative performance change and physiological reactivity of subjects classified according to their attitude toward a specific stressor are independent of the type task when the stressor remains constant.

1. There will be significant differences in performance between subjects expressing a "high fear of shock" versus those expressing a "low fear of shock" on a perceptual motor task, with "high fear of shock" subjects exhibiting greater impairment to a stressor (threat of shock).

2. There will be significant differences in performance between subjects expressing a "high fear of shock" versus those expressing a "low fear of shock" on a cognitive interference task, with "high fear of shock" subjects exhibiting greater impairment to a stressor (threat of shock).

3. There will be significant differences in autonomic responses between subjects expressing a "high fear of shock" versus those expressing a "low fear of shock" while performing a perceptual-motor task, with "high fear of shock" subjects exhibiting greater increases when exposed to a stressor (threat of shock).

4. There will be significant differences in autonomic responses between subjects expressing a "high fear of shock" versus those expressing a "low fear of shock" while performing a cognitive interference task under the Press Test condition, with "high fear of shock" subjects exhibiting greater increases when exposed to a stressor (threat of shock).

CHAPTER II

METHOD

Subjects

The subjects were forty male students[1] from the University of Oklahoma, ranging from 18 to 25 years of age.

The method for selection of subjects was based upon scores obtained as a result of the seven-point scale (Primary attitude questionnaire with equi-distant spaces on all scales) administered by an associate of the experimenter approximately one month in advance of subject participation in the experiment. Subjects responding to the extreme ends of the scale item under study, i.e., "fear of shock," were assigned to one of two groups designated as either "high fear of shock" (HFS) or "low fear of shock" (LFS) subjects. This particular item was number 11 of the Primary attitude questionnaire. The complete scale is shown in Appendix E. As a subsidiary or pilot consideration, a second attitude questionnaire, the Semantic Differential (Osgood, Suci and Tannenbaum, 1965), was administered along with the Primary questionnaire for comparative purposes and was not used in the selection of subjects. The complete scale may be seen in Appendix F.

[1]Forty-three subjects were selected but three of these had to be eliminated due to inability to discriminate between some of the colors used in one of the tasks.

Subjects selected as possible participants were chosen on the basis of their response to the first two or last two equi-distance spaces on the scale under consideration. This was done by the experimenter who then submitted the entire pool of subjects (N=65) to an associate for the purpose of obtaining the required number of subjects.

Apparatus

Performance tasks consisted of a modified, commercial version of the Stroop Test (Stroop, 1935), called the Press Test (Baehr, Corsini, and Renck, 1961), and a pursuit rotor apparatus. Part III of the modified Stroop Test, hereafter called the Press Test (PT), provides the subject with a series of tasks requiring perceptual discrimination between the names of colors and a different color of ink used in spelling. For example, the word "red" may be printed in blue ink, the word "green" in red ink and the word "blue" in yellow ink. The subject must discriminate between the names of colors used (red, green, blue, or yellow), and the different color of the ink used in spelling the color names, by writing down the first letter of the ink color rather than the first letter of the name of the color. The task requires the subject to make as many discriminatory responses as rapidly as possible in a circular space designated on an 8" X 11" page containing numerous items. Two additional parts of the PT were used for task familiarity purposes during the training phase of the experiment. Part I of the PT required the subject to write down the first letter of a series of spelled-out color names such as green, blue, red, and yellow.

For example, "G" for green, "B" for blue, "R" for red and "Y" for yellow. All color names for Part I were spelled out in black ink which required no color discrimination. However, Part II of the PT required the subject to discriminate different colors by writing down the first letter of a small circle of color, that is, "B" for a blue circle of color, "R" for a red circle of color, etc.

The pursuit rotor was a conventional tracking-task apparatus (Lafayette Instrument Company, Model 2203A) attached to a Hunter Model 120 A Klockounter (Series D). The Klockounter connection to the PR was modified by use of a 6-volt dry cell battery and relay switch. Contact of the subject's stylus with the metal target disk on the PR turntable energized a 6-volt relay which in turn closed contacts to start the Klockounter. The use of the relay isolated the subject from any possible electrical connection with the Klockounter. This constituted a safety precaution, since it was necessary to ground the subject in order to obtain relatively noise-free physiological recordings. Rotational speed of the PR turntable was kept at a constant 60 RPM throughout the experiment. The metal target disk was cleaned with steelwool after each subject completed the PR task as suggested by Ammons (1955).

The physiological recording instrument was a Beckman Type R Dynograph. Two channels were utilized for the recording of heart rate. The primary channel recorded the electrocardiogram (EKG) directly, while a secondary channel recorded the output of a cardiotachometer to provide a measure of the "beat-by-beat" variation in heart rate. Beckman biopotential electrodes for the EKG were attached by means of adhesive disks to the lateral walls of the subject's chest at the base of the rib cage. Eye blinks were obtained from Beckman miniature biopotential electrodes attached immediately above and below the left eye. The output of these electrodes was AC coupled through a .1 second time constant to a third channel of the recorder. An EKG plate electrode was attached to the wrist of the subject's nonprefered hand (the hand not normally used in writing) and served as the ground electrode. Only heart rate as obtained from the EKG channel was used in the present study. The eye blink and cardiotachometer channels were included for a separate purpose and will not be reported here. They are mentioned only for the purpose of describing the complete apparatuses used and procedures followed. Appendix A contains a photograph of a sample recording.

An Applegate Model 230 stimulator was used as the threat-of-shock apparatus. Both current control face dials and a "current-on" light were operable, but no current could pass to the other end of the spliced "dummy" cable where two EKG plate electrodes were fastened to the subject's leg by means of rubber electrode straps.

The subject was seated in a cushioned swivel chair inside a wooden cubicle 42" wide, 72" high and 42" deep which was open at one end for access purposes. The front of the cubicle contained a one-way vision glass insert approximately 30" X 23" which provided the experimenter with an unobstructed view of the subject and task area. A fluorescent lamp placed on top of the cubicle at the center of the access area was positioned in such a manner that the subject received over-the-shoulder illumination and the experimenter direct illumination since the experimenter sat facing the subject from a distance of approximately 3 1/2 feet away. The task area inside the cubicle (40" X 70" X 40") contained a built-in counter the width of the cubicle, 18" wide and 32" high.

The PR apparatus was positioned in the center of the counter and flush with the top. To provide performance space for the PT, an over-lay counter was constructed with approximately the same dimentions as the built-in counter, except for a 1 1/2" height difference, that could be easily placed into position or removed.

Appendix B contains a photograph of the equipment and experimental arrangement utilized by the experimenter. Appendix C and Appendix D contain photographs of the subject arrangement and the equipment for performing the PT Task (Appendix C) or the PR task (Appendix D), threat-of-shock apparatus, including the one-way mirror, and lighting arrangement. Two 3M Wollensack tape recorders (See Appendix B) and a stop watch completed the test equipment.

Procedure

No information was provided any subject contacted prior to the experiment other than the fact they had been randomly selected from the student directory for possible paid participation in an experiment involving learning processes. A total of 20 HFS and 20 LFS subjects were contacted and employed in the experiment. Half of the HFS and LFS subjects were further assigned upon arrival for the experiment to the PT task and the other half to the PR task. Task assignment was based upon a simple rotational system. If the first subject performed the PT task, then the second subject was given the PR task, etc. The experimenter was given no knowledge by the associate as to whether the subject arriving for the experiment was an HFS or an LFS type.

Upon arrival, the subject was taken to the experimental room and seated in the booth illustrated in Appendix C and Appendix D. All lights were turned off except for the one in the subject's booth, and a brief greeting expressing appreciation of his participation was played. The initial greeting in addition to all further instructions was tape recorded in order to reduce possible experimenter effects (Rosenthal, 1966). Following the greeting an explanation of the purpose of the experiment was given. The purpose was disguised to the extent that subjects were not told anything about the experiment beyond the fact that they were being tested with respect to studying the effects of generalized muscle tension on learning, and that this was the reason for using electrodes. They were also told that the purpose of the one-way mirror "... provides the experimenter with the opportunity to know when to assist you in the event the instructions are not entirely clear, which otherwise could result in improper performance techniques." Subjects were further told that they would be unable to detect experimenter movement on the other side. It was explained that the experimenter would need to make necessary adjustments of the equipment and that such movement would, therefore, not distract them during task performance. The use of a one-way mirror thus precluded any subject-performance technique variability, such as occasional misuse of the stylus, which had been detected in an earlier study by Thackray and Pearson (1968).

After the greeting and general purposes explanation of the experiment had been played, the recorder was turned off and electrode attachments were made. Following attachment of electrodes. the Beckman Dynograph was turned on and adjusted. After determination that satisfactory recordings were being obtained, the tape recorder was turned on again and explicit instructions were given concerning the nature of the task (PT or PR) and the procedural techniques to be used in performing the task. Performance of the task began immediately following these final instructions.

The training phase of the PT task consisted of three parts, with each part, as described earlier, progressively more difficult. Each part consisted of 5 trials of 20-seconds duration with 20-second rest periods between each trial, for a total of 15 trials. The verbal commands to "begin working" or "stop working" were also prerecorded, thus ensuring precise 20-second trial and intertrial periods. The actual parts were sufficiently long so that no subject could complete any one of the parts in the five 20-second trials administered.

Scoring of each trial of the PT consisted of the total correct responses minus errors. Separation of trials was accomplished by having the subject draw a line under the last response of each trial when he heard the words "stop working." Scoring of the PT was accomplished during the rest period following training and prior to the testing phase.

The training phase for subjects assigned the PR task also consisted of 15 trials of 20 seconds duration with 20-second rest periods between each trial. The score of each trial consisted of the total time that the subject kept the stylus in contact with the metal target disc of the PR. The total time of each trial was recorded by the experimenter who then reset the electric Klockounter.

Although the length of the training phase was the same for both PR and PT tasks, it should be noted that the training phase of the PT consisted of the three separate parts of this test, while for PR the task, of course, remained constant over the 15 trials.

Following completion of the training phase all subjects were informed that they were to "... relax for a few minutes while the experimenter sets the recorder for further instructions and rechecks the equipment." A three-minute rest period ensued during which the experimenter scored some of the data. After providing the subject with new PT performance sheets, (when PT was the task under study) and at the end of three minutes, the recorder was turned on and test instructions were played.

Test-phase instructions for both PT and PR subjects were identical. They were informed that the next phase of the experiment would be essentially the same except that now they would have to perform under threat-of-shock. They were further told that shock would be administered if they failed to maintain their average performance level already established during the training phase; that is, if their performance dropped below the previously obtained average score, they would receive an electrical shock.

