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THE EFFECTS OF ANXIETY, STRESS, TASK DIFFICULTY AND STAGE OF LEARNING ON PERFORMANCE IN PAIRED-ASSOCIATE LEARNING

by

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CHAPTER I

INTRODUCTION

Statement of the General Problem

The problem to which this dissertation will address itself to can be stated as follows: What are the effects of anxiety, stress, task difficulty, and stage of learning on learning performance?

Background of the Problem

Although the current interest in anxiety phenomena has historical roots in the philosophical and theological views of Pascal and Kierkegaard, Freud is recognized as the first person who attempted to explicate the meaning of anxiety within the context of psychological theory.[1] Freud viewed anxiety as something felt, an unpleasant state or condition. His study of anxiety was mainly concerned with

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[1]Rollo May, The Meaning of Anxiety (New York: Ronald Press, 1950).

identifying the sources of stimulation which precipitated anxiety rather than analyzing the properties of anxiety states.

Other theorists after Freud have attempted to illuminate and clarify further the meaning of anxiety and its influence on animal and human behavior. Prior to 1950, little experimental research on human anxiety was reported. Since 1950, there has been a constant upsurge in experimental research on anxiety.

In the recent book, Anxiety and Behavior, seventeen authors offer twelve different explanations for the effects of anxiety. These explanations include a wide range of task and cognitive variables.[1] None of these theories are totally contradictory, rather each theory deals with a somewhat different set of variables and usually a different conception and measurement of anxiety. Thus, it is difficult to establish a basis for integration or

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[1]Charles D. Spielberger, ed., Anxiety and Behavior (New York: Academic Press, 1966).

comparison of two or more theories of anxiety.

Much of the present ambiguity in the conceptual status of anxiety seems to arise from the fact that most authors do not make a distinction between the Cattell labels "trait anxiety" and "state anxiety." He interprets the trait anxiety factor as stable individual differences in a unitary, relatively permanent personality characteristic. State anxiety, on the other hand, refers to a transitory condition of the organism which fluctuates over time.[1]

Most of the empirical work on transitory anxiety has attempted to delineate the properties of the anxiety state and the stimulus conditions which evoke it whereas the investigation of trait anxiety has focused upon the individual differences between groups of subjects presumed to differ in anxiety level. There is little experimental evidence which addresses itself to the relationship of the

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[1]Raymond B. Cattell, "Anxiety and Motivation: Theory and Crucial Experiments," in Anxiety and Behavior, ed. by Charles D. Spielberger (New York: Academic Press, 1966), pp. 23-62.

response level of trait anxiety to the response level of state anxiety of any given stimulus. Rather most studies of anxiety have been concerned either with anxiety as a trait or with anxiety as a state, but rarely with both.

Definition of Terms

The terms of be used in this study are defined as follows:

1. Anxiety--is a hypothetical construct or a personality trait which reflects the level of emotionality within an individual. The level of emotionality, in turn, determines the total effective drive level of an organism. The concept of drive level is theorized as one of the intervening variables which determines the strength of a response. The level of drive or anxiety is operationally defined as an individual's obtained score on the Manifest Anxiety Scale.[1] Anxiety and drive are considered synonymous in this study.

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[1]Janet A. Taylor, "A Personality Scale of Manifest Anxiety," Journal of Abnormal and Social Psychology, XLVIII (1953), 285-290.

2. Stress is a state produced by nonspecific stimulation which is associated with the activation of certain cortical mechanisms, particularly, the Reticular Formation. Stress is defined operationally at the biaural administration of continuous white noise as three prescribed decibel levels--zero decibels, fifty decibels, and seventy-two decibels.

3. Task Difficulty is the ease with which a stimulus-response connection can be made to some criterion. In paired-associate learning tasks it has been found that difficulty is a function of two interrelated variables, the degree of association between any stimulus word and the corresponding response word, and the degree of similarity among the words in the list. Therefore, associative connection and intralist similarity are the operational measures of difficulty. The easy task is defined operationally as a paired adjective list with each stimulus word having a high associative connection with the corresponding response word as well as low associative connection with other words in the list, i.e., low intralist similarity. The medium difficult task is defined

operationally as a paired adjective list with each stimulus word having an intermediate associative connection with the corresponding response word as well as intermediate intralist similarity. The difficult task is defined operationally as a paired adjective list with each stimulus word having a low associative connection with the corresponding response word as well as intermediate intralist similarity.

The degree of associative connection between a stimulus and response word and the degree of intralist similarity is determined by the normative data on the closeness of associative connection and the similarity of meaning for common adjectives gathered by Conrad H. Haagen.[1]

4. Stage of Learning is a discrete period of time between the first and last presentation of the lists of paired adjectives. Stage of learning is defined operationally as four trials on a list of paired ajectives.

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[1]Conrad H. Haagen, "Synonymity, Vividness, Familiarity and Association Value Ratings of 400 Pairs of Common Adjectives," Journal of Psychology, XXVII (1949), 453-463.

5. Learning is defined as a relatively permanent change in response potentiality which occurs as a result of practice. Learning, in this study, is operationally defined as the individual's observed performance on a paired associates list which is measured by the number of correct anticipations per trial.

Significance of the Study

Anxiety has long been recognized as generally having a deleterious effect upon the learning process. Cattell, in a summary of his review of anxiety, learning and school achievement, states that "at the simple empirical level at least we must recognize that anxiety is more frequently a cognitive disorganizer than an aid to learning, as shown by the loadings of the anxiety factor on reduced capacity for immediate memory, poorer simple calculation performance. . . ."[1] If this is true, then it

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[1]Raymond B. Cattell, "Anxiety and Motivation: Theory and Crucial Experiments," in Anxiety and Behavior, ed. by Charles D. Spielberger (New York: Academic Press, 1966), p. 46.

would seem the educator should attempt to find ways in which he might reduce anxiety particularly in classroom learning so that anxious students do not become so handicapped by their anxiety that they are unable to retain what is taught to them. However, the experimental evidence is not sufficient at this point to develop adequate intervention strategies which the ordinary classroom teacher could employ to vitiate the deleterious effects of anxiety on learning. Sieber has suggested that the gap between experimental findings on the effects of anxiety and their application to classroom learning is in part due to the fact that most experimenters do not take into account the environmental and organismic variables which affect the applied situation.[1] However, the complex nature of anxiety and its effects upon the cognitive processes are such that andequately designed studies of a laboratory nature have not yet been carried out. The lack of well designed and properly controlled experiments tends to

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[1]Joan E. Sieber, "A Paradigm for Experimental Modification of the Effects of Test Anxiety on Cognitive Processes," American Educational Research Journal, VI (1969), 46-61.

militate against well documented findings about the effect of anxiety and hence the development of intervention strategies for classroom use. Although this present state of affairs should not stifle the effects of the applied researcher, it does point out that much is yet to be learned about the nature of anxiety. Until more data are obtained under controlled conditions, it will continue to be difficult for the applied researcher to design more precise experiments and to develop programs which will lead to the reduction or capitalization of anxiety and its effects upon classroom learning.

An experiment by Slater studied the effects of noise on pupil performance in an actual classroom situation. Slater tested children on a routine task of short duration under quiet (forty-five to fifty-five decibels), average (fifty-five to seventy-five decibels), and noisy (seventy-five to ninety decibels) conditions. She found that noise had no effect, either detrimental or facilitative, upon the accuracy or speed of the children's performance.[1]

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[1]Barbara R. Slater, "Effects of Noise on Pupil Performance," Journal of Educational Psychology, LIX (1968), 239-243.

Spielberger has found a higher incidence of college drop-outs among high anxious students. With this knowledge, he developed a counseling program which identified high anxious subjects before school began and worked with them in group sessions for one semester. He found that this type of program reduced the high attrition rate among high anxious students.[1]

In summary, it can be seen that as one learns more about the nature and effects of anxiety and stress in classroom learning, more sophisticated intervention strategies based upon the nature of the classroom task can be developed. The end result should be the reduction of anxiety or capitalization upon anxiety and hence, the facilitation of learning.

Assumptions

This experiment is based on the following assumptions:

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[1]Charles D. Spielberger and Henry Weitz, "Improving the Academic Performance of Anxious College Freshment: A Group Counseling Approach to the Prevention of Underachievement," Psychological Monographs, LXXVIII (1964), No. 13.

1. The Manifest Anxiety Scale measures the level of emotionality of an individual and consequently reflects his level of Drive or Anxiety. Further, it is assumed that the level of Drive differentially effects the strength of a response elicited from the organism.

2. White noise administered biaurally produces a state which is associated with the activation of the Reticular Formation.

3. An individual's performance on a paired associate learning task is indicative of what they have learned.

4. The learning of a paired associates list is similar to some types of classroom learning so that the learning which occurs in the experimental situation has a corresponding application to that type of classroom learning.

Limitations

The delimiting factors of this experiment are as follows:

1. This study is limited to the verbal learning of a paired-associate list of adjectives.

2. The observations of this experiment are limited to male resident students of a private college who consented to sign a waiver of personal freedom.

3. The controlled laboratory setting used in this study limits the applicability of the findings to a traditional classroom environment.

Review of the Research Literature

The voluminous empirical research on anxiety precludes any attempt to summarize it here. Suffice it to say that there are selective reviews of various segments of this literature available.[1] This review of literature

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[1] Eugenia Hanfmann, "Psychological Approaches to the Study of Anxiety," in Anxiety, ed. by Peter H. Hoch and Joseph Zubin (New York: Grune & Stratton, 1950), pp. 51-69; Merton S. Krause, "The Measurement of Transitory Anxiety," Psychological Review, LXVIII (1961), 178-189; Richard S. Lazarus, James P. Deese, and Sonia F. Osler, "The Effects of Psychological Stress upon Performance," Psychological Bulletin, XLIX (1952), 293-317; Barclay Martin, "The Assessment of Anxiety by Physiological Behavioral Measures," Psychological Bulletin, LVIII (1961), 234-255.

will focus upon the theoretical formulations about the nature of anxiety of Kenneth and Janet Spence and Robert Malmo, and pertinent literature which relates to the interaction of anxiety with stress, task difficulty and stage of learning.

Spence and Spence Theory of Anxiety

The Spence and Spence Theory of Anxiety in complex learning is partially based upon an earlier formulation of the relationship between anxiety and classical conditioning. Their theoretical formulation assumes that a learning factor, that is, Habit Strength (H), combines in a multiplicative manner with a generalized drive factor (D) to determine Reaction Potential, that is, strength of a response (E). Spence and Spence state this relationship as: $E = f(H \times D)$.[1] They further assume that in classical conditioning situation, the level of Drive (D) is a function of the magnitude of a hypothetical

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[1]Janet T. Spence and Kenneth W. Spence, "The Motivational Components of Manifest Anxiety: Drive and Drive Stimuli," in Anxiety and Behavior, ed. by Charles D. Spielberger (New York: Academic Press, 1966), p. 293.

mechanism which is a persistent emotional response aroused by aversive stimuli. The Manifest Anxiety Scale was developed as an operational measure of individual differences in emotionality and it was assumed that the score obtained on this scale is a reflection of the level of Drive of that individual.[1]

From this theoretical base, Spence and Spence attempt to extend their theory to account for more complex learning phenomena, particularly that which relates to the learning of a paired-associate learning task. If, in the case of a single item in a list, the initial habit strength of the correct response is stronger than the strength of the incorrect competing responses, the multiplicative relationship between Habit Strength (H) and Drive (D) in determining the strength of the response (E), implies that the higher the level of Drive, the greater is

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[1] Janet A. Taylor, "A Personality Scale of Manifest Anxiety," Journal of Abnormal Psychology, XLVIII (1953), 285-290. Janet T. Spence and Janet A. Taylor are one and the same person. Janet A. Taylor was married to Kenneth W. Spence in the early sixties. For the sake of consistency, the author will refer to these individuals as Spence and Spence.

the difference between the E values of the correct and the incorrect responses.

Assuming that only the difference in E value need to be taken into account in predicting the effects of the level of Drive on performance, the following prediction can be made: When the correct response-to-be learned is initially stronger than the incorrect responses, performance should be a direct function of the level of Drive. The relationship between this prediction and performance on an easy task is straight forward. If task difficulty is defined in terms of the meaningfulness of the paired-associate list and intralist similarity, then performance on an easy task, that is, high meaningfulness of materials and low intralist similarity, should be positively related to drive leve; the higher the drive level the better the performance and the lower the drive level the greater the decrement in performance. Medium drive level will result in performance at a level between that of high and low drive levels. However, the predictions of the Spence and Spence drive theory for more difficult learning tasks are more complex. Spence would

define difficulty as the response competition of two or more habit tendencies so that, if the response to-be-learned has a weaker habit tendency than a stronger incorrect response then the incorrect response will compete with the correct to-be-learned response, and consequently, a more difficult task to master. In the case of more difficult tasks, the prediction of Spence and Spence is as follows:

> If correct-to-be learned response is initially weaker than one or more of the competing response tendencies, then the higher the drive, the poorer the performance in the early stages of learning. However, as learning of the correct responses increases over trials, the habit strength of these responses would be expected to equal and then exceed those of competing responses. Thus, while the performance of a high drive group would be expected to be inferior to that of a low drive group in early stages of learning, it should become superior in later stages.[1]

Spence and Spence state that in order to test adequately this hypothesis one should introduce an

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[1]Janet T. Spence and Kenneth W. Spence, "The Motivational Components of Manifest Anxiety: Drive and Drive Stimuli," in Anxiety and Behavior, ed. by Charles D. Spielberger (New York: Academic Press, 1966), p. 300.

experimental stress variable because the evidence tends to favor the fact that the Manifest Anxiety Scale measures situational anxiety and not chronic anxiety, that is, anxiety in which the individuals emotional responsiveness is aroused only under stressful conditions.

