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STRESS, PERSONALITY, AND PERFORMANCE ON COURSE EXAMINATIONS

by
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STRESS, PERSONALITY, AND PERFORMANCE ON COURSE EXAMINATIONS

Neil A. Carrier

The problem of this study was to determine the relationship of four personality variables to performance of students on a course examination under experimentally manipulated stress.

The variables are:

1. The SA (Permeability) dimension: a measure of tendency to be influenced by internal and external stimuli and to dependence upon others in decision making.

2. The S (Stability) dimension: a stability-anxiety dimension reflecting nervous tension and desurgency.

3. Need for Achievement (n Ach): a measure of need for success in competition with some standard of excellence.

4. Need for Affiliation (n Aff): a measure of need to establish or maintain positive affective relations with others.

Subjects were students in Introductory General Psychology at the University of Michigan during the Spring semester, 1955.

A regression equation was devised to predict the scores of these students on their third examination. Independent variables in the regression equation were grade-point average, American Council on Education total test score, and scores on the first two course examinations. The weights for these independent variables were computed from data on students in the same course during the previous semester.

When the predicted third examination scores were computed, two equated groups were formed by assigning students to a low or high stress experimental group where they took their third examination. This "matching" procedure controlled for intellectual and motivational factors which influence performance.

Stress was conceived as situational conditions which a student perceives as erecting potential barriers to his movement toward the goal of doing well on the examination. A high stress group was created by certain operations calculated to raise stress to a reasonable maximum. A low stress group took the test under conditions in which attempts were made to reduce stress as much as possible. The final sample of subjects consisted of 125 students in each of the stress groups.

The data were analyzed to determine whether students who obtained certain scores on the personality measures had shown a differential performance response under the two stress conditions.

Findings:

1. The examination scores of female subjects were more detrimentally affected by stress than those of male subjects.

2. As was predicted, the examination scores of high SA students were more detrimentally affected by stress than those of low or moderate SA students.

3. An hypothesis predicting greater detriment to the performance of low S than to that of moderate or high S students under stress received tentative support for male subjects only.

4. A prediction that moderate n Ach males would show a greater performance decrement than low or high n Ach males was not validated. However, low n Ach females were more detrimentally affected by stress than moderate or high n Ach females.

5. A prediction that high n Aff subjects would show a greater performance loss than moderate or low n Aff subjects was not verified.

6. When the virtually uncorrelated SA and S dimensions were combined to produce four personality "types," high SA-high S females displayed a significant performance decrement under stress. High SA-high S males gave similar but statistically unreliable results.

7. Similar analysis of n Ach-n Aff types showed no performance differences between stress conditions by

male subjects. Examination scores of low n Ach-low n Aff females under the two stress conditions were significantly different.

Performance on course examinations is determined not only by intelligence and knowledge of materials, but also by the interaction of stress conditions and personality factors. Students most detrimentally affected by stress conditions are likely to be: highly permeable females, low stability males, low n Ach females, high permeability-high stability females, and low n Ach-low n Aff females. They are also likely to be females rather than males.

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CHAPTER I

RELEVANT RESEARCH STUDIES AND CONCEPTS

A. The Effect of Stress and Anxiety on Behavior: An Active Research Area

The last few years have seen the publication of a number of experimental studies of the effect of psychological stress or anxiety on behavior. Recent enthusiasm to do work in this area is evident in the welcome accorded by researchers to tests of anxiety. This enthusiasm is apparent from the number of studies which have employed two particular tests.

The first of these is the Taylor Scale of Manifest Anxiety. (64) Beginning with a syndrome called "manifest anxiety," items which were judged to be indicative of this anxiety were selected by clinical psychologists from the Minnesota Multiphasic Personality Inventory. These items were then assembled in a questionnaire. The score obtained from a subject who answers this questionnaire is assumed to be a measure of his manifest anxiety. This latter term refers to certain overt behavior patterns such as reports of chronic worry or fatigue, excessive activity of autonomically controlled effectors, sleeplessness, and the like. These reactions are assumed to be the overt expressions of an internal tension state of the person.