At this juncture, the experimenter turned off the recorder and placed the dummy shock apparatus in the approximate position shown in Appendix C and Appendix D. (A white cloth covered the apparatus which prevented the subject from seeing it prior to this time.) Two ankle electrodes were then fastened to the subject's leg and the apparatus was plugged into a wall outlet which, in turn, illuminated the green "power-on" light on the face of the device. The two dials on the face of the shock apparatus were manipulated while the subject watched in order to enhance his belief that the apparatus was capable of delivering the promised electrical current. Continuing the recorded instruction, the subject was told to be ready to begin the test phase. A complete transcript of instructions is given in Appendix G.

The PR procedures during the testing phase were identical to the training phase; however, the PT procedures were slightly modified. Only Part III of the PT task was used, i.e., the complex discrimination judgments, since it was felt that the lack of task complexity of Parts I and II would result in too low a task demand with resultant loss of measurable response differences between the induced stress situation (testing phase) and the training phase (Murphy, 1959).

At the end of the testing phase which consisted of 5 trials only (as compared to 15 trials during training), the Beckman Dynograph was turned off and the recordings were placed into a folder, room lights were turned on, and the electrodes were removed from the subject. Finally, the subject was asked to sign a secrecy oath concerning any aspect of the experiment, since any prior knowledge which a potential subject might receive could contaminate the data. A post-experiment query was also made as to their feelings about receiving shock, i.e., by means of a paper and pencil test a subject rated his feelings on a seven-point scale from "slightly concerned" to "strongly concerned" (identical in format to the scale of the Primary attitude questionnaire).

Scoring and Analysis of Data

For the PT performance data, each subject's mean score on the last five 20-second training trials (Part III), his score on the first 20-second test trial (Part III), and the algebraic difference between these two scores were obtained. Although five test trials were given to each subject, only the first trial was used in data analysis. This method of analysis was deemed appropriate due to the fact that maximal effects of threat-of-shock would obtain for the first trial with progressively less effect thereafter if threat-of-shock was not reinforced. Since actual shock was not administered, it was also felt that subsequent to the first test trial a subject would be able to perceive the amount of effort necessary to avoid receipt of shock, particularly for the PT task, since it was an easy matter for the subject to count the number of color-discrimination responses immediately following the first trial. Further, it was felt that the most appropriate measure of the training phase should be the mean of the last five trials rather than the last trial itself to reduce error variance as much as possible. Analysis of the PR performance data was identical to analysis of the PT performance data.

Three heart rate scores were obtained for each subject: the mean number of beats during the last five 20-second training trials, the number of beats during the first 20-second test trial, and the algebraic difference between these two scores. All scores were multiplied by three to convert them to a rate-per-minute base. The periods scored for heart rate were the same as those employed for performance analysis in order to make the data as comparable as possible.

Data analysis consisted of homogeneity of variance tests by use of the F max test (Walker and Lev, 1953, p. 192); t tests of the training phase data between HFS and LFS subjects performing the PT or PR task and HR; t tests of the difference scores between training and test phases for HFS and LFS subjects performing the PT or PR task and HR (Walker and Lev, 1953, p. 156). Additionally a chi-square contingency test (Chi-square tests of independence by Walker and Lev, 1953, pp. 99-101) was performed comparing results of Item 11 of the seven-point attitude scale used for subject selection with the results of the post-experiment query as to how concerned subjects felt about the possible reception of shock while performing the PR or PT task.

CHAPTER III

RESULTS

Training Phase

In order to determine whether differences in homogeneity of variance existed between the HFS and LFS groups in heart rate (HR) or performance prior to introduction of the experimental effects under investigation, F max tests (Walker and Lev, 1953, p. 192) were conducted. No significant differences were found between the variance of the training phase HR data for HFS and LFS group assigned to either the PR (F max $= 1.51$, $p > .05$) or PT (F max $= 2.67$, $p > .05$) condition. Likewise, comparisons of the performance data variances during training for these same groups revealed nonsignificant differences for both PR (F max $= 1.89$, $p > .05$) and PT (F max $= 1.49$, $p > .05$). These results support the requirement for homogeneity of variance (Siegal, 1956) in the use of parametric (t) tests on the training data.

In order to ascertain whether all groups were similar, tests of mean differences (Walker and Lev, 1953, pp. 156-157) between HFS-LFS groups were conducted on HR and on PR and PT performance measures, with .05 as the region of rejection.

Mean HR comparisons between the HFS ($\bar{X} = 82.2$) and LFS ($\bar{X} = 84.6$)

subjects while performing the PR task, resulted in no significant difference ($P > .35$). Similar results were obtained when comparing mean HR between HFS ($\bar{X} = 88.5$) and LFS ($\bar{X} = 86.3$) subjects while performing the PT task ($P > .35$). These results are shown in Table 1.

The close similarity of HR between the HFS and LFS groups is graphically represented in Figure 1 for those assigned the PR task and in Figure 2 for those assigned the PT task.

Pursuit rotor (PR) mean score comparisons between HFS ($\bar{X} = 7.2$) and LFS ($\bar{X} = 7.4$) subjects reveal no significant differences ($P > .45$) as shown in Table 2. Also, no significant differences ($P > .35$) are noted in Table 2 between the mean PT scores of HFS ($\bar{X} = 17.60$) and LFS ($\bar{X} = 17.26$) subjects. The almost identical mean performance scores of HFS and LFS subjects assigned the PR task or the PT task are graphically represented in Figures 3 and 4, respectively.

Tables 1 and 2 and Figures 1 through 4 reveal no significant differences between the HFS and LFS groups. Thus, prior to the introduction of the main experimental effect under investigation, i.e., threat of shock, all groups appeared to be homogeneous in terms of HR and performance ability for the two assigned tasks of PR and PT.

Testing Phase

Performance data for the PR and PT tasks consisted of the algebraic difference between each subject's score on his first test trial and the mean of his preceding five training trials. Mean scores of HFS and LFS subjects obtained while performing the PR and PT tasks under the experimental condition (threat of shock) are contained in

TABLE 1

HEART RATE COMPARISON BETWEEN HIGH AND LOW FEAR OF SHOCK SUBJECTS WHILE PERFORMING TASKS DURING TRAINING PHASE

Task Condition	Group	Mean Heart Rate	Difference	Variance	t	p
	HFS	82.2		134.26		
PR			2.40		0.41	NS
	LFS	84.6		203.51		
	HFS	88.5		107.10		
PT			2.20		0.35	NS
	LFS	86.3		286.01		

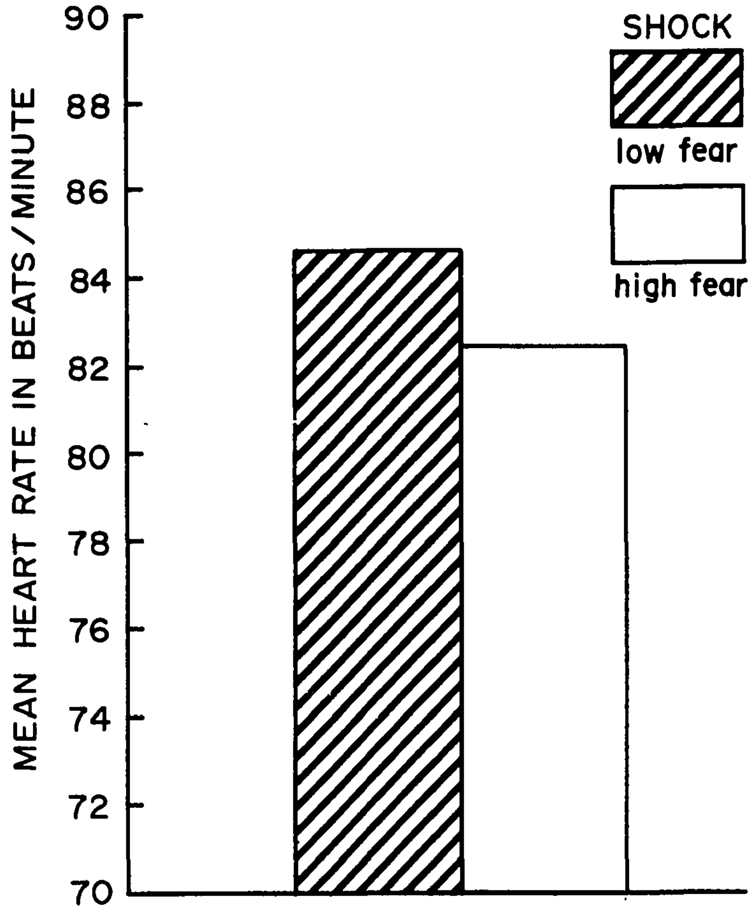

Figure I. Mean heart rate of high and low fear of shock subjects while performing pursuit rotor task under training conditions.

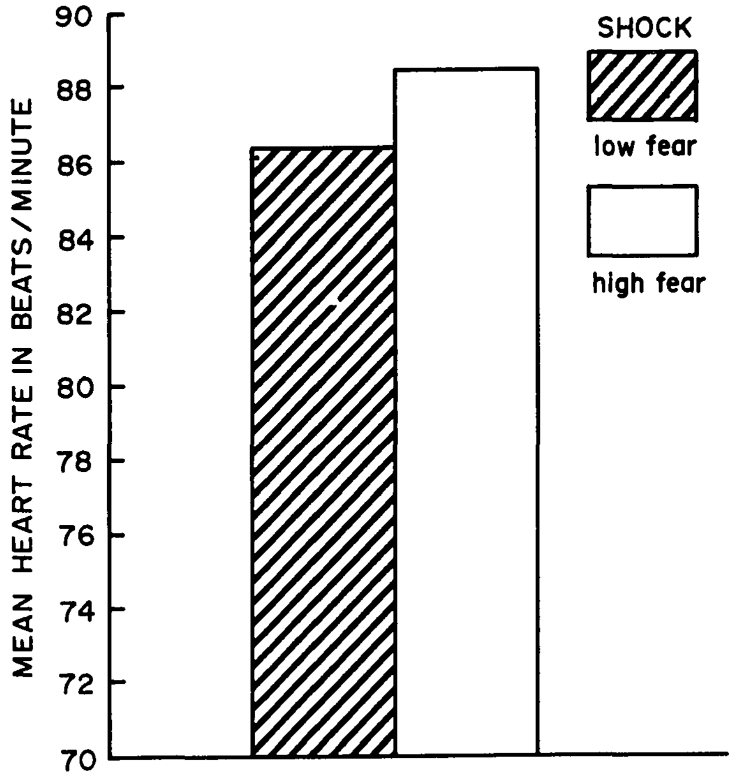

Figure 2. Mean heart rate of high and low fear of shock subjects while performing press test task under training conditions.