Experimental Evidence for Spence and Spence Theory of Anxiety

With respect to verification of the predictions for easy tasks, Besch; Spence, Ferber and McFann; and Standish and Champion have reported positive results.[1] Predictions of performance for more difficult tasks have been wrought with both design and methodological deficiencies which make generalizations about the validity of these predictions from the Spence and Spence theory hazardous. None of these studies employed

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[1] Norma F. Besch, "Paired-Associates Learning as a Function of Anxiety Level and Shock," Journal of Personality, XXVII (1959), 116-124; Kenneth W. Spence, John Taylor, and Rhoda Ketchel, "Anxiety (Drive) Level and Degree of Competition in Paired-Associates Learning," Journal of Experimental Psychology, LII (1956), 306-310; Robert R. Standish and Richard A. Champion, "Task Difficulty and Drive in Verbal Learning," Journal of Experimental Psychology, LIX (1960), 361-365.

a design which would allow one to test for stage of learning effects clearly predicted by the theory. The studies mentioned above are weak methodologically in that they did not include a medium anxious group of subjects and level of difficulty was not manipulated. However, the same problem exists with those studies in which negative evidence was reported with respect to the Spence and Spence theory of drive. Both Lovaas and Sarason used a medium anxious group but failed to account for stage of learning and degree of task difficulty, however, both authors introduced different levels of experimental stress.[1]

Malmo's Theory of Activation

Malmo has derived a different set of predictions to account for the differential learning performance of

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[1] Ole I. Lovaas, "The Relationship of Induced Muscular Tension, Tension Level, and Manifest Anxiety in Learning," Journal of Experimental Psychology, LIX (1960), 145-152; Irwin G. Sarason, "Effect of Anxiety, Motivational Instructions, and Failure on Serial Learning," Journal of Experimental Psychology, LI (1956), 253-260.

high and low drive subjects as they learn easy and difficult tasks. Malmo assumes that drive, stress, and task difficulty interact with each other during the learning performance. He claims that the introduction of stress hinders the performance of high drive individuals and facilitates the performance of low drive subjects. In the case of a more difficult task, the introduction of stress produces a more deleterious effect upon performance of the high drive group than the low drive group.

Malmo has derived these predictions from the neuropsychological theory of activation as proposed by Lindsley and further elaborated by Hebb.[1] According to this theory there is a continuum from a low level of activation up to an optimum level of activation for a

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[1]Donald B. Lindsley, "Emotion," in Handbook of Experimental Psychology, ed. by S. S. Stevens (New York: John Wiley & Sons, 1951), pp. 473-516; Donald O. Hebb, "Drives and the C.N.S. (conceptual nervous system)," Psychological Review, LXII (1955), 243-254.

given function, where performance rises monotonically with increasing activation level. However, beyond this optimum level performance will drop and the relationship of performance to level of activation is nonmonotonic. The performance curves under these conditions is referred to as the inverted U curve.[1]

Malmo has attempted to reinterpret in light of Activation theory the positive findings reported by Spence to support drive theory. Malmo states:

> It is possible that these results (referring to Spence's evidence) were produced simply by a rise in D (drive) directly rather than by the greater relative potency of competing responses. It seems that correct responses were suffering from too much D, rather than that they were losing out because of competing responses being strengthened by the greater D. This would also apply where the correct response is strongest, but where competing responses that are subthreshold with a low level of drive are moved above threshold by raising drive.[2]

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[1] Robert B. Malmo, "Activation: A Neuropsychological Dimension, Psychological Review, LXVI (1959), 367-386.

[2] Robert B. Malmo, "Measurement of Drive: An Unsolved Problem in Psychology," in Nebraska Symposium on Motivation, ed. by Marshall R. Jones (Lincoln: University of Nebraska Press, 1958), p. 235.

If one takes a reductionist's point of view, Malmo's theory would certainly be more parsimonious in that it requires fewer assumptions in order to make a set of predictions than the theory proposed by Spence and Spence.

Whether or not the relationship between drive, task difficulty and performance is a monotonic function as proposed by Spence or is more adequately represented by an inverted U function (nonmonotonic) as stated by Malmo is still an empirical question. There seems to be no definite answer to this question in the literature.

Task Difficulty

The problem, in question, has been confounded further because different authors use different variables to define task difficulty. Some researchers maintain that all variables related to the difficulty of a task will affect performance in an identical manner. Underwood, Runquist, and Schulz have suggested that the effects of these variables which relate to task difficulty are not identical. He claims that meaningfulness of materials and intralist similarity each affect task difficulty in different ways.

The distinction which Underwood, Runquist, and Schulz refer to is that between the associative stage of learning (early performance trials) and the response learning stage (later trials). It has been shown that the effects of varying intralist similarity (competitional task) are localized in the associative stages of learning. The effects of varying meaningfulness, on the other hand, has been shown to be localized in the response learning stage.[1]

Underwood, Runquist, and Schulz's analysis of paired-associate learning permits one to refine the Spence and Spence predictions according to task difficulty both with respect to intralist similarity and meaningfulness. The easiest task one can construct is where similarity between stimulus members is low and likewise, the similarity between response members is low. Also meaningfulness (defined as association value between stimulus and

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[1] Benton J. Underwood, Willard N. Runquist and Rudolph W. Schulz, "Response Learning in Paired-Associate Lists as a Function of Intralist Similarity," Journal of Experimental Psychology, LVIII (1959), 70-78.

response) is high. The difficult task is constructed by using stimulus members of intermediate similarity and response members of low similarity, and consequently, meaningfulness is low, or the associative value between stimulus and response is low. Thus, an easy task is one with minimal response competition and difficult task is one with near maximal response competition. A task of intermediate difficulty can be constructed where the intralist similarity of its stimulus members are intermediate and the response members are low in similarity but the meaningfulness of the list is of medium association value. Clearly, these three types of tasks are within the theoretical boundary conditions of both Malmo's Theory of Activation and Spence and Spence Drive Theory.

Although several studies have used different levels of meaningfulness of a task that involve response competition, no study has systematically varied meaningfulness, anxiety, and stress in one experiment.

Stress

The findings on the effects of stress on easy and difficult tasks has been equivocal. Taylor found that

stress in an easy noncompetitional paired-associate task resulted in the superior performance of the high anxious group over the low anxious group.[1] Levitt and Goss found no differential performance curves for the high- and low-anxious subjects.[2] The introduction of stress appears to affect differentially the performance of high and low anxious groups when the task involves competing responses. Spielberger and Smith varied anxiety, stage of learning and difficulty under stress-nonstress conditions. They found that stress instructions produced a greater decrement in the performance of high anxious subjects relative to low anxious subjects in a difficult competitional serial learning task.[3] For reasons unexplained by the authors, separate analyses for the neutral and stress conditions were performed. Since their conclusions and generalizations

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[1]Janet A. Taylor, "The Effects of Anxiety Level and Psychological Stress on Verbal Learning," Journal of Abnormal and Social Psychology, LVII (1958), 55-60.

[2]Herbert Levitt and Albert E. Goss, "Stimulus Attributes and Drive in Paired-Associate Learning," Journal of Experimental Psychology, LXII (1961), 243-252.

[3]Charles D. Spielberger and Lou Hicks Smith, "Anxiety (Drive), Stress, and Serial Position Effects in Serial-Verbal Learning," Journal of Experimental Psychology, LXXII (1966), 589-595.

were drawn from the stress condition analysis, one would have to consider if the same results would have been rendered by combining the neutral and stress subjects into one factorial design. At any rate, their findings were interpreted as positive support for the Spence and Spence Theory of Drive.

Brief mention should be made of the effects which different types of stress might have upon task difficulty as defined in this paper. The utilization of ego-involving stress instructions has the effect of motivating high and low anxious subjects to different degrees. Mandler and Sarason, and Child claim that high anxious subjects react more emotionally to ego-stress instructions which in turn elicit stronger task-irrelevant responses than for low anxious subjects.[1] Consequently, ego-involving stress instructions are not used in this experiment, but rather white noise is utilized because it has more

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[1]George Mandler and Seymour B. Sarason, "A Study of Anxiety and Learning," Journal of Abnormal and Social Psychology, XLVII (1952), 561-565; Irvin L. Child, "Personality," in Annual Review of Psychology, ed. by Paul R. Farnsworth (Palo Alto: Annual Reviews, Inc., 1954), pp. 149-170.

nonspecific "energizing" properties. White noise permits a more adequate quantification of different levels of stress and to this extent provides for more precise methodology.

White noise produces a nonspecific arousal effect on paired-associates learning as evidenced by the work of Hörmann and Todt. They found that medium intensity (fifty decibels) of white noise facilitated learning more than either a low intensity (zero decibels) or high intensity (seventy-five decibels) of white noise.[1] However, these subjects were unselected with respect to anxiety.

Purpose of the Study

Specifically, the purpose of this study is to investigate the effects of anxiety, stress, task difficulty, and stage of learning on an individual's performance on paired-associate verbal learning; and to achieve some further clarity or differentiation among various theoretical

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[1]Hans Hörmann and Eberhard Todt, "Lörm Und Lernen," Zeitshrift Fur Experimenteele und Angewandte Psychologie, VII (1960), 422-426.

positions concerning these effects. In other words, what are some of the factors, both within the human organism and in his environment which facilitate or hinder his performance on relatively simple and complex verbal learning?

Specific Re-Statement of Problem

The specific question considered in this study is as follows:

> What are the effects of anxiety, stress, task difficulty, and stage of learning on performance in a paired associate learning task?

Research Hypotheses

The following general research hypotheses are advanced:

1. The learning performance on an easy task is expected to be positively related to the level of anxiety; the higher the anxiety level, the better the performance should be relative to lower levels of anxiety.

2. The effect of stress on the performance of an easy task is expected to be a direct function of the

individual's level of anxiety. In other words, stress is an additive function of anxiety on the performance of an easy learning task.

3. The learning performance on a more difficult task is a function of the stage of learning and the level of anxiety; that is, the performance of the high anxiety group is expected to be inferior to that of a low and medium anxiety group in the early stages of learning and the high anxiety groups is expected to be superior to the low and medium anxiety groups in the later stages of learning.

4. The effect of stress on the learning performance of a more difficult task is expected to be a function of the level of anxiety and stage of learning. Consequently, stressful conditions are expected to raise the existing level of anxiety, especially the higher levels of anxiety, hence the high anxiety group would be expected to manifest a greater performance decrement on the more difficult learning task than the low and medium anxiety groups.

Operational Hypotheses

Corresponding to the general research hypotheses, the operational hypotheses are as follows:

1. Subjects who score in the upper twentieth percentile on the Manifest Anxiety Scale are expected to make more correct anticipations on a paired-associate list of high associative connection between the stimulus and response and low intralist similarity than will subjects who score either between the thirty-fifth and sixty-fifth or below the twentieth percentile on the Manifest Anxiety Scale.

2. All the subjects who are assigned to the stress conditions, that is, either fifty or seventy-two decibels of white noise, are expected to make more correct anticipations on a paired-associate list of high associative connection between the stimulus and response and low intralist similarity than those subjects who are assigned to the no-stress condition.

3. Subjects who score in the upper twentieth percentile on the Manifest Anxiety Scale are expected to make

fewer correct anticipations during the first two trial blocks on a paired-associate learning task of intermediate or low associative connection between the stimulus and response and intermediate to high intralist similarity than those subjects who score either between the thirty-fifth and sixty-fifth or twentieth percentile on the Manifest Anxiety Scale. Also, it is expected that during the third to the fifth trial block of learning the three anxiety groups should make the same number of correct anticipations. Finally, it is expected that those subjects who score above the twentieth percentile on the Manifest Anxiety Scale will make more correct anticipations during the sixth and seventh trial blocks of learning than those subjects who score either between the thirty-fifth and sixth-fifth or below twentieth percentile on the Manifest Anxiety Scale.

4. Subjects who score in the upper twentieth percentile of the Manifest Anxiety Scale and who are assigned to the stress conditions, that is, to either fifty or seventy-two decibels of white noise, are expected to make fewer correct anticipations on a paired-associate learning task of intermediate or low associative connection between

the stimulus and response and intermediate to high intra-list similarity than those subjects who score either between the thirty-fifth and sixty-fifth or below the twentieth percentile of the Manifest Anxiety Scale.

Statistical Hypotheses

Corresponding to the general research hypotheses, the following statistical hypotheses are advanced:

1. There will be no significant main effects for anxiety, nor will there be significant effects for anxiety by task difficulty interaction.

2. There will be no significant main effects for stress nor will there be a significant effect either for the stress by anxiety interaction or the anxiety by stress by task difficulty interaction.

3. There will be no significant effects for anxiety by task difficulty, nor will there be significant effects for the anxiety by task difficulty by stages of learning interaction.

4. There will be no significant effects for the

anxiety by stress by level of task difficulty by stage of learning interaction.

CHAPTER II

METHOD

Experimental Design

A four-factor design was employed for establishing the experimental units for analyses with three levels of three variables and seven levels of the fourth variable. The levels of the four variables were: high, medium and low anxiety; high, medium, and low stress (white noise); difficult, medium difficult, and easy paired-associates learning task; and seven stages of learning representing four trials for each stage on a list of paired adjectives.

Subjects

The subjects were selected from 240 male resident-hall students at the University of Detroit. The subjects were administered the fifty item Manifest Anxiety Scale which was embedded in the K-Scale of the Minnesota Multiphasic Personal Inventory. The K-Scale was used to eliminate extreme defensive reactions of the students.

Consequently, any person who obtained a T score of seventy or above was eliminated from the population prior to selecting the experimental sample. Five students in the population were eliminated. One was from the high anxious group; two were from the medium anxious group; and the other two were from the low anxious group.

From the remaining population, an equal number (N = 15) of high-, medium-, and low anxious subjects were selected. The high and low anxious group were chosen from the upper and lower twentieth percentile of the distribution of the Manifest Anxiety Scale scores for all students. The medium anxious group was selected from the population scores which fell between the thirty-fifth and sixty-fifth percentile band of the population distribution.

The high anxious subjects used in the experiment ranged in Manifest Anxiety Scale scores from twenty to thirty-one; medium anxious subjects ranged from fourteen to seventeen; and, the low anxious subjects obtained scores between two and seven. Subjects were not informed of any connection between the group administered test and their participation in a memory experiment. All subjects were

näive with respect to verbal learning experiments. Subjects from each anxiety group were then randomly assigned to one of three stress conditions prior to their participation in the learning experiment. The means and standard deviations on the Manifest Anxiety Scale for the nine experimental groups are given in Table 1.