A second important research tool is the Test Anxiety Questionnaire developed by Sarason and Mandler. (53) This instrument secures responses to a series of questions pertaining to feelings about taking individually administered intelligence tests, group intelligence tests, and academic course tests. Presumably, a score on this questionnaire reflects the degree of test anxiety which a person brings to a testing situation.

B. Three Research Approaches

Three general experimental approaches have been used to study the effect of stress and anxiety on behavior. One approach is reflected by studies relating the degree of internal anxiety of subjects to some behavioral measure, such as speed of avoidance conditioning, or learning of nonsense syllables. A second approach is illustrated by studies of the performance of subjects under conditions intentionally made stressful. For example, the performance in solving arithmetic problems of subjects given periodic painful electric shock may be compared with the performance of subjects working without shock. This second approach attempts no direct measure of an internal anxiety state, but oviously assumes that the stress conditions will create some kind of an internal state which will have an effect on performance. A third research approach focusses upon the interaction of certain personality variables and

situational stress as they affect behavior. A study of this kind might determine whether subjects who score low on the "X" test of personality perform more poorly under stress conditions than similarly scoring subjects under non-stress conditions.

Let us look now at representative experimental studies which may be classified under each of these headings.

1. Studies Relating Existing Anxiety to Performance Measures

This first type of approach is illustrated by the well-known work of Taylor. (65) Operating from a Hullian learning model, Taylor proposed that the total drive strength of a subject was partly a function of his usual anxiety level. Subjects with a high level of this anxiety, were expected to display a greater amount of avoidance conditioning than subjects with a low level of anxiety. This view clearly conceives of anxiety as a drive. The higher this drive, the stronger will be the excitatory potential, and consequently the greater the response strength as shown by conditioning. This is an additive model in which anxiety increases the strength of a response. In the study cited, subjects scoring high on the Taylor Scale were compared on avoidance conditioning with subjects getting a low anxiety score on the scale. In keeping with predictions, high anxiety subjects were found to display stronger avoidance conditioning of the eyelid response

than low anxiety subjects. A second study by Spence and Taylor (61) confirmed this finding.

Other studies have employed this same technique of relating manifest anxiety to performance. Taylor and Spence (68) found that high anxiety (high drive) subjects made more errors and required a larger number of trials to reach the learning criterion in a task of simple serial learning than low anxiety subjects. A study by Montague (42) revealed that subjects classified as "anxious" on the basis of Taylor scale scores performed less well than "non-anxious" subjects on a difficult serial learning task, and showed greater improvement than non-anxious subjects as the task became easier. A study by Lucas (28) also indicated that increased difficulty in rote serial learning is associated with lowered performance in anxious subjects.

The relation of reaction time to anxiety has been studied by Wenar (72) who reported high Taylor Scale scorers (high anxiety) to have a faster reaction time than low scorers. Grice (16) studied the same problem but saw the anxiety-reaction time relationship disappear when he controlled for intellectual ability. Finally, somewhat different dependent variables have interested other investigators such as Bitterman and Kniffin (5) who reported no relation between anxiety level and recognition level for neutral and "taboo" words, Cox and Sarason (9) who report the Sarason Scale to be correlated with

certain Rorschach signs of anxiety, and Wesley (73) who found no relationship between manifest anxiety and perseveration of response in a concept formation task.

2. Studies of Performance in Stress Situations

In this second group of studies no measure of an internal anxiety or personality state of the subject is attempted. Certain stressful conditions are set up and the subject's performance is observed. Induced stress here has been shown by Korchin and Basowitz (21) to decrease the efficiency of perception, by Pally (45) to produce greater rigidity of thinking in Einstellung problems, and by Lazarus and Eriksen (25) to cause greater task improvement by high grade-point average students than by poor students. Coppock (8) concluded that stress initiates a kind of "vicious circle" reaction in which awareness of one's anxiety increases anxiety. Smock (59) found stress increased intolerance of ambiguity and caused more premature "wrong" responses which were tenaciously adhered to longer by anxious subjects than by relaxed subjects.