TABLE 2

MEAN SCORE COMPARISON BETWEEN HIGH AND LOW FEAR OF SHOCK SUBJECTS DURING TRAINING PHASE

Task Condition	Group	Mean Score	Difference	Variance	*t*	p
	HFS	7.2		5.01		
PR			0.2		0.16	NS
	LFS	7.4		9.50		
	HFS	17.6		6.70		
PT			0.4		0.31	NS
	LFS	17.2		10.00		

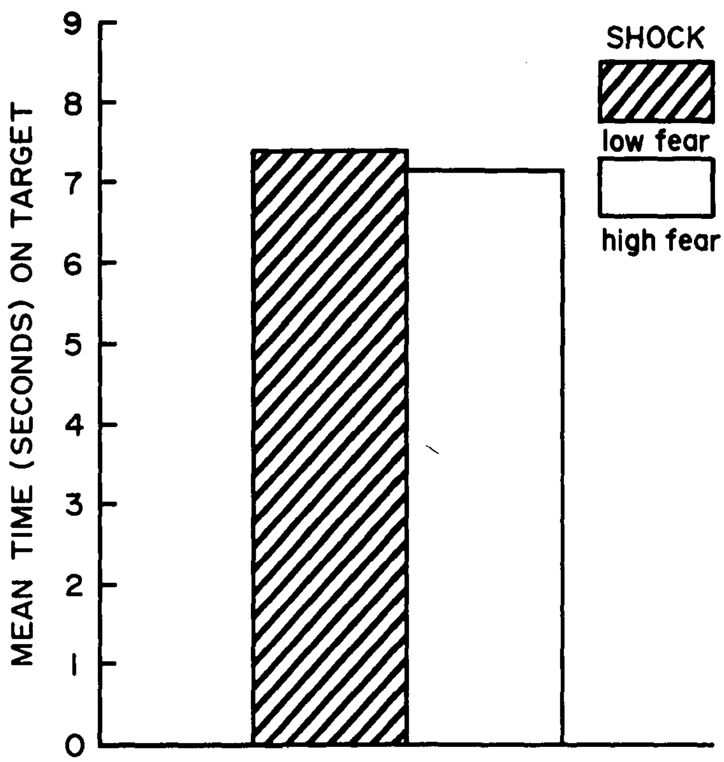

Figure 3. Mean time-on-target of high and low fear of shock subjects while performing pursuit rotor task under training conditions.

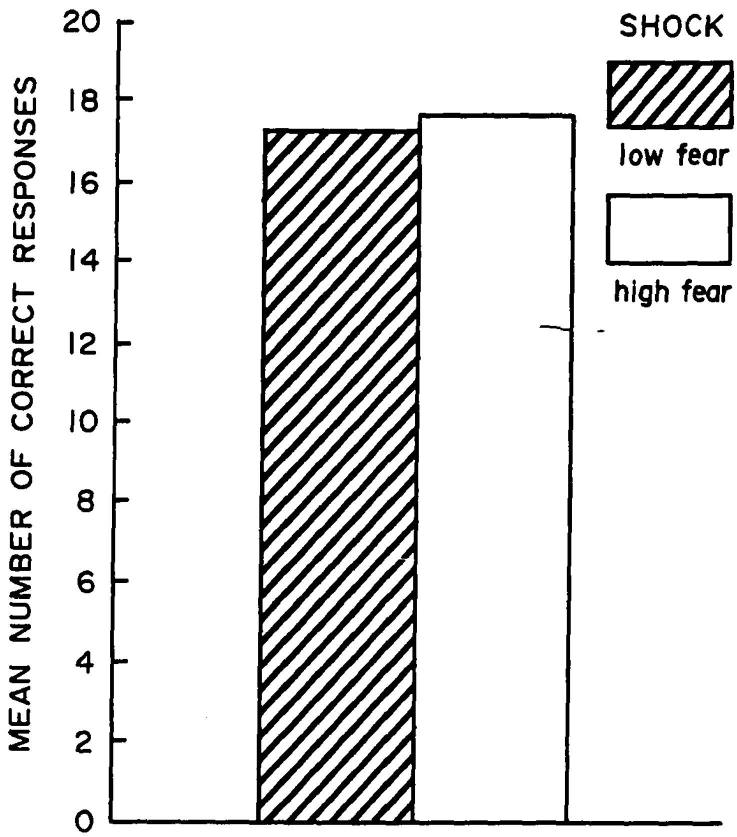

Figure 4. Mean number of correct responses of high and low fear of shock subjects while performing press test task under training conditions.

Appendix H. The testing-phase data are presented in terms of the four hypotheses advanced earlier.

Hypothesis 1. The first hypothesis predicted a significant difference in performance between subjects expressing a "high fear of shock" (HFS) and those expressing a "low fear of shock" (LFS) while performing the PR task. Also, it was predicted that the difference would be in terms of a greater relative impairment for the HFS group. The results revealed a mean change score from training to testing of only .57 seconds for the HFS subjects, while the mean change for LFS subjects was 3.60. Table 3 reveals that the difference between the groups is significant beyond the .001 level of significance. Graphic illustration of the differences between the HFS and LFS groups are shown in Figure 5.

Hypothesis 2. The second hypothesis predicted significant differences between HFS and LFS groups on the Press Test (PT). It was further predicted that HFS subjects would show a greater relative impairment during testing than LFS subjects. The results revealed a mean change score increase of only .70 discrimination responses for the HFS subjects, while the mean change for LFS subjects was 3.54. Hypothesis 2 is supported ($P < .01$) as indicated by the results in Table 4. Figure 6 illustrates the differences in performance change of the HFS and LFS groups on this task.

Hypothesis 3. Significant differences in autonomic response (HR) between HFS and LFS subjects while performing the PR task

TABLE 3

COMPARISON OF MEAN CHANGE IN TIME-ON-TARGET FROM TRAINING TO TESTING PHASE OF HIGH AND LOW FEAR OF SHOCK SUBJECTS WHILE PERFORMING PURSUIT ROTOR TASK

Group	Mean Time on Target Change Score	Difference	Variance	*t*	p
HFS	0.57		2.05		
		3.03		4.52	.001
LFS	3.60		2.48		

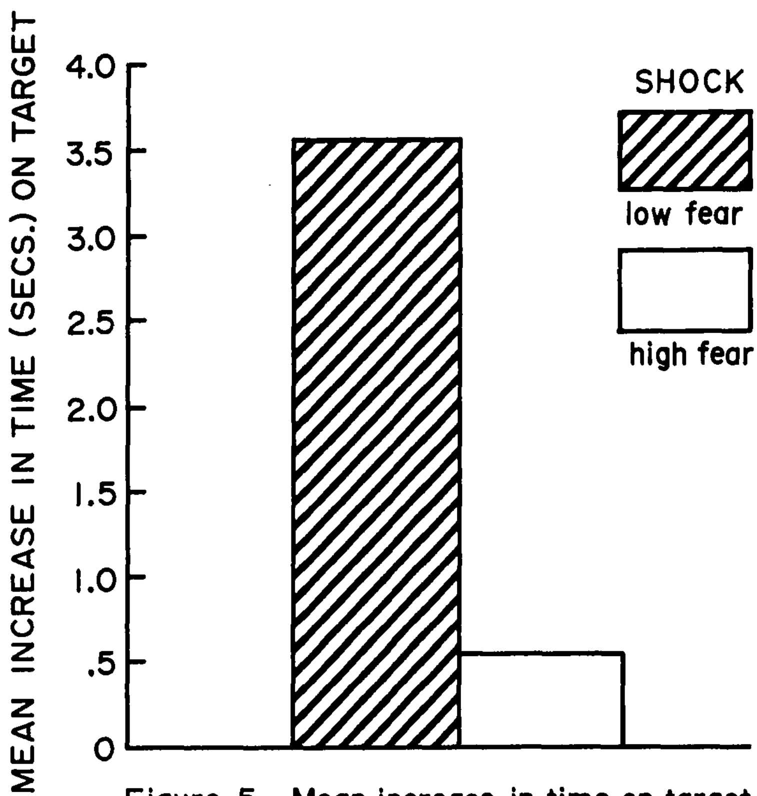

Figure 5. Mean increase in time on target of high and low fear of shock subjects under threat of shock condition while performing pursuit rotor task.

TABLE 4

COMPARISON OF MEAN CHANGE IN NUMBER OF CORRECT RESPONSES FROM TRAINING TO TESTING PHASE OF HIGH AND LOW FEAR OF SHOCK SUBJECTS WHILE PERFORMING PRESS TEST TASK

Group	Mean Number Correct Response Change	Difference	Variance	*t*	p
HFS	0.70		2.03		
		2.84		3.73	.01
LFS	3.54		3.94		

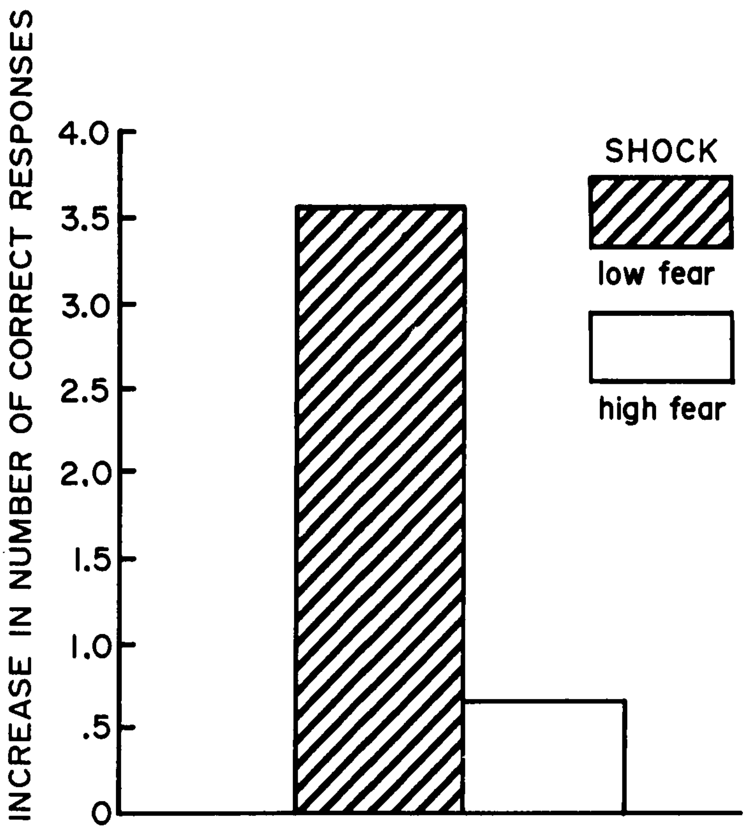

Figure 6. Mean increase in number of correct responses of high and low fear of shock subjects under threat of shock condition while performing press test task.

was predicted. Further, the HFS group was predicted to show a greater mean HR change than the LFS group. The results revealed a mean heart rate change score increase of only 6.9 beats per minute (bpm) for the LFS subjects, while the mean heart rate increase for HFS subjects was 25.2 bpm. Hypothesis 3 is supported ($P < .01$) as shown in Table 5. The difference in mean HR change between HFS and LFS subjects during PR performance is illustrated in Figure 7.