TABLE 1

MEANS AND STANDARD DEVIATIONS (SD) FOR SCORES ON THE MANIFEST ANXIETY SCALE OF THE NINE EXPERIMENTAL GROUPS

Anxiety	Stress	N	Mean	SD
High	High	5	27.8	2.17
High	Med.	5	29.0	0.71
High	Low	5	25.2	2.28
Med.	High	5	15.0	1.10
Med.	Med.	5	15.4	1.14
Med.	Low	5	15.8	1.64
Low	High	5	6.2	1.79
Low	Med.	5	5.0	2.00
Low	Low	5	7.0	1.23

Procedure

Stimulus Materials

The experimental test list was comprised of eighteen

pairs of adjectives representing three levels of difficulty which were constructed from Haagen's word list of common adjectives. Three sets of six pairs of adjectives were formed to obtain the three levels of difficulty. This was done by manipulating the degree of meaningfulness in terms of association value between stimulus and response and by manipulating the degree of intralist similarity. The easy task list was constructed by minimizing intralist similarity and maximizing meaningfulness. The medium difficult task was made by stimulus and response members of intermediate similarity and by using paired adjectives of intermediate associative value. The difficult task has stimulus members of intermediate similarity and response members of intermediate similarity and the association value between the stimulus and response was low. Table 2 shows the three test list of paired adjectives used in the experiment.

All three lists were presented to the subjects in three different random orders to avoid any serial learning effects.

A practice list of fifteen paired nouns of low associative connections was used to acquaint the subjects

TABLE 2

TEST LISTS OF STIMULUS AND RESPONSE PAIRS FOR THREE LEVELS OF TASK DIFFICULTY

Easy		Medium Difficult		Difficult	
Stimulus	Response	Stimulus	Response	Stimulus	Response
Barren	Fruitless	Desert	Effete	Giant	Pressing
Frigid	Artic	Arid	Insane	Jumbo	Threadbare
Supple	Limber	Icy	Gelid	Obscure	Brazen
Mammoth	Oversize	Chilling	Middle	Hazy	Nomad
Unclear	Clouded	Pliant	Ductile	Evil	Quiet
Wicked	Sinful	Lithesome	Rural	Vicious	Yonder

with the procedure for paired-associate learning and to provide both minimal and maximal performance criteria.

Apparatus

Both the practice and experimental lists were typed in capital letters on endless white tapes and presented to the subjects on a Gerbrands Memory Drum. The successive stimulus member of each list was exposed every three seconds, which included a 1.5 second anticipation interval.

There was a 4.5 second intertrial interval.

A Gerbrands Twin Oscillator with a white noise generator was used for inducing stress. Each subject was fitted comfortably with a sponge-padded biaural earphone. The twin oscillator was calibrated for three levels of white noise: Zero decibels; fifty decibels; and seventy-two decibels which represented the low stress, medium stress, and high stress condition- respectively.

Experimental Procedure

All subjects were tested individually under one of the three experimental conditions of stress. Immediately following the reading of instructions which described the method of learning to the individual, each subject received six trials on the practice list. The earphones were placed on the subject but no noise was used for the practice list. A two minute rest period was given to the subject during which time, he was moved to another seat where the test list was set up. Using the anticipation method, each subject was run to a criterion of either two successive perfect trials or a total of thirty trials on the experimental list, whichever occurred first.

On each trial the experimenter, who was seated directly behind the subject, recorded the correct anticipations for each item of each trial. A response was considered to be correct if the subject gave the correct response during the 1.5 second anticipation interval.

In order to equate the subjects on initial learning performance, the practice list was used as a screening device. If a subject made at least five correct responses or forty-five or more correct responses during the practice trials, he was eliminated from the experiment. One subject from the high anxious group was eliminated on the basis of the maximal performance criterion and he was replaced with another subject. None of the subjects failed to meet the minimal performance criterion.

CHAPTER III

FINDINGS

Results

In order to evaluate the experimental treatment effects, it was necessary to determine whether or not the groups in the experiment differed significantly in learning ability prior to the introduction of the experimental conditions. To test for prior learning differences, a simple one-way analysis of variance was used for the total number of correct anticipations on the six trials of the practice list. The means and standard deviations of the nine treatment groups and the analysis of variance are presented in Tables 3 and 4 respectively. The F test for treatment is not significant. It can be assumed that any significant results obtained from the test list could not be attributed to differential learning rates of the various groups prior to the administration of experimental treatments.

The Kuder-Richardson estimate of reliability of the

TABLE 3

MEANS AND STANDARD DEVIATIONS (SD) OF TOTAL CORRECT ANTICIPATIONS FOR THE PRACTICE LIST

Anxiety	Stress	N	Mean	SD
High	High	5	18.6	8.68
High	Med.	5	24.0	12.94
High	Low	5	22.4	9.62
Med.	High	5	18.0	10.08
Med.	Med.	5	17.8	14.31
Med.	Low	5	24.8	9.38
Low	High	5	28.2	10.90
Low	Med.	5	21.0	10.52
Low	Low	5	23.6	14.78

TABLE 4

SUMMARY FOR ANALYSIS OF VARIANCE OF ANXIETY OF GROUP EFFECTS ON THE PRACTICE LIST

(N = 45)

Source	SS	DF	MS	F-Ratio	p
Anxiety Groups	582.58	8	72.82	0.613	N.S.
Error	4274.00	36	118.72		
Total	4856.58	44			

paired-associate learning scores was .83.[1] This finding is similar to the split halves reliability coefficients reported elsewhere.[2] Bartlett's test for homogeneity of variance was calculated for all trial blocks on which the analysis of variance was performed. None of the chi-squares approached the .05 significance level. Thus the assumption of homogeneity of variance was considered justified.

The number of correct anticipations obtained by each subject for each block of four trials served as the dependent variable for the following statistical analysis. Subjects who reached the criterion prior to the thirtieth trial were given credit for perfect performance on all trials subsequent to the criterion.

Table 5 contains the means of the number of correct anticipations for all seven stages of learning for the twenty

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[1]Edwin E. Ghiselli, Theory of Psychological Measurement (New York: McGraw-Hill, Inc., 1964), p. 287.

[2]Ernest R. Hilgard, "Methods and Procedures in the Study of Learning," in Handbook of Experimental Psychology, ed. by Stanley S. Stevens (New York: John Wiley & Sons, 1951), pp. 517-567.

TABLE 5

"MEANS" OF CORRECT ANTICIPATIONS FOR STAGES OF LEARNING, I-VII OF ALL TREATMENT COMBINATIONS

Treatment Combination				Stages of Learning	
Anxiety	Stress	Difficulty	N	I	II
High	High	Easy	5	8.8	16.0
High	Medium	Easy	5	11.0	16.0
High	Low	Easy	5	10.2	15.6
High	High	Med. Diff.	5	2.6	7.0
High	Medium	Med. Diff.	5	3.8	11.2
High	Low	Med. Diff.	5	4.6	11.8
High	High	Diff.	5	2.6	7.0
High	Medium	Diff.	5	1.8	7.0
High	Low	Diff.	5	2.2	10.0
Medium	High	Easy	5	9.6	15.2
Medium	Medium	Easy	5	12.6	16.2
Medium	Low	Easy	5	9.0	16.0
Medium	High	Med. Diff.	5	2.4	8.6
Medium	Medium	Med. Diff.	5	2.0	7.0
Medium	Low	Med. Diff.	5	3.2	9.8
Medium	High	Diff.	5	1.4	9.4
Medium	Medium	Diff.	5	2.6	6.4
Medium	Low	Diff.	5	2.2	8.2
Low	High	Easy	5	9.2	18.2
Low	Medium	Easy	5	9.2	18.8
Low	Low	Easy	5	7.6	13.8
Low	High	Med. Diff.	5	3.0	10.0
Low	Medium	Med. Diff.	5	2.2	8.6
Low	Low	Med. Diff.	5	3.6	10.2
Low	High	Diff.	5	2.4	10.6
Low	Medium	Diff.	5	2.6	8.2
Low	Low	Diff.	5	4.8	8.4

TABLE 5--Continued

Treatment Combination			Stages of Learning	
Anxiety	Stress	Difficulty	III	IV
High	High	Easy	18.4	19.0
High	Medium	Easy	17.8	19.4
High	Low	Easy	19.0	20.2
High	High	Med. Diff.	11.2	14.8
High	Medium	Med. Diff.	15.6	18.4
High	Low	Med. Diff.	15.4	17.0
High	High	Diff.	9.8	14.0
High	Medium	Diff.	12.0	15.0
High	Low	Diff.	14.6	17.6
Medium	High	Easy	19.0	20.0
Medium	Medium	Easy	16.8	20.0
Medium	Low	Easy	18.8	19.4
Medium	High	Med. Diff.	12.2	16.4
Medium	Medium	Med. Diff.	11.2	14.0
Medium	Low	Med. Diff.	13.8	14.6
Medium	High	Diff.	13.4	13.6
Medium	Medium	Diff.	9.4	14.8
Medium	Low	Diff.	12.2	14.2
Low	High	Easy	20.4	21.6
Low	Medium	Easy	18.4	20.0
Low	Low	Easy	17.8	20.0
Low	High	Med. Diff.	16.6	18.6
Low	Medium	Med. Diff.	13.2	16.0
Low	Low	Med. Diff.	14.0	17.6
Low	High	Diff.	17.8	19.6
Low	Medium	Diff.	9.8	12.4
Low	Low	Diff.	14.2	15.6

TABLE 5--Continued

Treatment Combination			Stages of Learning		
Anxiety	Stress	Difficulty	V	VI	VII
High	High	Easy	20.4	21.4	21.6
High	Medium	Easy	20.4	20.8	23.0
High	Low	Easy	22.8	23.2	23.8
High	High	Med. Diff.	18.2	20.4	21.4
High	Medium	Med. Diff.	21.8	22.4	22.8
High	Low	Med. Diff.	19.2	20.2	21.8
High	High	Diff.	16.4	19.4	20.8
High	Medium	Diff.	18.2	20.6	21.6
High	Low	Diff.	18.8	20.8	22.0
Medium	High	Easy	21.4	23.2	23.8
Medium	Medium	Easy	21.0	23.6	23.4
Medium	Low	Easy	21.6	21.6	22.8
Medium	High	Med. Diff.	18.6	21.2	22.8
Medium	Medium	Med. Diff.	14.8	17.8	19.4
Medium	Low	Med. Diff.	16.2	17.0	21.4
Medium	High	Diff.	17.8	20.2	20.8
Medium	Medium	Diff.	16.4	19.8	19.4
Medium	Low	Diff.	17.4	19.2	21.0
Low	High	Easy	22.6	22.6	24.0
Low	Medium	Easy	21.0	21.8	21.2
Low	Low	Easy	21.0	21.4	22.6
Low	High	Med. Diff.	22.0	22.0	23.8
Low	Medium	Med. Diff.	16.6	18.6	21.6
Low	Low	Med. Diff.	19.4	21.4	22.0
Low	High	Diff.	21.4	23.2	24.0
Low	Medium	Diff.	16.4	17.6	19.2
Low	Low	Diff.	16.4	17.8	18.4

seven treatment combinations. Differences among these means were assessed by the analysis of variance which is summarized in Table 6. The analysis of variance was a repeated measured design. The levels of factor A, Anxiety, and factor Str, Stress, constitute the pq combinations in a p x q factorial set, and the levels of factor Diff, Task Difficulty, and factor SL, Stage of Learning constitute the rs combinations in a r x s factorial set. The repeated measures are observed under the rs combinations. The mean square estimates are derived on the assumption that the levels of all the factors are fixed.[1]

The Effects of Anxiety on the Performance of an Easy Learning Task

Reference to Table 6 shows that both the F-ratio for anxiety and anxiety by task difficulty are not significant. The mean number of correct anticipations for the high, medium, and low anxious subjects for trials 2-30 are

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[1]Benjamin J. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill, Inc., 1962), pp. 349-351.

TABLE 6

SUMMARY FOR THE ANALYSIS OF VARIANCE OF THE EFFECTS OF ANXIETY, STRESS, TASK DIFFICULTY, AND STAGE OF LEARNING ON PAIRED-ASSOCIATE LEARNING PERFORMANCE

Source	SS	df	MS	F-Ratio	P
Between subjects					
Anxiety (A)	133.14	2	66.57	0.33	NS
Stress (Str)	125.99	2	62.99	0.31	NS
A x Str	615.79	4	153.95	0.75	NS
Subjects within groups	7,384.46	36	205.12		
Within subjects					
Task Difficulty (Diff)	4,128.29	2	2,064.15	51.82	.001
A x Diff	125.20	4	31.30	0.78	NS
Str x Diff	71.91	4	17.98	0.45	NS
A x Str x Diff	216.59	8	27.07	0.68	NS
(Diff) x (subj. w. groups)	2,867.77	72	39.83		
Stage of Learning (SL)	23,384.72	6	4,730.79	538.80	.001
A x SL	77.43	12	6.45	0.74	NS
Str x SL	129.64	12	10.80	1.23	.25
A x Str x SL	173.89	24	7.25	0.83	NS
(SL) x (subj. w. groups)	1,896.54	216	8.78		
Diff x SL	939.68	12	78.31	14.51	.001
A x Diff x SL	79.35	24	3.31	0.61	NS
Str x Diff x SL	162.92	24	6.79	1.26	.25
A x Str x Diff x SL	227.40	48	4.74	0.88	NS
(Diff x SL) x (subj. w. groups)	2,331.10	432	5.40		

129.57, 131.32, 131.04 respectively. The test for differences between these means reveal no significant differences. Therefore, the following statistical hypotheses are accepted:

1. There are no significant main effects for Anxiety.

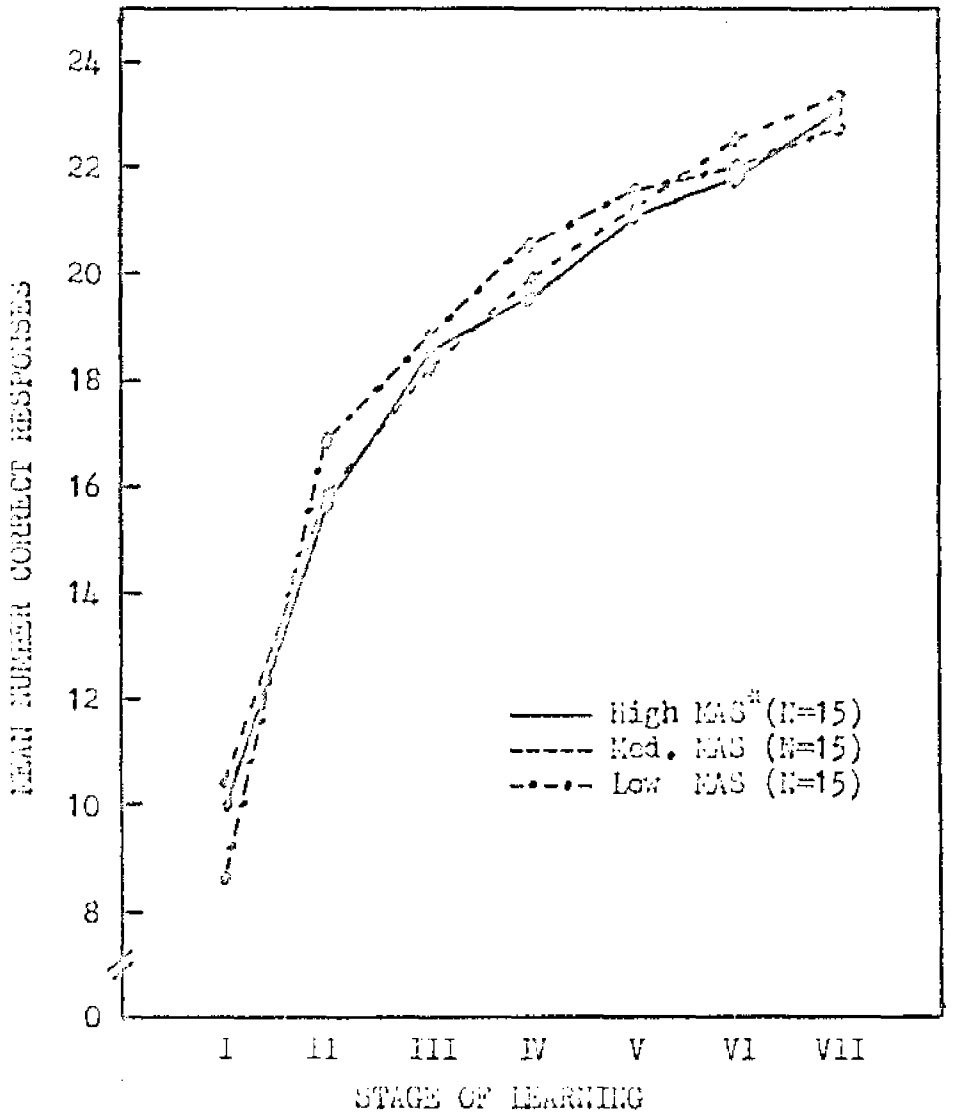
2. There are no significant effects for the Anxiety by Task Difficulty interaction.

Hence, the general research hypothesis that the learning performance on an easy task is positively related to the level of Anxiety is rejected.

The lack of a significant relationship between anxiety and performance on an easy task is more clearly depicted in Figure 1. It is seen that the performance curves which represent the geometric profiles for the three anxiety groups have almost identical shapes.

The Effects of Anxiety and Stress on the Performance of an Easy Learning Task

The analysis of the data on Table 6 reveals that there are no significant main effects for stress, or interaction effects for stress by anxiety and anxiety by stress by



*Manifest Anxiety Scale

Fig. 1.--Mean number of correct responses given over the Stages of Learning by High-, Medium-, and Low-Anxious subjects on the Easy Task (For the "Means" used to plot these curves, see Table 8, Appendix IV).

task difficulty. It can be safely assumed that the group profile for the three anxiety groups under thre three stress conditions for an easy task are similar in shape (note the means for the groups in question on Table 5). The research hypothesis is rejected in that stress is not related to the existing level of anxiety, and in that stress does not combine with anxiety in an additive fashion to produce increments in learning performance on an easy task.

The Effects of Anxiety, Task Difficulty, and Stage of Learning on Performance

The data of this experiment do not support the prediction that the high anxious subjects will perform more poorly on difficult tasks than the low anxious and medium anxious subjects in the early stages of learning and that the high anxious subjects' performance will be superior to the two other groups of subjects in the later stages of learning. Evidence for the rejection of this research hypothesis is supported by the lack of statistically significant effects for the following interactions; (1) anxiety by task difficulty; and (2) anxiety by task difficulty by stage of learning.

The relationship of anxiety to task difficulty is geometrically depicted in Figure 2.

It can be readily seen from Figure 2 that the curvature of the performance profiles are due to the significant main effect for task difficulty. It also can be observed in Figure 2 that the profiles for the anxiety groups are identical statistically.

Figures 3 and 4 show the relationship of anxiety to task difficulty and stage of learning.

Figures 3 and 4 clearly depict the lack of the predicted inferiority of high-anxious subjects to both the low-anxious and medium-anxious subjects in the early trial blocks of learning on the two difficult tasks and the predicted superiority of the high anxious group in the later trial blocks of learning. If one can assume that anxiety level represents the various levels of activation, then neither Figure 3 nor Figure 4 would support Malmo's theory, since the group profiles are identical for both tasks.

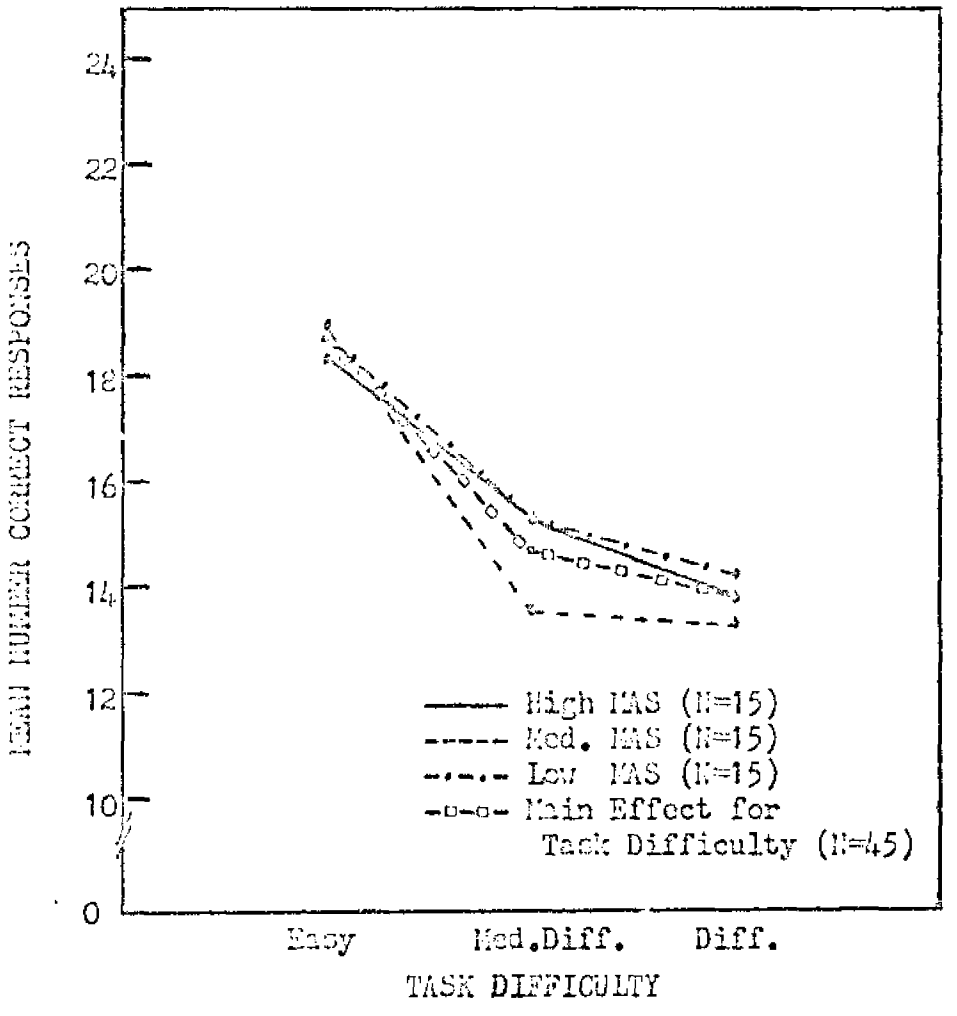


Fig. 2.--Profiles for simple effects of Anxiety for Task Difficulty and main effect for Task Difficulty (For the "Means" used to plot these curves, see Tables 2 & 4, Appendix IV).

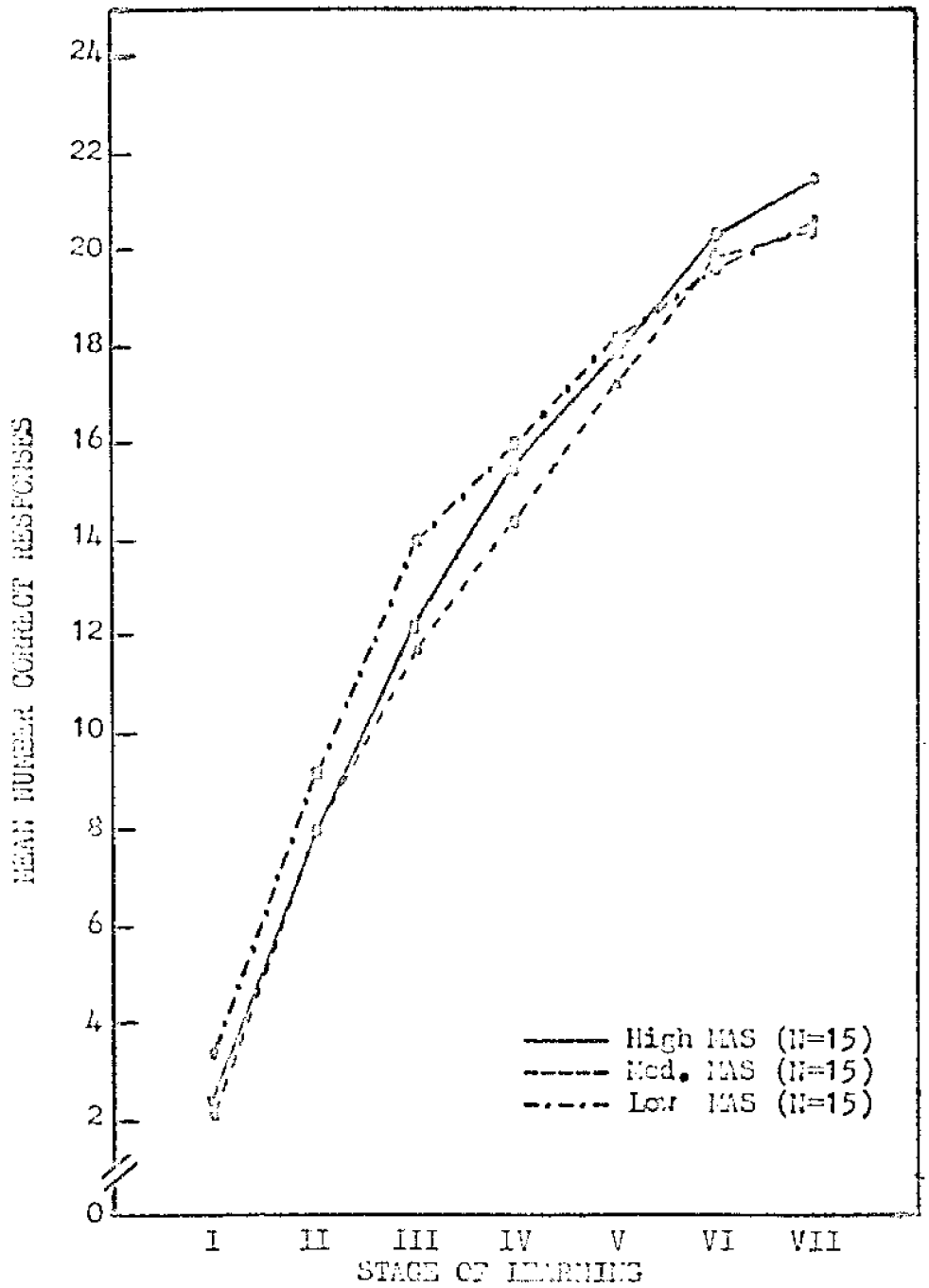


Fig. 3.—Mean number of correct responses given over the Stages of Learning by High-, Medium-, and Low-Anxious subjects on the Difficulty Task (For the "Means" used to plot these curves, see Table 8, Appendix IV).