3. Studies of the Interaction of Stress and Personality Upon Performance

This third type of research approach reflects an interest in the extent to which certain personality characteristics mediate the stress-performance relationship. Studies of this type try to determine whether sub-

jects with differing personality scores show different performance reactions to induced stress. When used in this way, we may consider such variables as Taylor's manifest anxiety, Sarason's test anxiety, neuroticism, intelligence, and similar aspects of personality as mediating or "intervening" variables. Certainly the problem of the personality correlates of behavior under stress has both theoretical and practical importance. Subjects have reacted in different and unpredicted ways to conditions presumed (or at least hoped) to be uniformly stressful. The attempt to devise and substantiate a theoretical accounting of such behaviors, however, is only beginning. And practically, it would be most useful to know what kinds of people are adversely affected by stress in certain situations. Beginnings have been made, however.

The increased responsiveness to threats of subjects high on the Taylor Scale has been observed by several investigators. Eriksen (12) reported this as did Spence, Farber, and Taylor (60). The latter reported that differences in the speed of eyelid conditioning of female subjects with high and low Taylor Scale scores were small until shock or the threat of shock was introduced into the situation. Cox and Sarason (9), in another study of the relationship between response measures of anxiety and induced anxiety, found that experimentally stimulated ego involvement or threat failed to increase Rorschach signs of anxiety. Deese, Lazarus, and Keenan (10) administered

strong electric shock to induce anxiety during the learning of simple nonsense syllables. They reported an interaction between subjects' scores on the Winne Neuroticism Scale (77), which correlates highly with the Taylor Scale, and the conditions of shock stress under which the learning took place. It was found that the performance of the low anxiety subjects was more detrimentally affected by the stress conditions than that of the high anxiety subjects. Lazarus, Deese, and Hamilton (24) conducted a virtual repetition of this study in order to explore the observed interaction further. However, one essential difference was intentionally introduced. The learning task was made more difficult by introducing a high degree of intraserial duplication in the nonsense syllables to be learned by the subjects. The investigators found a marked difference between their results and those observed by Deese, Lazarus, and Keenan. Instead of the low anxiety subjects scoring significantly lower, the high anxiety subjects scored lower, although not significantly so. This finding appears, of course, consistent with that of Montague (42) and of Lucas (28), namely, that task difficulty reverses the usual anxiety-avoidance learning relationship.

Osler (44) reported in 1954 a study of performance as a function of two types of stress. She measured the effects of failure and fear of authority stress on performance on an arithmetic test. Analysis revealed that failure

depressed performance while fear had no significant effect. An attempt to relate the subjects' manifest anxiety scores to their performance failed to display a significant relationship. The results, however, "leaned" in the expected direction.

Taylor and Farber (66), using failure-stress, found submissive children showing a performance decrement while ascendant children showed an improvement. Hutt's (20) study of Stanford-Binet performance under stress demonstrated that maladjusted children showed impaired mental age scores. Lazarus and Eriksen (25) report that high grade-point average college students showed improved digit-symbol performance under stress while low grade-point average students showed a decrement and greater variability in performance. Scholastic aptitude test (ACE) scores were held constant in this study. Adams (1) reports no relationship between neurotic tendency scores on the Bernreuter Personality Inventory and performance under failure stress. Marquart (32) reports a similar finding using the Bernreuter in a similar experiment.

Taylor's scale of manifest anxiety was used by Osler (44) in an attempt to determine whether subjects' anxiety level was related to performance under stress conditions. A similar personality measure developed by Winne (77), was used by Deese, Lazarus, and Keenan (10) as we have already mentioned. And, of course, the somewhat

similar attempts of Sarason to perfect a measure of test anxiety may also be considered as an effort to determine one aspect of the complex of personality which "intervenes" between stress stimuli and resulting behavior. However, only a beginning has been made on this point. Indeed, many of the differences in the studies reported here, although statistically significant, are not of large magnitude. Their significance is theoretical rather than practical. There is clearly a need for further attempts to relate other accepted personality measures to behavior under stress. Important progress in this area is attendant not only upon this requirement, but is also intimately tied to a more careful specification and standardization of response measures. With different kinds of independent, intervening, and dependent variables all "running around loose" and unstandardized in the many current experiments on stress and behavior, the resulting inconclusiveness is certainly not unexpected. These are strict requirements. But real progress in this area must wait for their fulfillment.