Hypothesis 4. As in Hypothesis 3 significant differences in HR change were predicted between HFS and LFS groups while performing the PT task. In addition, it was predicted that the HFS group's mean HR change would be significantly greater when compared with the mean HR change of the LFS group. The results revealed a mean heart rate change score increase of only 4 bpm for the LFS subjects, while the mean heart rate increase for HFS subjects increased 26 bpm. Hypothesis 4 is supported ($p < .001$ level of significance). Results of these comparisons can be seen in Table 6. An illustration of the mean HR change between HFS and LFS subjects is contained in Figure 8.

In order to illustrate graphically the effectiveness of the method of subject classification, scatter diagrams of both heart rate and performance change data are presented for the PR and PT tasks. These are shown in Figures 9 and 10 for the PR and PT data respectively. The + and - signs adjacent to each point are not relevant to the present interpretation of these figures and their significance will be discussed later.

TABLE 5

COMPARISON OF MEAN HEART RATE CHANGE FROM TRAINING TO TESTING PHASE OF HIGH AND LOW FEAR OF SHOCK SUBJECTS WHILE PERFORMING A PURSUIT ROTOR TASK

Group	Mean Heart Rate Change	Difference	Variance	*t*	p
HFS	25.2		192.10		
		18.3		3.27	.01
LFS	6.9		130.84		

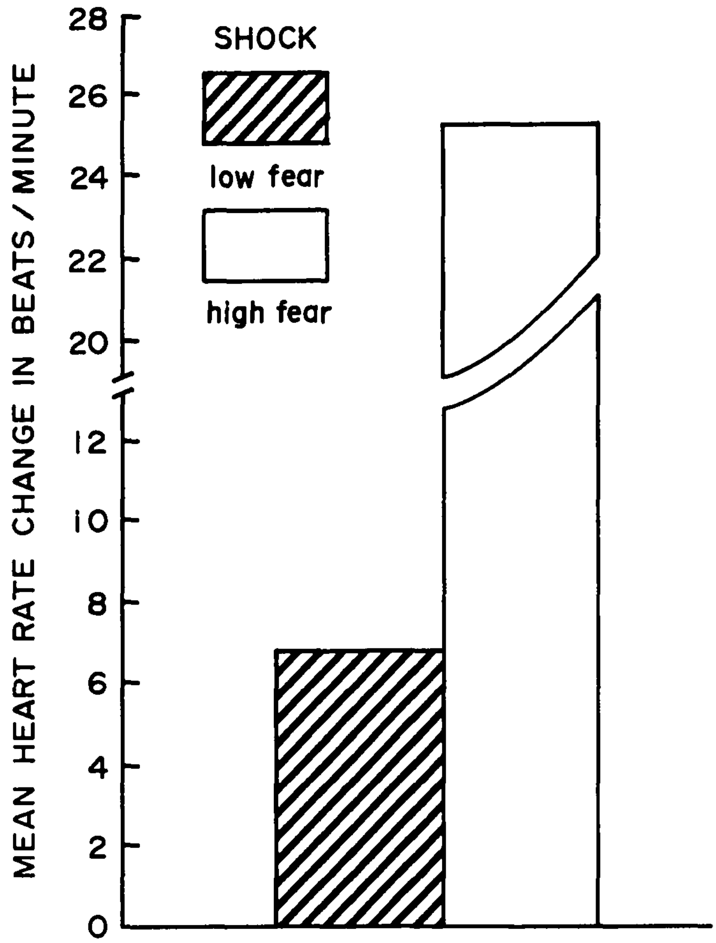

Figure 7. Mean heart rate change of high and low fear of shock subjects under threat of shock condition while performing pursuit rotor task.

COMPARISON OF MEAN HEART RATE CHANGE FROM TRAINING TO TESTING PHASE OF HIGH AND LOW FEAR OF SHOCK SUBJECTS WHILE PERFORMING PRESS TEST TASK

Group	Mean Heart Rate Change	Difference	Variance	*t*	p
HFS	26.0		26.22*		
		22		4.22	.001
LFS	4.0		245.55*		

*Computations based on two sample t-test where variances are considered unequal (Walker and Lev, 1953, pp. 157-58).

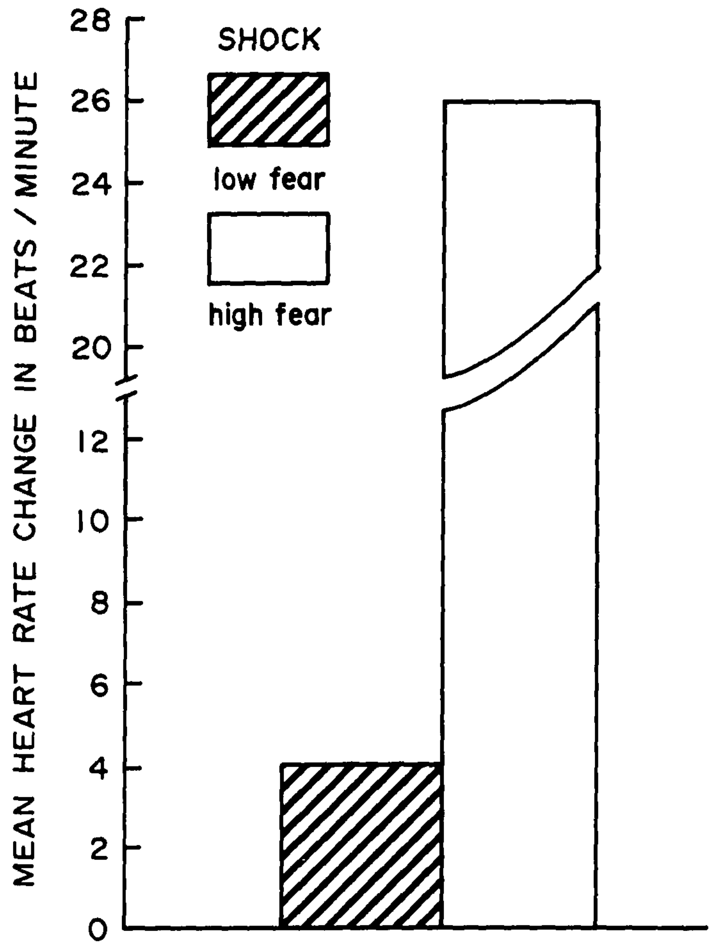

Figure 8. Mean heart rate change of high and low fear of shock subjects under threat of shock condition while performing press test task.

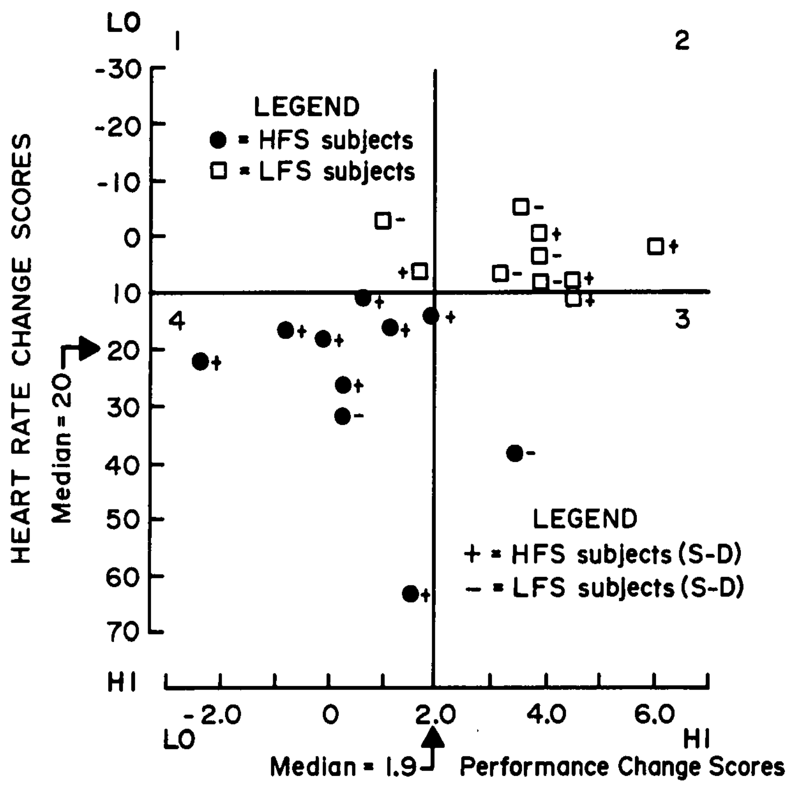

Figure 9. Scatter diagram of heart rate and performance change scores for HFS and LFS subjects (N=20) under the pursuit rotor task conditions.

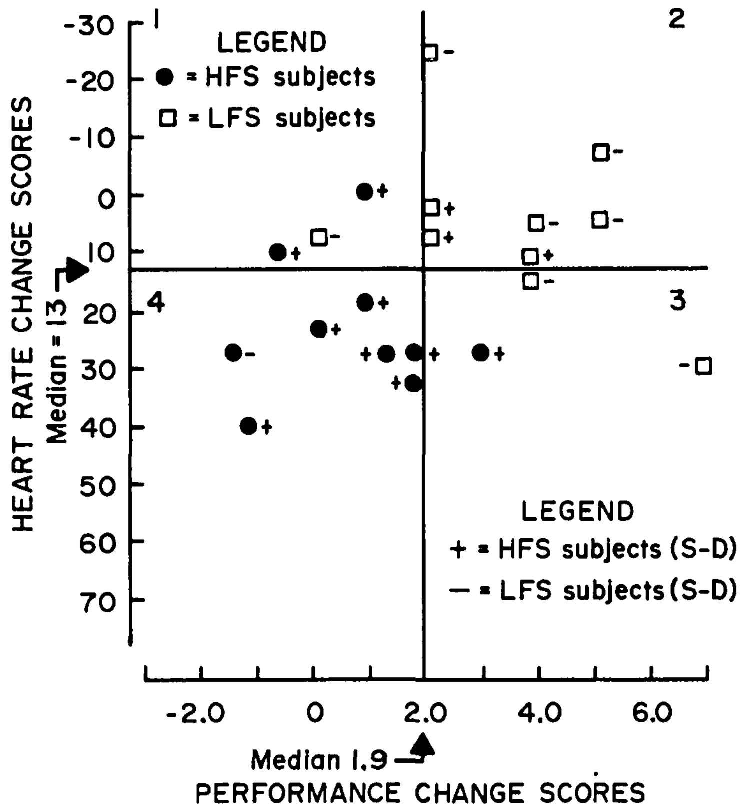

Figure 10. Scatter diagram of heart rate and performance change scores for HFS and LFS subjects (N=20) under the press test task conditions.