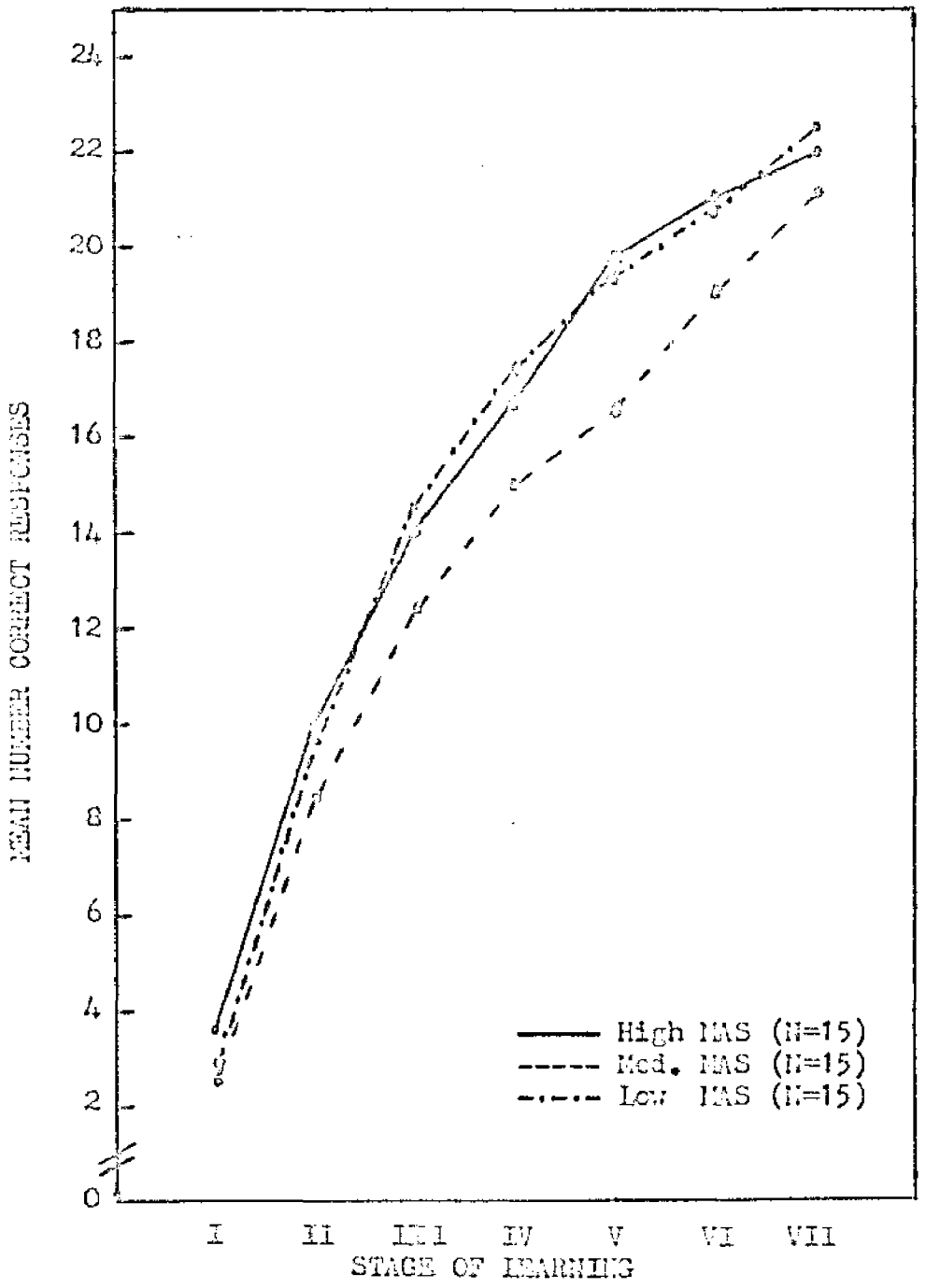


Fig. 4.—Mean number of correct responses given over the Stages of Learning by High-, Medium-, and Low-Anxious subjects on the Medium Difficult Task (For the "Means" used to plot these curves, see Table 8, Appendix IV).

The Effects of Anxiety, Stress, Task Difficulty, and Stage of Learning on Performance

Table 6 shows that the predicted interaction of anxiety by stress by task difficulty by stage of learning is not significant. Further, Table 5 reveals no predictable trend with respect to the differential effect of stress on the various anxiety groups in either the early or the later stages of learning. If one observes the first stage of learning on the difficult task the inverse is seen as was hypothesized; namely, that high anxious subjects tend to perform better under stressful conditions and low anxious and medium anxious subjects tend to perform better under nonstressful conditions on the most difficult task (see Fig. 3). In the later stages of learning on the difficult task, there is no clear differentiation between the anxiety groups among the three levels of stress.

The geometric interpretation of the interaction effects of stress, task difficulty and anxiety are presented in Figures 5, 6A, 6B and 6C. The learning curves in Figure 5 indicate that the shapes of the profiles for task difficulty are identical, but that the level of the profiles are statistically different. However, Figure 6 better illustrates

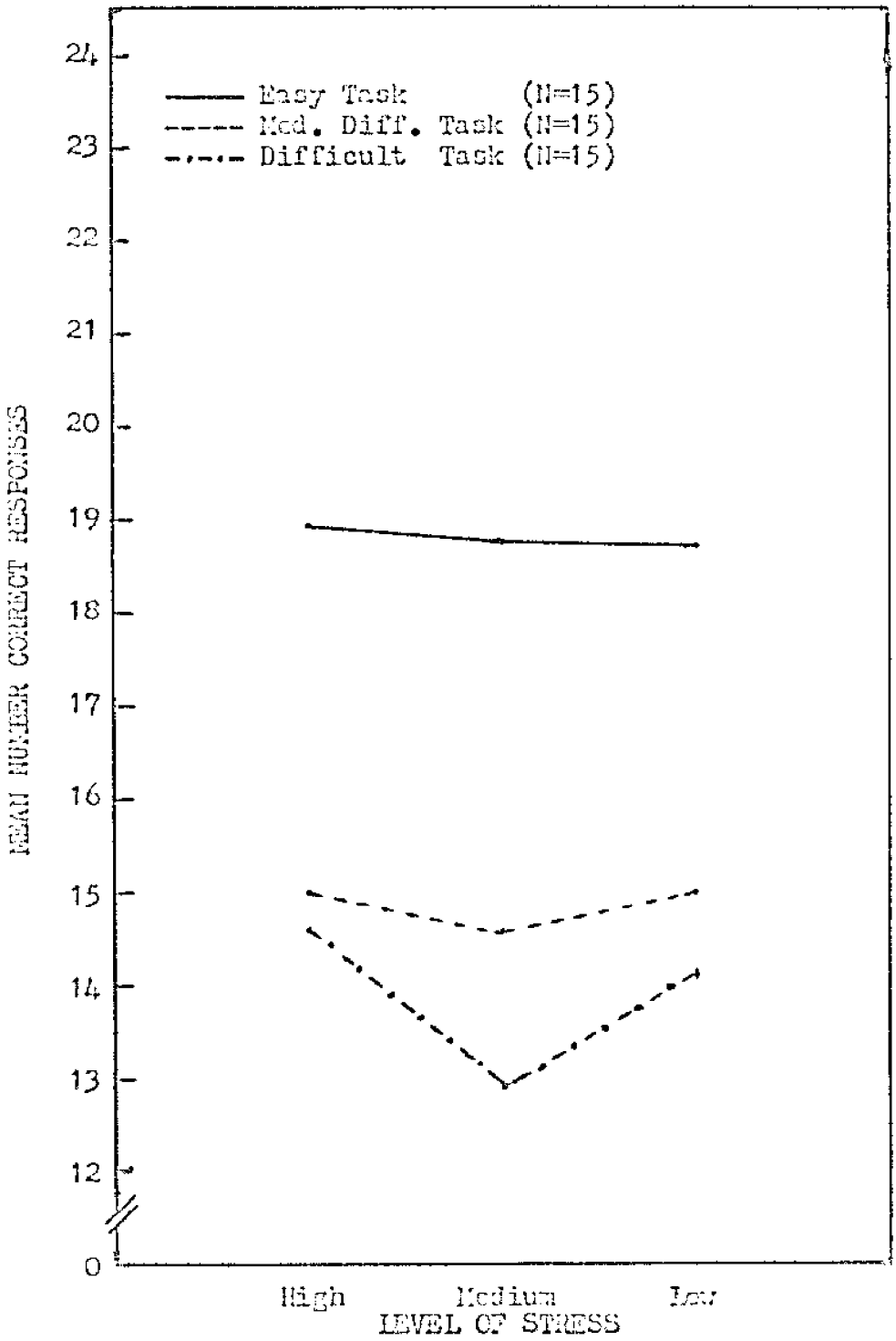


Fig. 5.--Profiles for the Stress by Task Difficulty interaction for all Levels of Anxiety (For the "Means" used to plot these curves, see Table 5, Appendix IV).

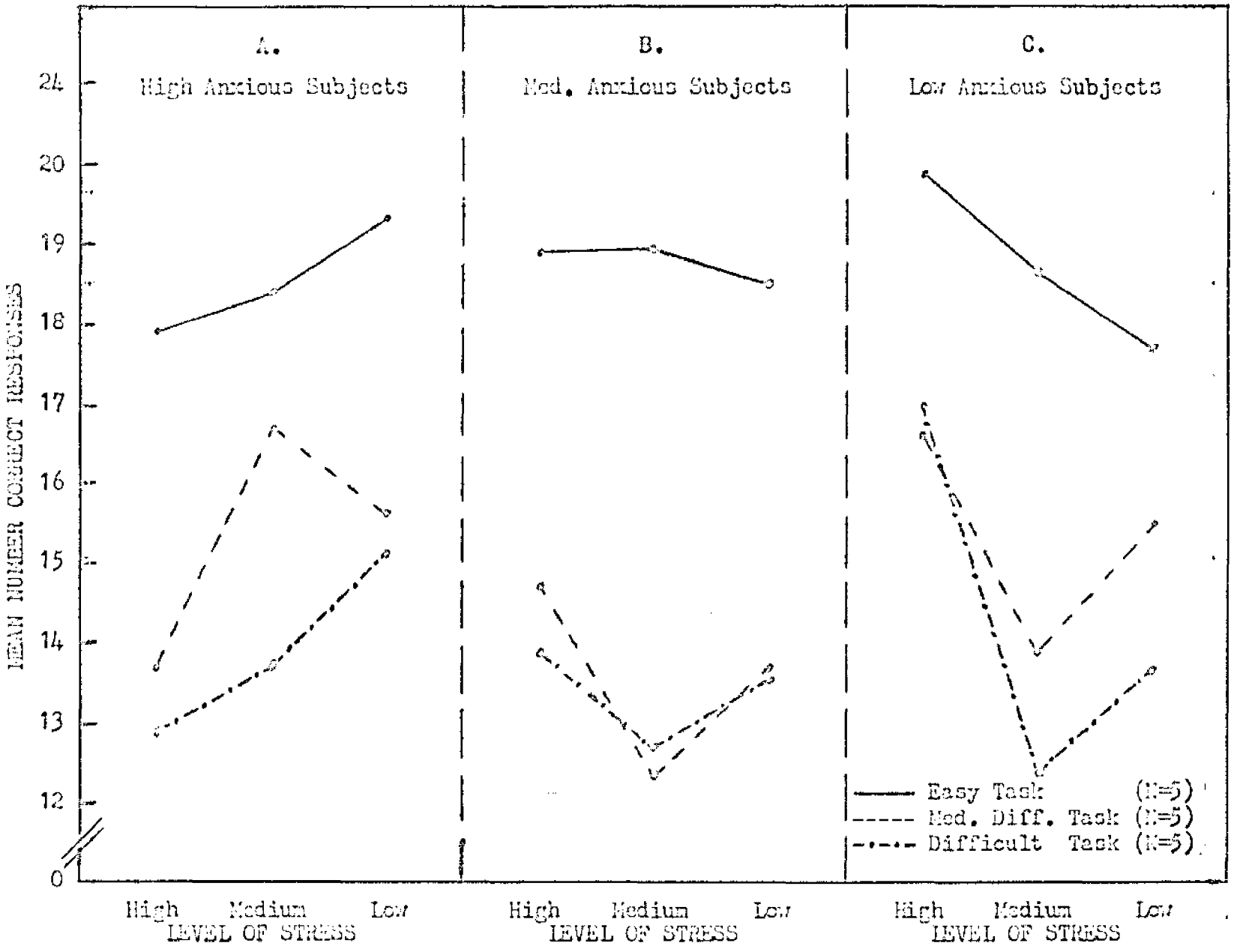


Fig. 6.—Profiles for the Stress by Task Difficulty Interactions for the three simple effects of Anxiety (For the "Means" used to plot these curves, see Table 7, Appendix IV).

the differential effects of the stress by task difficulty interactions for the simple effects of anxiety. Malmo's prediction that the performance of high anxious subjects suffer from too much anxiety appears to be partially supported in the case of easy and medium difficult tasks. The only exception to his predictions is the inferior performance of low anxious and medium anxious groups under medium stress where one would assume there would be optimal performance.

Differences between the means depicted in Figure 7, for the three levels of task difficulty for the seven stages of learning were evaluated by the Newman-Keuls procedure.[1] This analysis showed that the means of the first three stages of learning for the easy task were significantly different from the corresponding means of the two more difficult tasks ($P < .05$). The differences between the means of the two difficult tasks were not significant. These results do not support the Spence and Spence prediction but

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[1] Winer, ibid., pp. 238-239.