Although the HFS and LFS groups represented in Figures 9 and 10 are not normal bivariate populations due to the experimental effects which preclude product-moment correlation tests (Walker and Lev, 1953, p. 248), there appears to be a linear relationship between HR and performance. In Quadrant 4 of Figure 9, 90% of the HFS subjects are clustered (high HR-low performance) and 70% of the LFS are clustered in diagonal Quadrant 2 (low HR-high performance). Similar relationships are present for subjects assigned the PT task (Figure 10). In Figure 10, 70% of the HFS subjects cluster in Quadrant 4 and 70% of the LFS subjects cluster in Quadrant 2. In further analysis of both scatter diagrams (Figures 9 and 10) it appears that both HR and performance change are about equal in terms of discriminating between HFS and LFS subjects. Thus, 80% of the LFS group were found to be below the median HR, and 80% of the HFS group above the median for the PT groups (see Figure 10). Likewise, 90% of the LFS subjects fell below the median HR, while 100% of the HFS subjects were above the median for the PR groups (see Figure 9). For performance on PR, 90% of the HFS subjects fell below the median, while 80% of the LFS subjects were above that value. Examination of the PT data showed 90% of the HFS subjects to be below the median, while 90% of the LFS subjects were above.

The results of a Chi-square contingency test (Walker and Lev, 1953, pp. 100-101) of responses by all subjects to a post-experiment attitude question (degree of concern toward the possibility of receiving shock) indicate that there is agreement between pre and post tests for the "fear of shock" item. In Table 7 it can be seen that significantly more HFS subjects selected on the basis of their previous response to Item 11 of the attitude questionnaire (see Appendix E) responded to the extreme "strongly concerned" end of the post-experiment question "How would you rate yourself as to the feeling of being stressed or anxious?" than LFS subjects. These results indicate the HFS subjects professed more subjective anxiety toward the perceived threat of shock than LFS subjects.

Finally, comparison of semantic differential (S-D) results, in terms of a subject's response to an item concerning his feeling about "electrical shock" and the same subject's response to Item No. 11 on the 7-point attitude scale, used in selecting the HFS and LFS groups, reveals that use of the S-D for group selection would possibly have resulted in more error variance. This can be demonstrated by comparing the quadrant location of each HFS and LFS subject (selected on the basis of response to the 7-point attitude scale) in terms of both performance and heart rate scores as shown in Figures 9 and 10, and the same subject's designation (HFS or LFS) had he been selected on the basis of response to the S-D. Both the 7-point attitude scale used in subject selection and the S-D, administered but not used, were identical in construction except for the terminology employed in soliciting a response; that is, the scale dimensions were the same length with the same equal distance between intervals. Also, in assigning HFS or LFS subjects on the basis of S-D responses, subjects marking the extreme ends (Position 6 or 7) on the "bad" adjectival side of the scale could be classified as HFS subjects but

TABLE 7

CHI-SQUARE CONTINGENCY TEST OF THE FEAR OF SHOCK ITEM

Groups Differentiated on Basis of Primary Questionnaire	Post-Questionnaire (High Fear)	Post-Questionnaire (Low Fear)
HFS	18	2
LFS	7	13

Note: N = 40, df = 1, x^2 = 10.56, p $<$ .01

the converse could not be considered. It seems no individual is likely to mark the extreme ends of the "good" adjectival side of the scale. In other words, an individual will rarely indicate that he feels very good about electrical shock. None of the 40 subjects responded beyond the neutral zone toward the "good" end of the scale. Thus, those not responding to the "bad" adjectival scale position at the extreme end, i.e. Position 6 or 7, were classified LFS subjects. (See Appendix F.)

In appraising Figure 10, mean heart rate (HR) change comparisons under PT task conditions show 80% of the LFS group (designated by an open square) below the median, but only 40% of these would be below the median had they been classified according to S-D responses (designated by a minus sign). The same trend holds for the HFS group when comparing mean HR changes, i.e. 80% of the HFS subjects were above the median (designated by closed circle) whereas only 60% of those classified according to the S-D were above the median (designated by a + sign).

Similar findings obtain for mean HR change comparisons under the PR task condition as illustrated in Figure 9. Again, 100% of the HFS subjects are above the median in the predicted direction and 90% of the LFS subject are below the median, also in the predicted direction. However, only 40% of the LFS subjects classified according to S-D results are below the median and 80% of the HFS subjects (S-D classified) are above the median. Table 8 contains median performance comparisons under the two attitude classifications in addition to the mean HR change comparisons discussed above. Performance com-

TABLE 8

COMPARISONS OF NUMBER OF SUBJECTS ABOVE AND BELOW THE MEDIAN CHANGE SCORES FOR HEART RATE AND PERFORMANCE WHEN DIFFERENTIATED ON THE BASIS OF THE PRIMARY QUESTIONNAIRES AND THE SEMANTIC DIFFERENTIAL

Question-naire	Classifi-cation	Task	Performance		Heart Rate	
			Above Median	Below Median	Above Median	Below Median
Primary	HFS	PR	1	9	10	0
S-D		PR	4	9	4	9
Primary	HFS	PT	1	9	8	2
S-D		PT	4	8	7	5
Primary	LFS	PR	8	2	1	9
S-D		PR	5	2	2	5
Primary	LFS	PT	9	1	2	8
S-D		PT	6	2	3	5

parisons (see Table 8) between subjects selected according to the 7-point scale and the same subjects had they been selected according to the S-D indicate, as do mean HR change comparisons, that less error variance is likely to be present when the 7-point attitude scale used in this study is the primary instrument rather than an S-D.

CHAPTER IV

DISCUSSION

The results of the present study support the original hypotheses that an attitude scale may effectively elicit differences between subjects toward a possibly threatening object or situation, and that the subsequent behavioral manifestations of these expressed evaluations may be reliably reflected in terms of both performance and autonomic (heart rate) response patterns. The effect of stress on performance and heart rate as delineated in this investigation is thus considered a function of a subject's attitude toward the stressor under investigation. This concept is, thus, considered correct based on confirmation of the predictions that: (1) Persons indicating a strong fear of shock on an attitude questionnaire subsequently manifest their concern in terms of performance impairment and increased heart rate when subjected to a shock threat situation; and, (2) Persons indicating no fear of shock on an attitude questionnaire subsequently manifest their concern in terms of significantly less change in performance or in heart rate.

These results, taken together with those also employing attitude questionnaires (Hodges & Spielberger, 1967; Thackray & Pearson, 1968), strongly support the position that appraisal of attitudes toward a specific stressor, in this case threat of shock, is highly predictive of behavioral responses to that stressor.

This suggests that a measure of specific attitude toward a specific stressor may be more predictive of the consequent behavioral response than measures of general anxiety. Certainly, the TMAS, as one of the most commonly used measures of general anxiety, has been singularly unsuccessful in predicting response to stress. Also, neither the study by Hodges and Spielberger (1967) nor the study by Thackray and Pearson (1968) found any relationship between TMAS scores and response to threat of shock.

To the extent that different degrees of threat may be elicited by different stressors, the inclusion of more than one behavioral descriptor employed as a means of attempting to identify the characteristics of a "highly anxious" person may contribute more to the lack of success in using self-descriptive inventories of general anxiety than any other single source. For example, when a person marks on the TMAS that he has "more fears" than his friends, not only is his response considered but one possible indication of anxiety, but other perhaps non-related indicants (e.g. bad dreams) are used to classify anxious individuals.

Thus, it would seem improbable, if not impossible, for an experimenter to identify which of many possible objects the "highly anxious" person may respond to in an experimental situation where stress is the variable under consideration. The probability of selecting a stressor which subjects perceive as stressful (and to which they would respond accordingly in terms of impaired performance and/or increased heart rate) is greater when employing attitude questionnaires than when employing TMAS type instruments. In the former instance, subjects are differentiated on the basis of their cognitive appraisal (attitude) concerning a <u>specific</u> object, which is subsequently utilized as the stressor in an experiment. In the latter instance, however, subjects are differentiated on the basis of an experimenter's interpretation of numerous personality indices, none of which may provide a sufficient clue as to the specific object they perceive as threatening. Consequently, the experimenter must "guess" which of many possible objects a "highly anxious" person is "fearful" of, to the extent it affects his response patterns. Thus, not only must the stressor which an experimenter selects be correct for one "highly anxious" person but it must apply to the entire <u>N</u> of subjects; error variance may thereby be increased.

In view of the foregoing a minimal step in trying to understand the relationship between personality characteristics and behavior may require the measurement of personality characteristics more contiguous with and less peripheral to the appropriate stimuli vis-a-vis the behavior one attempts to predict. The present status of personality tests reported in Chapter I, however, does not appear to be much different from that of a decade ago:

> The inherent difficulties of constructing valid inventories and the poor validities which the inventors usually produce make many psychologists feel that further work along these lines would be futile... (thus) the successful measurement of personality characteristics will rest largely on testing procedures other than self-description inventories (Nunnally, 1959, p. 336-337).

To assume, however, that any form of attitude questionnaire would necessarily improve prediction of stress susceptibility over other assessment techniques would be to oversimplify the measurement of attitude. The possibility for erroneous classification of subjects may also be present in attitude questionnaires if, for example, any of the precautions discussed in Chapter I are ignored.

That this may be the case can be demonstrated by reviewing Figures 9 and 10 of the Results section which show more variance for the Semantic Differential (S-D), in terms of performance and heart rate response patterns, than for the primary instrument.[2] One of the reasons that there is more variance present for the S-D may be the result of insufficient attention to the precaution concerning "relevancy." Perhaps no other problem in constructing attitude scales is greater than that of selecting concepts and categories (against which the subject evaluates concepts) which are most relevant to a study (Osgood, et.al., 1957). Generally, the designer of an attitude questionnaire imposes his own or someone else's choice of concepts and categories upon individuals to whom the instrument is administered without due regard for cultural or language usage differences that may exist (Sherif, Sherif & Nebergall, 1965). This practice permits a possible source of variance to be present that becomes evident after the administration of the questionnaire. " ... an apparently irrelevant adjective pair may turn out to be relevant. If consistent systematic variance can be identified with an adjective pair, then one would have

[2]The primary instrument and the S-D were administered to subjects simultaneously but only the primary instrument was utilized in differentiating subjects subsequently selected as participants in the present study.

to conclude that the adjective is relevant to the concepts" (Kerlinger, 1964, p. 570). In an attempt to reduce this possible source of error variance, a technique called "elicitation" has been suggested (Hood, 1961; Pearson, 1966). It is a procedure for obtaining concepts and categories that are meaningful to the subjects to whom an experimenter wishes to administer an attitude test. Thus, prior to the construction of an attitude questionnaire, the experimenter submits a list of concepts (all or some of which he intends to investigate in terms of a subject's evaluative responses) to a population of potential subjects from which he will later draw his sample. The experimenter then requests this potential subject population to write down adjectives or descriptors which they would use in describing or discussing these concepts. If the experimenter has been successful in disguising the purpose of his request so as to avoid bias effects (Rosenthal, 1966), he may then use these "elicited" descriptors, terms, or categories by incorporating them into the construction of the attitude scale he subsequently administers.

As a result of not using the "elicitation" technique suggested above in constructing the S-D, certain problems in scoring and interpreting the S-D became evident. For example, none of the 40 subjects administered the S-D marked the extreme positions (last two or first two spaces of the 7 spaces provided) for the positive end of the bi-polar terms available for evaluating the concept of "electrical shock" (i.e., good, pleasant, and desirable). This was not the case for the negative end of the bi-polar terms (i.e., bad, unpleasant, and undesirable); an indication, perhaps, that individuals do not feel unconcerned toward the concept of "electrical shock" to the extent they would evaluate it as extremely good, pleasant or desirable.

Thus, in order to make between-questionnaire comparisons of performance and heart rate response patterns, quite different methods for classifying subjects were employed i.e., subjects marking the "neutral" zone on the primary questionnaire were not classified, but if they marked the "neutral zone" on the S-D they were arbitrarily classified LFS subjects. The same procedure was followed in classifying the HFS subjects.

Concepts and categories should not only be "relevant," they should also be explicit. The concept or term "electrical shock" used in the S-D, considered analogous to the concept "Being asked to participate in an experiment that involves electrical shock" used in the primary questionnaire, may have been more connotative than denotative. As a connotative term, "electrical shock" may have conveyed a number of meanings to a subject in addition to the explicit or denotative one the experimenter had in mind. For example, a subject may have evaluated the concept "electrical shock" in terms of: (a) his receiving the shock; (b) someone else receiving the shock, e.g., patients in a hospital; or (c) animals in an experiment receiving the shock. Thus, it is evident that the scoring problem, as well as the questionnaire explicitness problem, contributed to the relative lack of success in classifying subjects with the S-D scale employed.

Although questionnaires may appear to be almost identical in design, an unsuspected source for error variance may reside in one slight variation. For example, the questionnaires reported in Chapter I (Hodges & Spielberger, 1967; Thackray & Pearson, 1968) and the one used in the present study were similar with the exception of the number of spaces provided for subject responses. In the former instance, the questionnaire scales provided a subject with five equidistance spaces for marking his response. This meant that a subject would have had to mark either extreme position, i.e., the first or last of the five spaces provided, if an experimenter chose this procedure for classifying subjects as HFS or LFS types. Generally, however, subjects tend to "shy" away from making extreme evaluations unless so forced by the nature of the instrument. Also, unless there is a very large pool of subjects available, this procedure for classifying individuals may not be possible; it is also time-consuming. As an alternative, an experimenter could consider responses in the first two and the last two of the five spaces provided as representing extreme views or definite attitudes toward some object under consideration. Now, however, there is only one middle space available on the five-space scale upon which an "unconcerned" or "no attitude" individual, discussed in Chapter I, is expected to make his response. Being unaware of the experimenters' classification scheme, this "unconcerned" or "no attitude" type person may mark one space to the right or left of the middle space and subsequently be classified erroneously as either HFS or LFS subject. Thus, when experimenters report that they classified those responding above the mid-point, on a five (equi-distance) space scale, as HFS subjects, and those below the mid-point as LFS subjects, the probability that a number of individuals who are neutral, uncommitted, unconcerned, or who have no attitude toward the object being investigated will be erroneously classified as HFS or LFS subjects may not occur as often if a seven (equi-distance) space scale is employed, similar to the primary instrument used in the present study. The use of a seven-space scale provides a subject who may be "neutral" three spaces for expressing his position e.g., one space to either side of the middle space; and, should thus reduce the probability for erroneous classification. While the present study did not systematically compare the effectiveness of the seven-point with the five-point scale, a seven-point scale was used in the hope of reducing errors of classification. In consideration of the foregoing observations, then, a number of different types of attitude questionnaires may be as reliable as those reported in the present study. This assumption, however, must await future research validation.

Finally, the results of the present study reveal that an attitude scale which differentiates subjects on the basis of perceived fear of shock, may be used reliably to predict performance at more than one type of task in a shock situation. In this study, subjects classified HFS or LFS on the basis of their expressed attitude toward a threat of shock manifested subsequent behavior patterns in a consistent manner when exposed to the stressor of shock irrespective of the task introduced. Thus, the attitude questionnaire used in this study appears considerably more effective in predicting response to a shock-stress situation based upon an individual's attitude toward a threat of shock situation irrespective of the task, than does any technique employing self-description inventories as represented by the TMAS. Further research is needed to determine whether attitude questionnaires may be used as effectively as those discussed in the present study in predicting response to stress situations other than shock.

CHAPTER V

SUMMARY

The present study was conducted in order to explore further the extent to which performance impairment and heart rate change are related to a subject's previously expressed attitude of fear toward a specific stressor under more than one task condition.

Three hundred sixty-five male students enrolled in Freshman and Sophomore courses at the University of Oklahoma were presented booklets containing twenty-four typical situations an individual may experience as stressful and were asked to express their feeling toward each of the situations on a seven (equi-distance) scale from "no concern" to "strong concern."

Since threat of shock was the stress situation under investigation, only persons expressing "no concern" or "strong concern" toward a fear of shock item in the booklet were selected as subjects. Thus, of the forty subjects selected, twenty were classified as high fear of shock (HFS) and twenty classified as low fear of shock (LFS).

Upon arrival for the experiment half of the HFS subjects were administered 15 trials on a perceptual motor task (pursuit rotor) and the remaining half were given 15 trials on a cognitive-interference task (press test). The same procedure was followed for the LFS subjects.

Each of the 15 training trials lasted 20 seconds followed by 20-second rest periods. Following training, all subjects were informed that shock would be administered on subsequent trials if they failed to maintain the average performance level they established during training. Shock electrodes were then attached to the subject's leg and connected to a dummy shock apparatus which prevented the actual administration of shock. All subjects were then given an additional five trials under the threat of shock condition. Heart rate was recorded continuously during all phases of the experiment.

Performance and heart rate measures taken during training were compared with performance and heart rate measures taken under the threat of shock conditions with the following results:

1. Significant performance impairment was present for HFS subjects relative to the LFS subjects on both the pursuit rotor (PR) and press test (PT) tasks under threat of shock conditions.

2. Significant heart rate increases were present for HFS subjects relative to the LFS subjects performing either the PR or PT task under threat of shock conditions.

The results support the hypothesis that the effects of stress on performance and heart rate are, to a considerable degree, a function of an individual's attitude toward the induced stressor. The data further support the additional hypothesis that individuals differentiated on the basis of their attitude toward a fear of shock item on an attitude questionnaire, generally demonstrate subsequent behavioral manifestations consistent with their evaluations irrespective of the specific tasks employed in this study.

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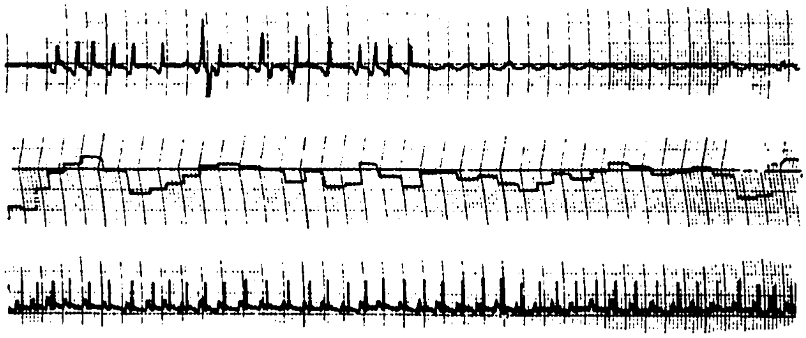
APPENDIX A

RECORDING OF A HFS AND LFS SUBJECT DURING FIRST TEST TRIAL UNDER THREAT OF SHOCK CONDITION SHOWING EYE-BLINK (top line) AND HEART RATE (lower lines). RIGHT HALF OF FIGURE REPRESENTS TRIAL DATA; LEFT HALF REPRESENTS A SUBSEQUENT REST PERIOD

FIRST TEST TRIAL

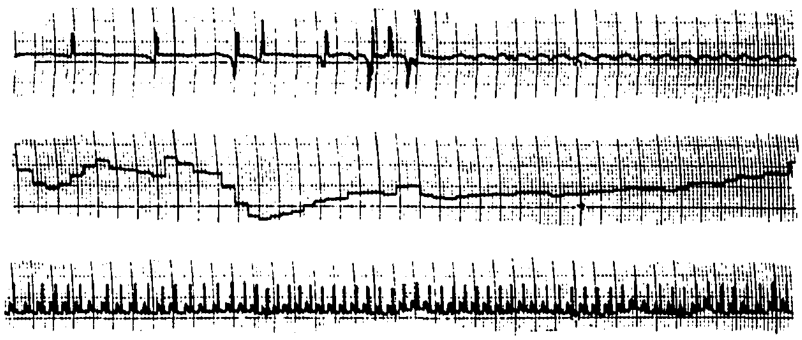
LFS



(63 bpm)