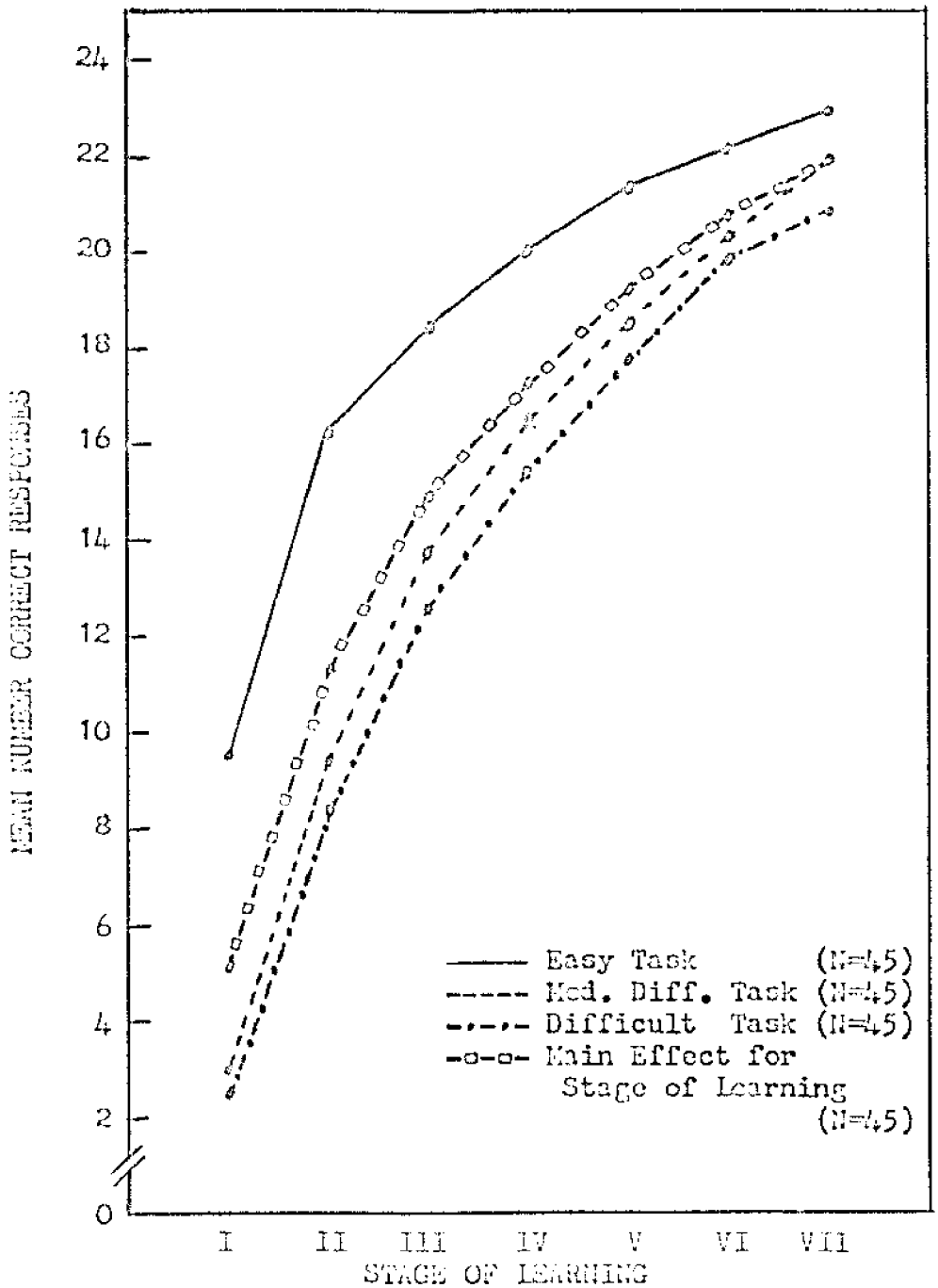

Fig. 7.—Profiles for the simple effects for Task Difficulty by Stage of Learning interaction and the main effect for Stage of Learning (For the "Means" used to plot these curves, see Table 6, Appendix IV).

rather support Underwood's concept that intralist similarity differentially affects the associative stages of learning, that is, the early trials; but that intralist similarity does not effect the response learning stage, that is, the later stages of learning. In other words, the paired-associate list of high intralist similarity tends to retard the response learning stage relative to the paired associate lists of low intralist similarity. It could be inferred from this analysis that the paired associate lists used in this experiment were sensitive to the effects of task difficulty and the stages of learning but that anxiety had no appreciable interactive effect on these variables.

The Effects of Stress on Anxiety

It was assumed that the Manifest Anxiety Scale reflects an individual's susceptibility to react to situational stress. A summary of the analysis of the data on Table 6 does not support this hypothesis; that is, there are no significant main effects for stress, nor significant effects for the anxiety by stress interaction. Figure 8 portrays the learning curves for the simple interactions of anxiety by stress for the three levels of task difficulty. It is apparent from this figure that high stress tends to

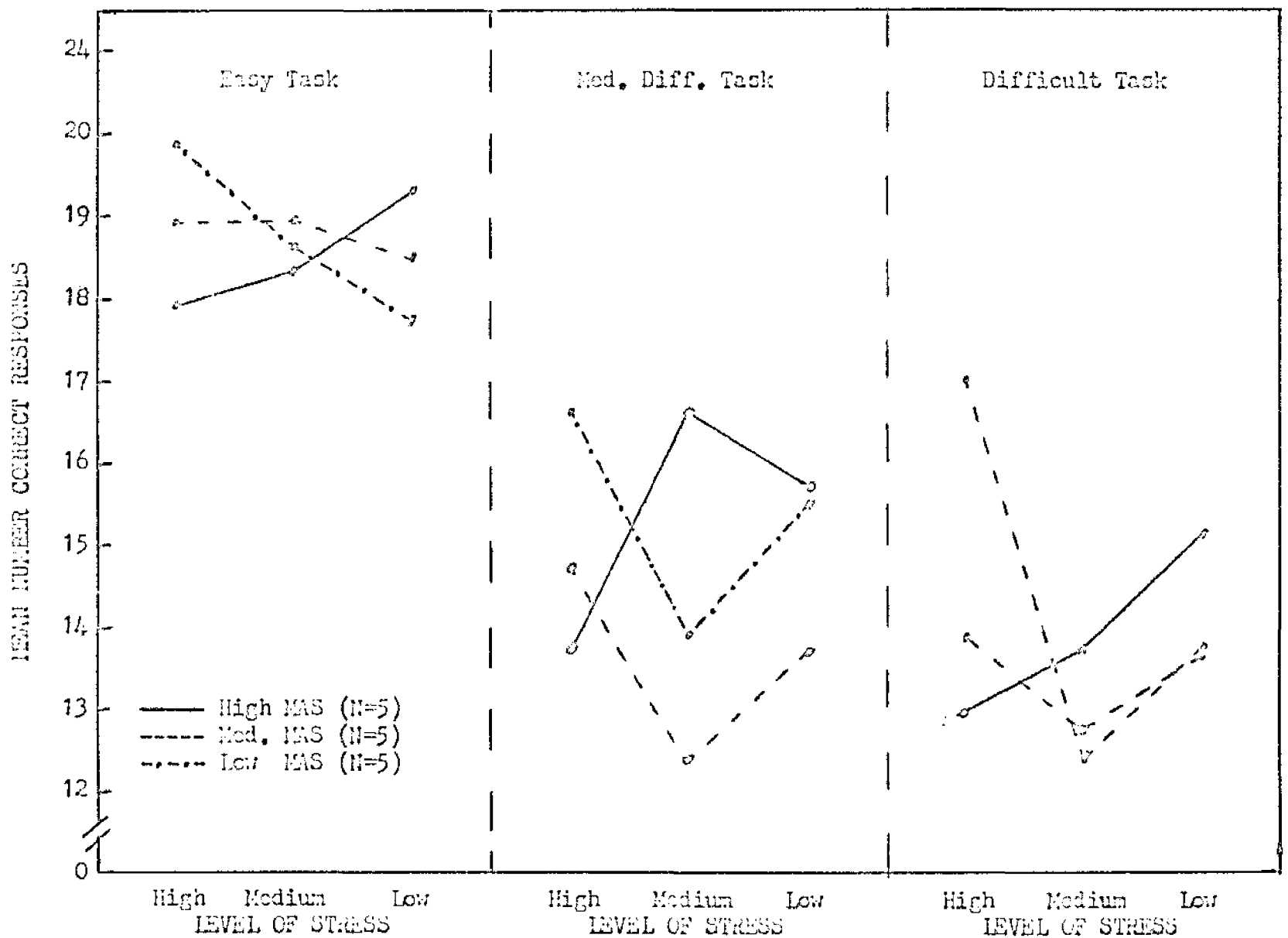

Fig. 8.--Profiles for simple interaction effects of Anxiety by Stress for each of three levels of Task Difficulty (For the "Means" used to plot these curves, see Table 7, Appendix IV).

suppress the performance of high anxious subjects while it facilitates the performance of low anxious and medium anxious subjects on all three levels of task difficulty. However, medium stress hinders the performance of the low anxious and medium anxious groups on the two difficult tasks more than either high, or low stress. The performance of high anxious subjects on the paired associate task of medium difficulty is facilitated under medium stress relative to both low stress and high stress conditions. Yet, on the more difficult task, the performance of high anxious individuals under mild stress was inferior to the low stress group but superior to the high stress group.

It would appear then that the scores on the Manifest Anxiety Scale do not reflect any direct relationship to situational stress factor but rather the scores tend to reflect different operative levels of anxiety depending upon the nature of the task. It can be concluded that the data from this experiment does not render conclusive the evidence that the Manifest Anxiety Scale measures an individual's susceptibility to situational stress factors.

Discussion

Anxiety and Task Variables

The results of this experiment lend minimal support to the Spence and Spence theoretical concept that anxiety interacts with the type of paired-associate learning task used in this study.

It is emphasized here that the operational definition of task difficulty used in this study is one which is very specific to verbal paired-associate learning. In other words, difficulty in this situation refers to a general ability to discriminate the correct stimulus in the presence of competing stimuli. This definition of task difficulty is contrasted to other types of task difficulty which employ varying degress of complexity such as that employed in typical problem-solving tasks.

It was found that level of anxiety, as measured by the Manifest Anxiety Scale, had no significant effect upon the type of task used in this study. Therefore, the assumption that the level of anxiety reflects, in part, the level of general drive of an individual and that higher

anxiety levels would produce superior performance on easy tasks was not confirmed. As pointed out in the review of literature, this is not inconsistent with the findings of some other experimenters.

The prediction that higher levels of anxiety will result in poorer performance in the initial stages of learning and will converge with lower levels of anxiety in the middle stages of learning, and finally become superior in performance in the later stages of learning was not confirmed. Several investigators have reported that the learning curves which they have obtained from the results based upon the above predictions tend to support the above prediction although no statistically significant differences between stages of learning were obtained. Spence himself states:

> While the differences between the two groups at the different stages of learning were not statistically reliable, the consistency which the rather intricate pattern of results has repeated itself in all three studies suggests the phenomenon is genuine and not just a chance one.[1]

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[1]Kenneth W. Spence, Janet A. Taylor, and Rhoda Ketchel, "Anxiety (Drive) Level and Degree of Competition in Paired-Associates Learning," Journal of Experimental Psychology, LII (1956), 309.

Figures 9 and 10 generally support the predictions of the Spence and Spence Anxiety Theory, particularly in the early stages of learning. It is noted, however, that the shape of the learning curves in Figures 10 and 11 could be attributed to chance due to the lack of any significant lower order interactions of anxiety with stress, task difficulty, or stage of learning. This is reinforced by the presence of a highly significant task difficulty by stage of learning interaction. The tasks were sensitive to various stages of learning which would appear to be well within the boundary conditions of the Spence and Spence Theory of Anxiety. Hence, one might speculate that Speilberger and Smith, who performed separate analysis on their neutral and stress condition, would have found the significant interaction of anxiety by difficulty by stage of learning had they combined the two stress conditions into one factorial experiment.[1]

The experiment described in this paper failed to show any significant differences between the three anxiety groups on all three test lists. In many instances differences

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[1]Janet T. Spence and Kenneth W. Spence, "The Motivational Components of Manifest Anxiety: Drive and Drive Stimuli, in Anxiety and Behavior, ed. by Charles D. Spielberger (New York: Academic Press, 1966), pp. 291-326.

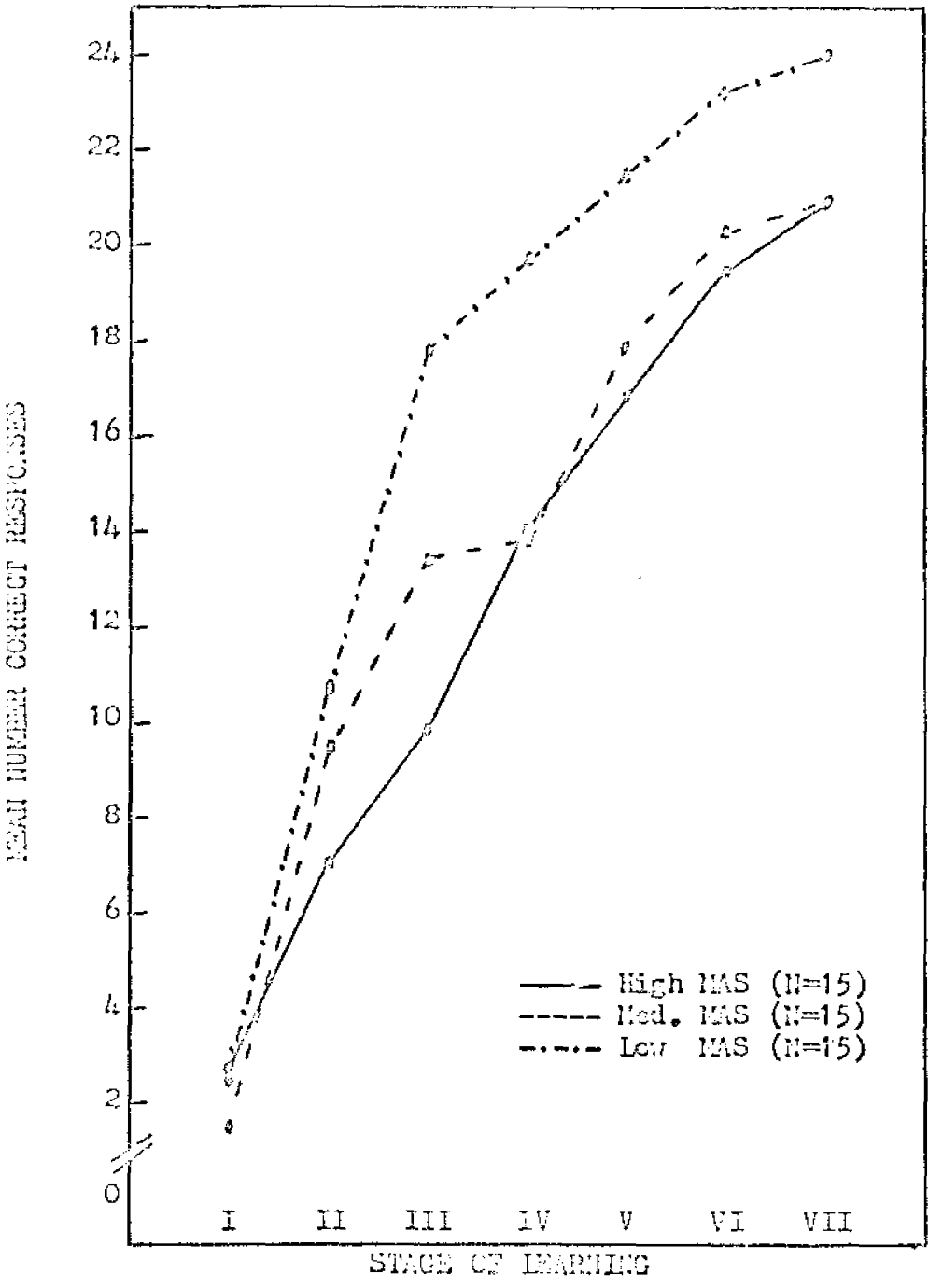

Fig. 9.--Mean number of correct responses given over the Stages of Learning by High-, Medium-, and Low-Anxious subjects under the High Stress condition on the Difficult Task (For the "Means" used to plot these curves, see Table 5, page 43-45).