FIRST TEST TRIAL

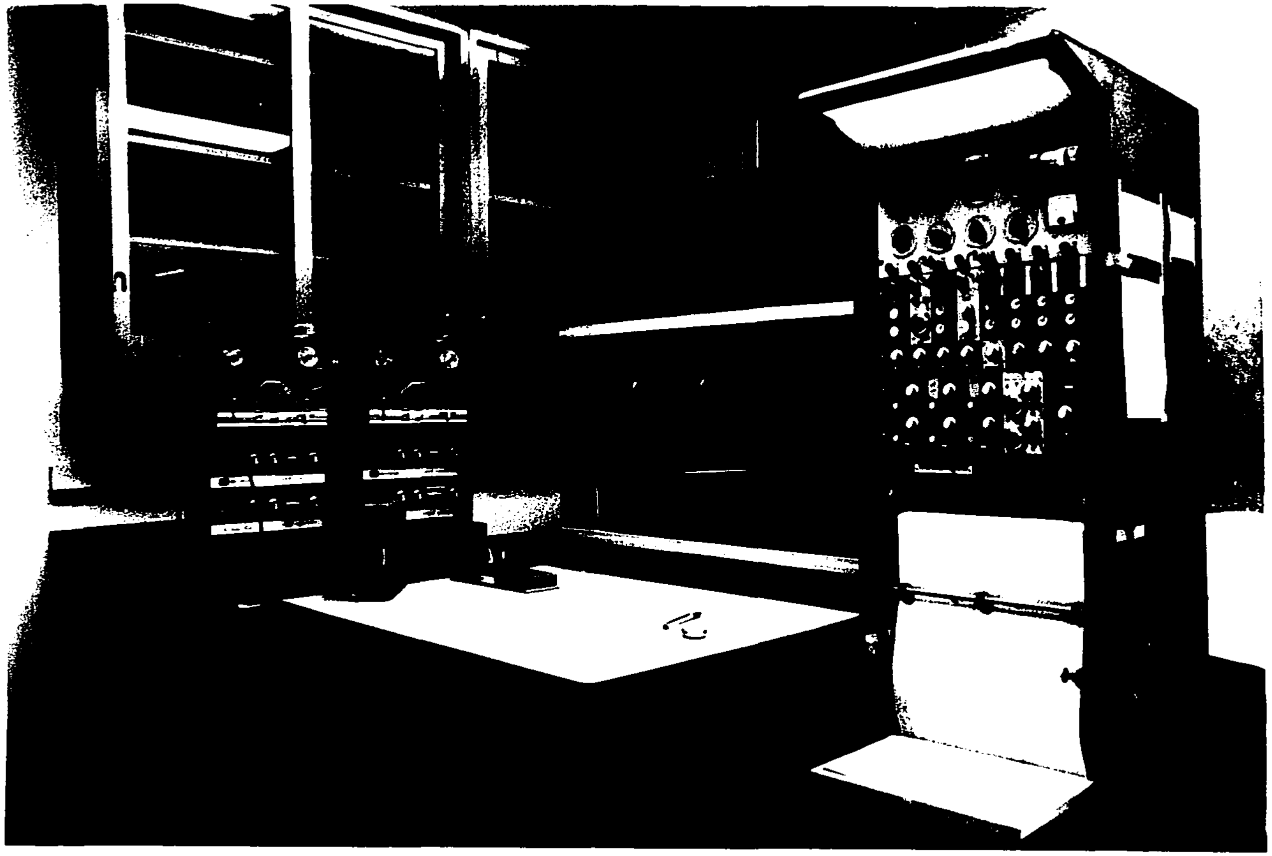
HFS



(99 bpm)

APPENDIX B

PHOTOGRAPH OF EQUIPMENT AND EXPERIMENTAL ARRANGEMENT



APPENDIX C

PHOTOGRAPH OF SUBJECT ARRANGEMENT AND EQUIPMENT FOR PERFORMING THE PRESS TEST TASK

APPENDIX D

PHOTOGRAPH OF SUBJECT ARRANGEMENT AND EQUIPMENT FOR PERFORMING THE PURSUIT ROTOR TASK

APPENDIX E

PRIMARY ATTITUDE QUESTIONNAIRE

Typical Experiences

Everyone has probably experienced some variation of the situations listed below, or would have a good idea of how they would react if placed in the situation.

If you have actually experienced any of the situations listed or any that closely resemble one you have experienced, place an X in the blank space for YES. If you have not experienced the situation but have some definite ideas about how you might react if confronted with the situation, place an X in the blank space for NO, BUT...

Leave a blank for any situations that arouse absolutely no feelings.

....

....

Situation No. 1 Riding in a car during a bad rain or snow storm with bad visibility. ____YES ____NO, BUT...

Situation No. 2 Riding in an airplane during a bad storm that bounced you around a bit. ____YES ____NO, BUT...

Situation No. 3 Watching a store or home burn down that was owned by someone you knew. ____YES ____NO, BUT...

Situation No. 4 Smashing your thumb or finger with a hammer or some other object. ____YES ____NO, BUT...

Situation No. 5 Being called on by an instructor to recite or answer a question when not prepared. ____YES ____NO, BUT...

Situation No. 6 Finding yourself in a discussion in which everyone else disagrees with what you say. ____YES ____NO, BUT...

Situation No. 7 Arriving at the scene of a very bad accident right after it happened. ____YES ____NO, BUT...

Situation No. 8 Trying to fix an electrical appliance or screw in a light bulb and getting shocked. ____YES ____NO, BUT...

Situation No. 9 Spilling something on your suit or dress at a formal party that seems to "stand out." ____YES ____NO, BUT...

Situation No. 10 Arriving late at an important function and having to walk to the front for a seat. ____YES ____NO, BUT...

Situation No. 11 Being asked to participate in an experiment that involves electrical shock. ____YES ____NO, BUT...

Situation No. 12 Having someone stand over you or pressure you to hurry up with a difficult job. ____YES ____NO, BUT...

Situation No. 13 Suddenly forgetting the name of a good friend or relative during an introduction. ____YES ____NO, BUT...

Situation No. 14 Taking a test for which you have not been able to adequately prepare. ____YES ____NO, BUT...

Situation No. 15 Being pressured into working at a task at "top speed" knowing it wasn't really important. ___YES ____NO, BUT...

Situation No. 16 Finding yourself in the position of winning or losing a sporting event for the team. ____YES ____NO, BUT...

Situation No. 17 During a relatively quiet period suddenly belching out loud at a dignified party. ____YES ____NO, BUT...

Situation No. 18 Having your best friend suddenly stop talking to you for no apparent reason. ____YES ____NO, BUT...

Situation No. 19 Pressured into making an important decision without adequate time to think about it. ___YES ____NO, BUT...

Situation No. 20 Threatened with physical harm if you did not comply with someone's request. ____YES ____NO, BUT...

Situation No. 21 Finding yourself forced into a situation you don't really want to be in. ____YES ____NO, BUT...

Situation No. 22 Being asked to be a subject for someone's experiment you know nothing about. ____YES ____NO, BUT...

Situation No. 23 Fainting at the sight of blood, or from being severely injured. ____YES ____NO, BUT...

Situation No. 24 Receiving an award for something you know someone else was really entitled to. ____YES ____NO, BUT...

Now, looking back at the page containing situations No. 1 thru 24, place an X according to how you feel about the situation in one of the spaces beside the appropriate situation listed below. For example, if you would feel only slightly concerned about being placed in the situation, place the X at the left end of the scale. If you would feel strongly concerned, place the X at the right end of the scale. If your response would be somewhere in between, place the X accordingly.

Sample

Situation No. 0 Being asked to ride a ferris wheel when scared to death of height. _XX_YES ____NO, BUT...

Situation No. 0 0______1______2______3______4______5______6_XX_7
slightly concerned — strongly concerned

....

....

Situation No. 1 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 2 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 3 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 4 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 5 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 6 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 7 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 8 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 9 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 10 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 11 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 12 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 13 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 14 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 15 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 16 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 17 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 18 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 19 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 20 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 21 0____1____2____3____4____5____6____7
slightly concerned — strongly concerned

Situation No. 22 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 23 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Situation No. 24 0______1______2______3______4______5______6______7
slightly concerned — strongly concerned

Thank you.

Please print your name and address in order that a letter of recognition for your time and cooperation may be sent to you and your professor.

(Circle one) Mr.
Mrs.
Miss ______________________________
Name (Please Print)

____
Street Address

____
City State

APPENDIX F

SEMANTIC DIFFERENTIAL

The purpose of this study is to measure the <u>meanings</u> of certain things to various people by having them judge them against a series of descriptive scales. In the center of the page are words or word phrases with descriptive adjectives on either side of the blank lines. Place an <u>X</u> in the appropriate space that seems to indicate your feelings about the word or word phrase, i.e., what does the word or word phrase mean to you.

SAMPLE

If you feel the word or word phrase in the <u>center</u> of the page is closely related to one end of the scale, then the <u>X</u> should be placed like so: ....

FIRE

good	____	____	____	____	____	____	XX	bad

If you feel the word or word phrase in the <u>center</u> of the page is only slightly related to the descriptive adjective at one end of the scale, then place an <u>X</u> accordingly.

....
....

ELECTRICAL SHOCK

good	____	____	____	____	____	____	____	bad
pleasant	____	____	____	____	____	____	____	unpleasant
desirable	____	____	____	____	____	____	____	undesirable
fair	____	____	____	____	____	____	____	unfair
valuable	____	____	____	____	____	____	____	worthless
strong	____	____	____	____	____	____	____	weak
healthy	____	____	____	____	____	____	____	sickly

ENCOURAGED TO "HURRY" OR GO "FASTER"

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

SMALL PAY - LITTLE JOB

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

SMALL PAY - BIG JOB

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

DISTRACTION

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

PHYSICAL EXERTION THAT LEADS TO FATIGUE

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

WORKING AT A REPETITIVE TYPE JOB
(SAME THING OVER AND OVER)

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

TAKING ORDERS

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

WORKING WHILE SOMEONE STANDS OVER YOU

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

TRYING TO CONCENTRATE ON SOMETHING WHILE SOMEONE "YAKS"

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

WORKING AROUND "HIGH" VOLTAGE

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

TORTURING AN ENEMY AGENT FOR INFORMATION
VITAL TO SURVIVAL OF SELF AND COUNTRY

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

LIVING DANGEROUSLY

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

RULES

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

TESTS

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

PRESSURE

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

REQUIRED TO ENDURE PHYSICAL PLAN

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

CONFINEMENT IN SMALL QUARTERS

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

CONVULSIVE ELECTRICAL SHOCK TREATMENT OF PATIENTS

good	___	___	___	___	___	___	___	bad
pleasant	___	___	___	___	___	___	___	unpleasant
desirable	___	___	___	___	___	___	___	undesirable
fair	___	___	___	___	___	___	___	unfair
valuable	___	___	___	___	___	___	___	worthless
strong	___	___	___	___	___	___	___	weak
healthy	___	___	___	___	___	___	___	sickly

APPENDIX G

TRANSCRIPT OF RECORDED INSTRUCTION FOR PRESS TEST AND PURSUIT ROTOR TASKS

INTRODUCTION

I would like to take this opportunity to thank you for coming to the Aeromedical center as a participant in our research program. Before we start with the main part of this experiment, I would like to explain why we are using recorded conversation and instructions. It has been found that a "gruff" or overly friendly voice used by an experimenter can result in biased data due to the influence it may have had on a participant. To preclude this from happening, recorded instructions will be used throughout this experiment. Also, the experimenter will not engage you in conversation at any time. To further insure consistency of performance results, a one-way mirror is being used. This arrangement provides the experimenter with the opportunity to know when to assist you in the event the instructions are not entirely clear which otherwise could result in improper performance techniques. However, the mirror should not be distracting for you since you will be unable to detect movement on the other side. This arrangement also permits the experimenter to move about freely for the purpose of making necessary adjustments of equipment without disturbing you.