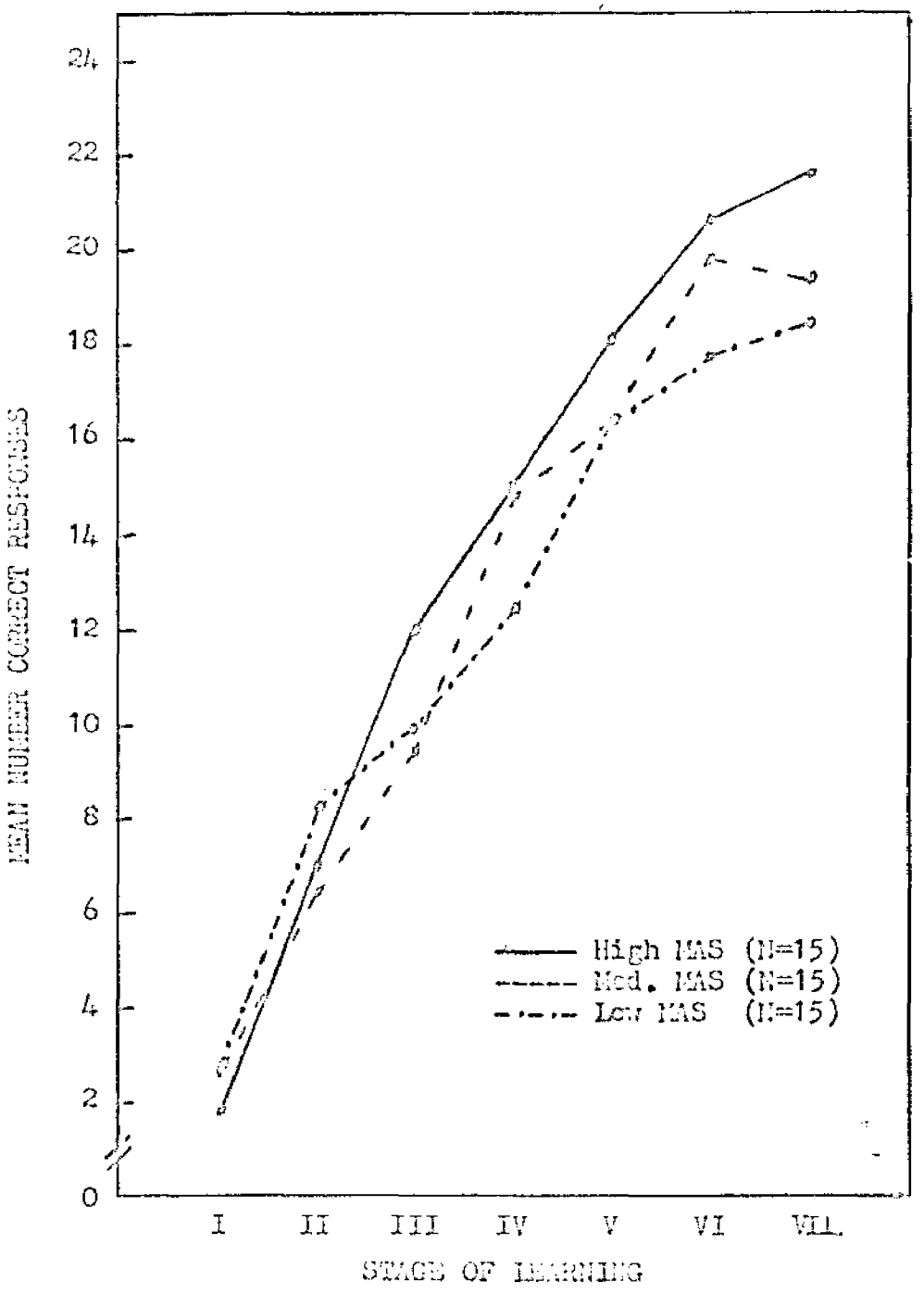

Fig. 10.--Mean number of correct responses given over the Stages of Learning by High-, Medium-, and Low-Anxious subjects under the Medium Stress condition on the Difficult Task (For the "Means" used to plot these curves, see page 43-45).

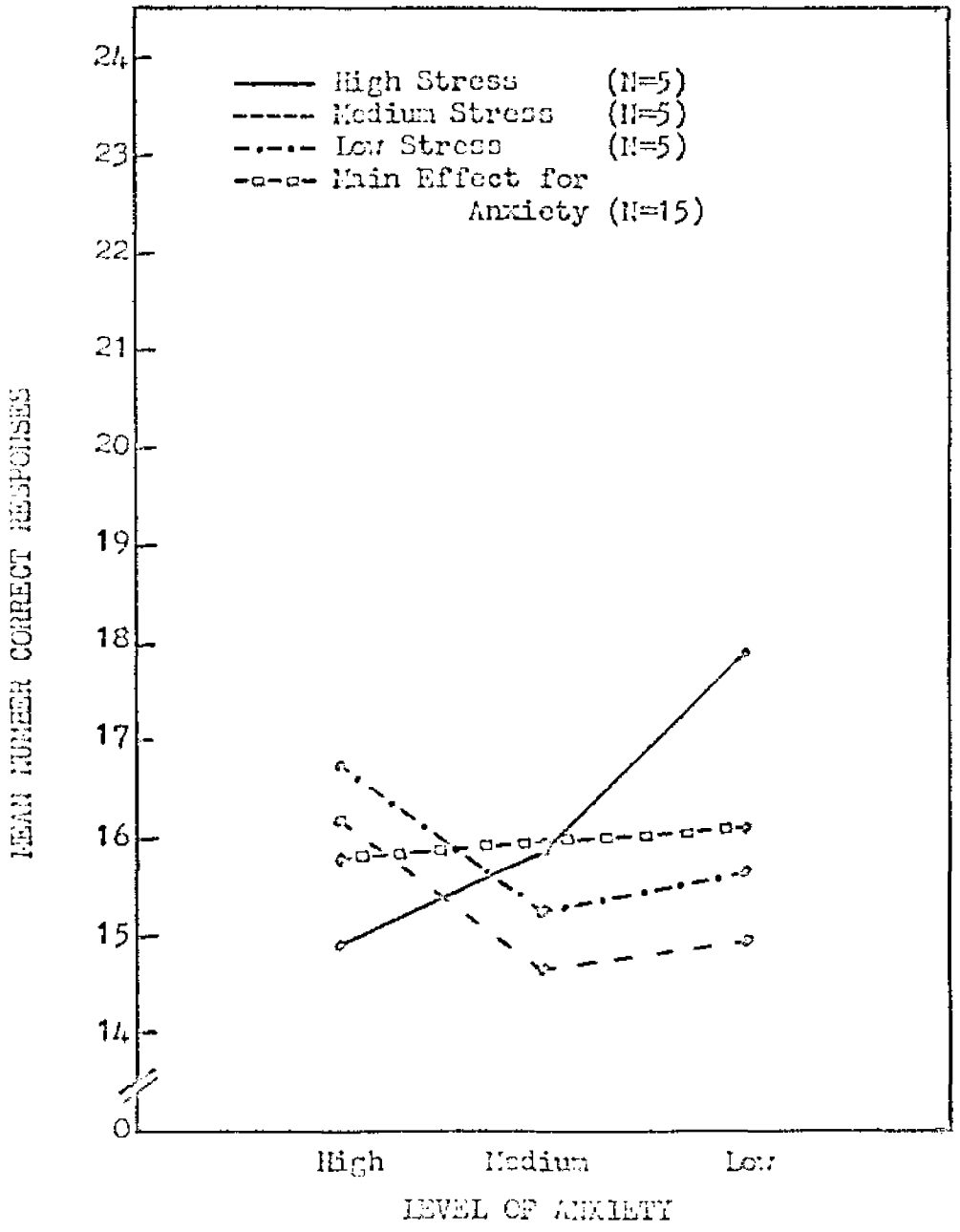

Fig. 11.--Profiles for simple interaction effects for Stress by Anxiety and the main effect for Anxiety (For the "Means" used to plot these curves, see Tables 1 & 3, Appendix IV).

between the high and low anxiety groups were in the predicted direction. However, the use of a third group on the continuum of anxiety, that is, the medium anxious group, yielded no predictable results.

In considering the implications of these results, two factors appear to be of considerable importance. The first pertains to the sensitivity of the Manifest Anxiety Scale as a measure of anxiety; the second concerns the effect of certain task variables and stress factors on the performance of subjects differing in anxiety level.

With regard to the sensitivity of the Manifest Anxiety Scale, the lack of any significant effect of anxiety by itself or in combination with other variables in this experiment tends to shed doubt on the construct validity of the Manifest Anxiety Scale as a measure of drive. Spence and Spence have argued that the preponderance of evidence supports the hypothesis that the Manifest Anxiety Scale reflects an individual's susceptibility to stress. Fig. 11 presents some evidence to support this notion (although not statistically).

The role of the level of anxiety on various task variables had minimal effects. Due to the rather complex set of assumptions which have to be made about the number of competing response tendencies, it seems that in order to predict performance differences between high, medium and low scores on the Manifest Anxiety Scale, that a more simple and parsimonious explanation ought to be sought to explain these results. For example, in the present experiment, Underwood's stage analysis of verbal learning, which would lead to the prediction that the most difficult task, due to its high intralist similarity would have a more deleterious effect upon performance in the early trials of learning than the two other lists with lower degrees of intralist similarity, seems more appropriate. Further, Underwood would predict that the performance on all three lists in later trials or the response learning stage should be relatively equal.

This prediction is based on the fact that lists with low intralist similarity will facilitate the response learning sooner because the learning of one response is expected to generalize to each of the remaining responses

of the list. On the other hand, lists with high intralist similarity will disrupt the associate stage of learning because of competition between the similar paired items and thereby delay the onset of the response learning stage.

The differential difficulty of paired-associate lists of high and low meaningfulness is primarily centered in the response learning stage, that is, the later trials of learning. With high meaningful lists, it is assumed that the stimulus and response terms are well integrated prior to the experiment. Conversely, the list of low meaningfulness is not well integrated prior to learning the list; therefore, Underwood would predict that the curves for correct responses would diverge more quickly for a high meaningful list than a low meaningful list. The support for these predictions are evidenced in this experiment by significant main effects for "task difficulty," "stage of learning," and by a significant "task difficulty" by"stage of learning" interaction effect.

The appeal of this explanation for the observed results of this experiment would be very easy to accept

because then one does not have to make as many assumptions as in the case of the Spence and Spence Theory of Anxiety.

The Effects of Stress

The present experiment failed to confirm the results reported by Hörmann and Todt in which medium stress produced the optimal performance in a paired associate learning task. Furthermore, Malmo's statement that high anxious subjects performed poorly because they were suffering from too much anxiety has little explanatory value. The only instance where medium stress produced optimal performance was in the case of the performance of high anxious subjects on a medium difficult task (See Figure 8). The learning curves in Figure 8 illustrate that stress effects performance in a direction directly opposed to his predictions. This is especially true of the two more difficult tasks. Instead of the predicted inverted U shaped curve, the converse is observed.

Malmo argues that stress, that is, strong auditory stimulation, could serve as an inhibitor of the overactivity in the anxiety states. He further conjectures

that high anxious persons are more or less constantly operating at a physiological level which is higher than normal. Therefore, he hypothesizes that in such cases where stimulation keeps physiological levels constantly very high over a long period of time there will be a gradual weakening of inhibitory mechanisms from overuse.[1] However, the stimulation to which he refers is "specific stimulation," that is, recurring events in one's daily life which are linked to the initial onset of the present anxiety state. "Nonspecific stimulation," such as white noise, according to Malmo, will not differentially affect an anxious or nonanxious person. The net result, then, on performance differences between high anxious and low anxious individuals under nonspecific stimulation should be minimal. The reason for this is that nonspecific stimulation acted an an inhibitor of overactivity in high anxious persons and as a facilitator of activity in low anxious individuals. The lack of any main effects or

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[1]Robert B. Malmo, "Anxiety and Behavioral Arousal," Psychological Review, LXIV (1957), 276-287.

interaction effects of anxiety in this study tends to support this notion. Essentially, the events that would occur, if this were the case, are that the performance effects of the two extreme anxiety groups would cancel one another. Although this analysis is extremely speculative it does deserve further experimentation.

Methodology

As far as it was able to be ascertained from a review of the literature, the experimental design employed in this study to test the Spence and Spence Theory of Anxiety was the first attempt to systematically vary four independent variables simultaneously. Clearly the verification of the predictions derived from the Spence and Spence theoretical formulations demand that all four variables be varied in any one experiment. It would appear that in any future experimentation in this area it would be profitable to attempt to refine and modify the four variables used in the present experiment rather than study any two or three of them in isolation.

Also the results of this study strongly suggest that

the effects of the four variables used in this experiment will vary and interact with each other in different ways depending upon the type of learning criteria used.

Finally, a statement which Kenneth Spence made in 1958 appears to be relevant to future investigators who attempt to design a multivariate experiment in this area. He said:

> . . . in order to derive implications concerning the effects of drive variation in any type of complex learning task, it is necessary to have, in addition to the drive theory, a further theoretical network concerning the variables and their interaction that are involved in the particular learning activity.[1]

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[1]Kenneth W. Spence, "A Theory of Emotionally Based Drive (D) and Its Relation to Performance in Simple Learning Situations," American Psychologist, XIII (1958), 137.

CHAPTER IV

SUMMARY

The present experiment was concerned with the effects of anxiety, stress, task difficulty, and stage of learning upon the performance in a paired-associate verbal learning situation. A 3 x 3 x 3 x 7 factorial analysis of variance with repeated measures on the last two factors was employed to evaluate the effects of these variables on performance in a paired-associate learning situation. The levels of the variables used were: (1) high, medium and low anxiety as defined by a subject's score on the Taylor Manifest Anxiety Scale; (2) high, medium, and low stress by utilizing various levels of white noise; (3) easy, medium difficulty, and difficult paired-associate tasks of common adjectives; difficulty was achieved by varying the degree of intralist similarity and degree of association between stimulus and response; and (4) seven stages of learning, achieved

by grouping the subjects' performance on the three test lists into seven blocks of four trials each.

Forty-five college male subjects participated in the study with fifteen subjects in each of the three anxiety groups. An equal number of subjects within each anxiety groups were randomly assigned to each of three stress conditions. Using the anticipation method, the subjects were administered a practice list of paired nouns and then were given thirty trials on the three test lists. The number of correct anticipations was recorded and used as the dependent variable in the subsequent statistical analysis.

The following results were obtained, and which apply <u>only</u> to paired-associate verbal learning situations:

1. The performance of the high anxiety group on an easy learning task was essentially the same as the performance of both the low and medium anxiety groups.

2. The analysis of correct response for a medium difficult and difficult task at various stages of learning

revealed no significant differences between the three anxiety groups.

3. Under stress conditions, the performance of all anxiety groups on an easy learning task was equivalent.

4. There was no clear performance differential between the high, medium, and low anxiety groups regardless of their respective level of stress or stage of learning.

5. Subjects under stressfull conditions performed as well as subjects under nonstressfull conditions regardless of level of anxiety or level of task difficulty.

On the basis of the findings of the present experiment it was concluded that the Spence and Spence construct of anxiety which reflects the individual's drive level is unrelated to: (1) acquisition performance on paired-associate verbal learning tasks of various degrees of difficulty; (2) acquisition performance at

different stages of learning regardless of level of difficulty of the paired-associate verbal learning task, and (3) the degree of situational stress in the acquisition phase of learning.

The major strength of this experiment was the simultaneous manipulation of four independent variables--a necessary condition to test adequately the validity of the Spence and Spence Theory of Anxiety. However, in the same context, a major weakness is created. Due to the lack of empirical knowledge of the interactive effects of the independent variables, the researcher will experience great difficulty in explicating second and third order interactions.

In order to resolve some of the theoretical issues of the effects of anxiety in future investigations, with more certitude and precision, the following suggestions are made:

1. More than one type of stress variable should be included. For example, shock, light, failure and ego-involving instructions may be used.

2. Different learning tasks which readily lend themselves to different types of learning criteria, such as acquisition, recall and forgetting should be designed.

3. More than one measured personality trait of anxiety should be utilized.

It is implied by the above suggestions that bivariate experimentation on learning phenomena is inadequate for the purpose of formulating heuristic laws of learning. This recommendation concurs with Cattell's introductory remarks in Tucker's chapter on learning theory in which he asserts that learning represents a situation which is "a multidimensional entity . . . and assumes that all aspects of a situation produce a learning change in all aspects of the organism's behavior, as a single total event."[1] Therefore, it is

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[1]Ledyard R. Tucker, "Learning Theory and Multivariate Experiment: Illustration by Determination of Generalized Learning Curves," in Handbook of Multivariate Experimental Psychology, ed. by Raymond B. Cattell (Chicago: Rand McNally & Co., 1966), p. 478.

recommended that future investigations be multivariate in nature, with respect to both design and analysis.

APPENDIX I

THE MANIFEST ANXIETY SCALE AND THE K-SCALE

DIRECTIONS

This test consists of numbered statements. Read each statement and decide whether it is true as applied to you or false as applied to you. If a statement is TRUE or MOSTLY TRUE, as applied to you, blacken between the lines in the column headed T. If a statement if FALSE or NOT USUALLY TRUE, as applied to you, blacken between the lines in the column headed F.

Remember to give YOUR OWN opinion of yourself. DO NOT LEAVE ANY BLANK SPACES.

In marking your answers on the answer sheet, be sure that the number of the statement agrees with the number on the answer sheet. Make your marks heavy and black. Erase completely any answer you wish to change.

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1. I have diarrhea once a month or more.
2. I am inclined to take things hard.
3. I have very few fears compared to my friends.

4. I have sometimes felt that difficulties were piling up so high that I could not overcome them.
5. At times I am all full of energy.
6. I am happy most of the time.
7. I sweat very easily even on cool days.
8. Sometimes I become so excited that I find it hard to get to sleep.
9. I find it hard to set aside a task that I have undertaken, even for a short time.
10. I have never felt better in my life than I do now.
11. I practically never blush.
12. I do not tire quickly.
13. I find it hard to make talk when I meet new people.
14. People often disappoint me.
15. I frequently find myself worrying about something.
16. It makes me nervous to have to wait.
17. I am more sensitive than most other people.
18. I have very few headaches.
19. At times I think I am no good at all.
20. Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.
21. I blush no more often than others.

22. I often think, "I wish I were a child again."
23. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.
24. I have periods of such great restlessness that I cannot sit long in a chair.
25. I feel anxiety about something or someone almost all the time.
26. At times I feel like smashing things.
27. It takes a lot of argument to convince most people of the truth.
28. Life is a strain for me much of the time.
29. Once in a while I put off until tomorrow what I ought to do today.
30. I have often met people who were supposed to be experts who were no better than I.
31. I am a high-strung person.
32. I get mad easily and then get over it soon.
33. I feel hungry almost all the time.
34. I worry quite a bit over possible misfortunes.
35. I must admit that I have at times been worried beyond reason over something that really did not matter.

36. I am certainly lacking in self-confidence.

37. I sometimes feel that I am about to go to pieces.

38. I cry easily.

39. I like to let people know where I stand on things.

40. I certainly feel useless at times.

41. I have nightmares every few nights.

42. I am usually clam and not easily upset.

43. I find it hard to keep my mind on a task or job.

44. I have had periods in which I lost sleep over worry.

45. At times my thoughts have raced ahead faster than I could speak them.

46. I am easily embarrassed.

47. It makes me uncomfortable to put on a stunt at a party even when others are doing the same sort of things.

48. Often I can't understand why I have been so cross and grouchy.

49. I dream frequently about things that are best kept to myself.

50. When in a group of people I have trouble thinking of the right things to talk about.

51. I believe I am no more nervous than most others.

52. At times I feel like swearing.

53. I am very seldom troubled by constipation.

54. I have been afraid of things or people that I knew could not hurt me.

55. I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others.

56. I have a great deal of stomach trouble.

57. I think nearly anyone would tell a lie to keep out of trouble.

58. What others think of me does not bother me.

59. I am often afraid that I am going to blush.

60. I shrink from facing a crisis or difficulty.

61. I wish I could be as happy as others seem to be.

62. My sleep is fitful and disturbed.

63. I am troubled by attacks of nausea and vomiting.

64. Criticism or scolding hurts me terribly.

65. I have periods in which I feel unusually cheerful without any special reason.

66. Sometimes, when embarrassed, I break out in a sweat which annoys me greatly.

67. At periods my mind seems to work more slowly than usual.

68. I am entirely self-confident.

69. My hands and feet are usually warm enough.

70. I worry over money and business.

71. I am against giving money to beggars.

72. I hardly ever notice my heart pounding and I am seldom short of breath.

73. I frequently notice my hand shakes when I try to do something.

74. I work under a great deal of tension.

75. I cannot keep my mind on one thing.

76. I am not unusually self-conscious.

APPENDIX II

CONSENT FORM

CONSENT FORM

I hereby agree to participate as a test subject in this experiment.

I understand that due to the nature of the variables which are being studied, it will not be possible to inform me completely at this time about nature and purpose of the procedures to be followed. I understand, however, that a complete explanation of the procedures and purpose of this experiment will be given to me, if ever requested it, following the termination of the experiment as a whole. I further understand that by participating in this experiment will in no way put myself in any abnormal physical or mental danger.

I hereby sign this form with full knowledge that information obtained in this experiment is strictly confidential and that this information will in no manner be used in my behalf or against me.

Signed_____

Date_____

Witnessed_____

APPENDIX III

INSTRUCTIONS

INSTRUCTIONS

We want to thank you for giving us some of your time to participate in this experiment.

Your task in this experiment is quite simple. Essentially, you will be required to learn a list of words presented in a serial fashion on a memory drum. The words which you will learn are a series of paired nouns or adjectives. The method of presentation is as follows.

The first word which will appear on the left side of the opening of the memory drum is the stimulus or the stem of the pair. In the next interval, there will appear the stimulus or stem again, BUT this time the stimulus or stem will be accompanied by the correct response, or its correct pair. Your task is to learn the response in the presence of the stimulus or stem ONLY, in other words, you attempt to anticipate the response when you see ONLY the stimulus or stem. An answer is correct if and only if you are able to anticipate the response before it is presented along with the stimulus.

The following is an example of how the pairs are to be learned: Let's say for example, that the pair is "night" (stimulus) and "side" (response). The stimulus word, "night" appears first on the left portion of the opening of the memory drum. When the word "night" is viewed, you would obviously call out "side" its correct pair. Then after a brief interval, both words "night" and "side" will appear in the opening.

As a further illustration, the words will appear in this form:

```
Presentation I --NIGHT                    --opening of the memory
                        ***brief interval  drum
Presentation II--NIGHT   SIDE
```

Several words will appear in this manner. Of course the method of learning is to anticipate the word "side" during the "Presentation I." In order to learn the lists, they will be presented several times with a brief rest interval between presentations.

Since you will obviously not know the correct response the first time the list is presented, you are asked to merely read the words off the tape as it revolves about the

memory drum for the first presentation only. After the first list is presented, you are asked to say OUT LOUD the correct response or what you think is the correct response during Presentation I. You will learn the lists under different conditions of noise intensities.

Are there any questions?

APPENDIX IV

TABLES OF CELL MEANS USED TO PLOT THE LEARNING CURVES ON FIGURES 1-12

TABLE 1

"MEANS" OF THE MAIN EFFECTS OF ANXIETY
AS DEPICTED IN FIGURE 12

Anxiety	N	Mean
High	15	15.8
Medium	15	15.9
Low	15	16.1

TABLE 2

"MEANS" OF THE MAIN EFFECTS OF TASK
DIFFICULTY AS DEPICTED IN FIGURE 2

Task Difficulty	N	Mean
Easy	45	18.7
Medium Difficult	45	14.7
Difficult	45	13.9

TABLE 3

"MEANS" OF THE SIMPLE EFFECTS FOR THE ANXIETY BY
STRESS INTERACTION AS DEPICTED IN FIGURE 12

		Stress		
Anxiety	N	High	Medium	Low
High	5	14.8	15.8	17.8
Medium	5	16.2	14.7	14.9
Low	5	16.7	15.3	15.6

TABLE 4

"MEANS" OF THE SIMPLE EFFECTS FOR THE ANXIETY BY TASK DIFFICULTY INTERACTION AS DEPICTED IN FIGURE 2

		Task Difficulty		
Anxiety	N	Easy	Med. Diff.	Diff.
High	15	18.5	15.3	13.9
Medium	15	18.8	13.6	13.4
Low	15	18.7	15.3	14.3

TABLE 5

"MEANS" OF THE SIMPLE EFFECTS FOR THE STRESS BY TASK DIFFICULTY INTERACTION AS DEPICTED IN FIGURE 5

		Task Difficulty		
Stress	N	Easy	Med.Diff.	Diff.
High	15	18.9	15.0	14.6
Medium	15	18.6	14.2	12.9
Low	15	18.5	15.0	14.1

TABLE 6

"MEANS" OF THE SIMPLE EFFECTS FOR THE TASK DIFFICULTY BY STAGE OF LEARNING INTERACTION AS DEPICTED IN FIGURE 7

		Task Difficulty		
Stage of Learning	N	Easy	Med. Diff.	Diff.
I	45	9.7	3.0	2.6
II	45	16.2	9.4	8.4
III	45	18.5	13.7	12.6
IV	45	20.0	16.4	15.3
V	45	21.4	18.5	17.7
VI	45	22.1	20.2	19.8
VII	45	22.9	21.9	20.8

TABLE 7

"MEANS" OF THE SIMPLE EFFECTS FOR THE ANXIETY BY STRESS BY TASK DIFFICULTY INTERACTION AS DEPICTED IN FIGURES 6 & 8

			Task Difficulty		
Anxiety	Stress	N	Easy	Med. Diff.	Diff.
High	High	5	17.9	13.7	12.9
High	Med.	5	18.3	16.6	13.7
High	Low	5	19.3	15.7	15.1
Med.	High	5	18.9	14.7	13.8
Med.	Med.	5	18.9	12.3	12.7
Med.	Low	5	18.5	13.7	13.6
Low	High	5	19.8	16.6	17.0
Low	Med.	5	18.6	13.8	12.3
Low	Low	5	17.7	15.5	13.7

TABLE 8

"MEANS" OF THE SIMPLE EFFECTS FOR THE ANXIETY BY TASK DIFFICULTY BY STAGE OF LEARNING INTERACTION AS DEPICTED IN FIGURES 1 & 3 & 4

			Stage of Learning						
Anxiety	Task Difficulty	N	I	II	III	IV	V	VI	VII
High	Easy	15	10.0	15.9	18.4	19.5	21.2	21.8	22.8
High	Med. Diff.	15	3.7	10.0	14.1	16.7	19.7	21.0	22.0
High	Difficult	15	2.2	8.0	12.1	15.5	17.8	20.3	21.5
Med.	Easy	15	10.4	15.8	18.2	19.8	21.3	22.5	23.3
Med.	Med. Diff.	15	2.5	8.5	12.4	15.0	16.5	19.0	21.2
Med.	Difficult	15	2.1	8.0	11.7	14.4	17.2	19.7	20.4
Low	Easy	15	8.7	16.9	18.9	20.5	21.5	21.9	22.6
Low	Med. Diff.	15	2.9	9.6	14.6	17.4	19.3	20.7	22.5
Low	Difficult	15	3.3	9.1	13.9	15.9	18.1	19.5	20.5

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College - Loras College; Dubuque, Iowa
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