Very briefly, the purpose of this experiment is to study the effect of generalized muscle tension on learning while performing a task. In order to accomplish this, simple response devices we call electrodes will be attached to your chest, forehead and to one hand. These electrodes are then plugged into a black terminal box which leads to the tall physiological recording machine standing near the booth where your physiological responses are traced onto a constantly moving roll of paper by means of ink pens. It is generally assumed that during the early phases of learning a new task, muscles are tight and have a tendency to become tense. After a short time, during which the task becomes more familiar, muscles will generally start to relax. Thus, one aspect of this research project is to measure some of the responses involved in learning a new or complex task.

At this time, the experimenter will attach the electrodes. You can help the attachment process by raising your shirt and under-shirt to about the level of your lower rib-cage. During attachment indicate to the experimenter which hand you wish the electrode attached. This should be the hand you do not normally use for writing or for performing a task. After attachment of the electrodes, get as comfortable as possible and relax while the experimenter checks the equipment for proper functioning.

(recorder off)

PRESS TEST INSTRUCTIONS

Before we start, let me suggest that you keep the hand with the attached electrode in your lap at all times.

Now let me direct your attention to the three clip-boards lying on the table to one side of you. Each contains one part of the task you are to perform. Each board is marked part I, II, or III. The instructions for each part are lying loose on top of each board and are enclosed in a clear plastic cover. They are also marked part I, II, or III. Now, listen very carefully to the procedure instructions ...... When you hear me say, "read instructions for part I, or II, or III," pick up the instruction sheet with your free hand and commence reading. You will have exactly one-minute for the reading of instructions. At the end of one-minute, you will be directed to place the instruction sheet to the opposite side of the table with your free hand, to place the clip-board in front of you for ease of writing, to pick up the pencil provided and to be ready to begin. A very important part of the procedures will be for you to draw a line under the column you are working on the moment you hear me say "stop working." There will be a series of short trials for each part with rest periods of 20 seconds between each trial. Each trial will commence with the instructions, "begin working" and will end with the instructions "stop working" at which time you will draw the line indicating the last column you were working on. I will indicate the end of each part with the words, "end of part I, II, or III." When you hear that part I, II, or III has ended, place the clip-board on the top of the instruction sheet you placed to the opposite side of the table earlier.

Although speed is important, accuracy is just as important. Your score may be lowered if the experimenter is unable to read your answer, so write as clearly as possible. Ok, remember, be sure you draw a line under the last column of work at the end of each trial when you hear me say, "stop working." Should you need a second sheet for any part, simply flip the top sheet over, crease it with your hand and continue working.

Now we are ready to begin. Read instructions for part I. (1-minute). Place instruction sheet to opposite side of table, place clip-board for part I in place for ease of writing, pick up pencil and be ready to begin.

That is the end of part I. Place clip-board to opposite side of table, pick up instructions for Part II and commence reading. (1-minute). Place instruction sheet to opposite side of table, place clip-board for part II in place for ease of writing, pick up pencil and be ready to begin.

That is the end of part II. Place clip-board to opposite side of table, pick up instructions for part III and commence reading. (1-minute). Place instruction sheet to opposite side of table, place clip-board for part III in place for ease of writing, pick up pencil and be ready to begin.

This is the end of part III. Now relax for a few minutes while the experimenter sets the recorder for further instructions and rechecks the equipment and scores your performance records.

(recorder off)

Now we are ready to proceed. During this phase of the experiment, your task will be as before with one exception, that is, only part III of the task will be used. You will be given another series of short trials with 20 second rest periods between each trial. Also, you will continue underlining the last column of work at the end of each trial when you hear me say, "stop working." The only additional requirement during this phase of the experiment will be for you to perform under pressure. To test your ability for performing under pressure, a distraction will be added to your task. In other words, if your performance should fall below the average score you obtained during the training session, you will receive an electric shock. The shock will not be harmful but will be uncomfortable. The receiving of shock will depend entirely upon your ability to maintain the level of proficiency you have already demonstrated. Remember, the shock, if you should receive it will not harm your physical well-being, however, it will be uncomfortable, so try to maintain the performance level you established earlier.

The instrument used for shock is an automatic device that will release current only in the event your score falls below the score you obtained earlier. Thus, the shock will be regulated by a red apparatus the experimenter will place on a table behind you. Also, two ankle electrodes will be attached to one of your legs. OK, relax a moment while the experimenter prepares for the next phase of your task.

(recorder off)

Ok, ready, pick up the instructions for part III and commence reading (1-minute). Place instruction sheet to opposite side of table, place clip-board for part III in place for ease of writing, pick up pencil and be ready to begin.

Good, that is the end of the testing phase. Now relax for a few minutes while the experimenter makes further preparations. Please remain as still as possible during this time.

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Very briefly, the purpose of this experiment is to study the effect of generalized muscle tension on learning while performing a task. In order to accomplish this, simple response devices we call electrodes will be attached to your chest, forehead and to one hand. These electrodes are then plugged into a black terminal box which leads to the tall physiological recording machine standing near the booth where your physiological responses are traced onto a constantly moving roll of paper by means of ink pens. It is generally assumed that during the early phases of learning a new task, muscles are tight and have a tendency to become tense. After a short time, during which the task becomes more familiar, muscles will generally start to relax. Thus, one aspect of this research project is to measure some of the responses involved in learning a new or complex task.

At this time, the experimenter will attach the electrodes. You can help the attachment process by raising your shirt and under-shirt to about the level of your lower rib-cage. During attachment indicate to the experimenter which hand you wish the electrode attached. This should be the hand you do not normally use for writing or for performing a task. After attachment of the electrodes, get as comfortable as possible and relax while the experimenter checks the equipment for proper functioning.

(recorder off)

PURSUIT ROTOR INSTRUCTIONS

Now let me direct your attention to the equipment in front of you. It is called a Pursuit Rotor. It is simply a turntable that rotates at a fixed number of revolutions like a phonograph player. Inserted in the top of the turntable is a small round silver disc. To one side of the turntable you will see a small wood and metal instrument we call a stylus. To familiarize yourself with how it operates, pick it up by the wooden handle, place the bent tip of the metal portion onto the small round disc of the turntable and pretend the turntable is rotating by making several circular movements with the stylus. Very good, remember, try not to hold the stylus down with your finger even though it has a certain amount of give to it. Ok, replace the stylus and relax a moment while I explain the rest of the procedure.

When the turntable rotates, in a clockwise manner, your task will be to keep the end of the stylus on the metal disc of the turntable. During the time you have the point of the stylus on the disc, an automatic timer records the duration of the contact. Each time the stylus slides off the disc, the timer automatically stops recording. Thus your score is the total time the point of the stylus is in contact with the metal disc of the turntable. Now, in order that you will not be caught unprepared for any trial, a yellow light will come on just before the turntable starts rotation. This light is to your left side. When this light comes on, place the stylus tip onto the metal disc and be ready to begin. There will be a series of trials with 20 second rest periods between each trial. The experimenter will record the results of each trial and reset the automatic timer. I will tell you when the session is over. Also, please remember to keep your hand and fingers on the wooden portion of the stylus only, and try to maintain your hand with the attached electrode as still as possible during all phases of the experiment. Ok, ready? Pick up the stylus, place it in position, wait for the yellow light to come on and be ready to begin.

(recorder off)

(recorder on)

Good, that is the end of the training session. Now relax for a few minutes while the experimenter sets the recorder for further instructions and rechecks the equipment. Please maintain your hand with the attached electrode as still as possible during this time. Thank you.

(recorder off)

Now we are ready to proceed. During this phase of the experiment, your task will be exactly as before. That is, you will be given another series of trials with 20 second rest periods in between. The only additional requirement during this phase of the experiment will be for you to perform under pressure. To test your ability to perform under pressure, we will add distraction to your task. In other words, if your performance should fall below the average score you obtained during the training session, you will receive an electric shock. The shock will not be harmful but will be uncomfortable. The receiving of shock will depend entirely upon your ability to maintain the level of proficiency you have already demonstrated. Remember, the shock, if you should receive it will not harm your physical well-being, however, it will be uncomfortable, so try to maintain the performance level you established earlier. The instrument used for shock is an automatic recording device that will release current only in the event your score falls below the score the experimenter sets into it. In other words, the experimenter will have no control over your possible receipt of shock. Such a possibility will be regulated automatically by the red apparatus the experimenter will place on a table beside you. Also, two ankle electrodes will be attached by the experimenter to one of your legs and adjustments made for recording your performance scores. As soon as the attachments have been made instructions for the next phase will continue.

(recorder off)

(recorder on)

Now we are ready to begin. Remember, the procedures are exactly as before. In 30 seconds you will receive the same indication as before for commencing the task..........

APPENDIX H

INDIVIDUAL PERFORMANCE AND HEART RATE SCORES DURING TRAINING (MEAN SCORE) AND TESTING (CHANGE SCORE)

	Pursuit Rotor		Heart Rate		Press Test		Heart Rate	
	Training -	Testing	Training -	Testing	Training -	Testing	Training -	Testing
HFS # 1					18.6	- .6	84	12
2					18.8	.2	116	25
3					15.0	1.0	83	1
4					21.4	-1.4	73	32
5					17.6	1.4	60	33
6					21.0	3.0	74	28
7					17.2	1.8	86	34
8					18.0	1.0	79	20
9					13.2	1.8	86	28
10					15.2	-1.2	81	39
11	8.5	- .2	123	18				
12	6.5	1.5	101	64				

APPENDIX H (continued)

	Pursuit Rotor		Heart Rate		Press Test		Heart Rate	
	Training	- Testing	Training	- Testing	Training	- Testing	Training	- Testing
HFS # 13	5.5	1.1	92	16				
14	8.3	1.9	92	16				
15	10.7	- .8	70	17				
16	11.6	.3	76	26				
17	6.3	3.4	85	38				
18	.4	.6	67	11				
19	8.1	.3	100	32				
20	6.6	-2.4	80	22				
LFS # 21					13.2	3.8	93	15
22					15.8	.2	70	8
23					12.8	2.2	77	4
24					16.8	5.2	92	- 5
25					19.2	3.8	76	14
26					20.0	2.0	91	8
27					19.0	4.0	89	7

APPENDIX H (continued)

	Pursuit Rotor		Heart Rate		Press Test		Heart Rate	
	Training	Testing	Training	Testing	Training	Testing	Training	Testing
LFS # 28					20.8	5.2	90	6
29					14.0	2.0	102	-21
30					21.0	7.0	66	33
31	9.6	3.2	71	7				
32	9.1	1.6	92	7				
33	4.1	1.0	77	--2				
34	4.7	6.0	82	2				
35	10.5	3.6	98	- 5				
36	4.7	3.8	93	0				
37	7.3	3.9	97	8				
38	7.7	4.5	76	8				
39	8.4	3.9	98	4				
40	8.5	4.5	79	11				