All three of the above experimental approaches have indicated that stress and anxiety are factors to be taken into account when measuring performance.

What conclusions from these experimental studies are most relevent to the present study?

We have noted several studies which indicate that stress and anxiety have been important contributors to the experimental task performance of subjects. There is also a strong suggestion from the studies cited that when the task on which performance is measured is a simple one (such as avoidance conditioning or learning of simple nonsense syllables), high anxiety facilitates performance. However, when the task is a difficult one (such as a complex serial learning task), high anxiety interferes with performance. These conclusions are evident in the studies employing the Taylor scale (10, 24) and from those by Montague (42) and Lucas (28). One might well expect that in the performance of such complex skills as are required of a student taking a college examination, high anxiety would have an inhibiting effect.

Since the measure of performance in the present study of stress and performance was scores of college students on a course examination, the relevance of the above conclusions is clear.[1] If these findings are valid, the performance of college students on course examinations could be expected to show a negative relationship to the degree of stress under which they worked.

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[1] See Chapter II for a detailed presentation of the study design.

C. Experimental Procedures for Producing Stress Situations

It is apparent that a variety of experimental stress procedures have been used in these studies to produce anxiety in subjects. Since the present study involves a manipulation of this variable, it is appropriate that some consideration be given to the various kinds of procedures used by others for this purpose.

One technique which has been employed to induce anxiety is the ubiquitous electric shock. (10,24,74,76) Failure in the task has been used in several other studies. (2,11,15,25,30,31,44,48,59,79)

The failure experience has generally been induced by presenting the subject with an unsolvable task, by interrupting the subject before he has finished a task, or by announcing false norms which indicate to the subject that he has failed to attain a standard. Other techniques have employed too rapid pacing (2,27), distraction (39), and fear of authority or harsh words from the experimenter. (44,59)

In their review of psychological stress and performance, Lazarus, Deese, and Osler (26) make a distinction between two basic types of stress situations: failure-stress and task-induced stress. (Failure-stress is illustrated by such techniques as giving the subject an insolvable task, announcing false norms which indicate failure, and by

interruption before task completion. Task-induced stress may involve such distractions as electric shock or verbal disparagement of the subjects' performance by the experimenter.) The authors justify this on the assumption that the motivation of the subject is likely to be different in each type of stress situation. The subject's motivation under task-induced stress depends on how he views the operations which are intended to be stressful. If he views the electric shock, or the pacing, or the other distractions as challenges to be "beat," then his effort level is apt to be raised. His motivation level is likely to be higher, in other words.

Another reason for making the distinction is that in spite of the problem of motivation in task-induced stress, it is an easier condition for the experimenter to manipulate than is failure-stress. In the latter, the experimenter is obliged to create a realistic threat to the subjects' self-esteem or to some goal-oriented behavior. Reactions to this kind of condition are likely to be more variable than reactions to the situation wherein stress is induced by unusual working conditions or by the excessive demands of the task.

D. Behavioral Measures Employed

One reason for the present fluid state of conclusions in the area of stress and performance is the lack of adequate specification and standardization of experimental stress conditions, i.e. the independent variables. But it

is also likely that another source of the lack of agreement is to be found in the number of different dependent variables employed in these studies. Note the variety of tasks employed in the following. The effect of stress on verbal intelligence test scores has been measured by Lantz (23) and Hutt (20), while Seashore and Bavelas (55) measured mental age scores on the Draw-a-Man test under frustrating conditions. Performance in solving arithmetic problems has been employed in studies by Osler (44) and Thorndike and Woodyard (70). The learning of various tasks under stress has been frequently studied: Taylor and Spence (68) employed a serial learning task; Taylor (65) measured conditioning of the eyelid response; a digit-symbol test was used by Williams (76) and Lazarus and Eriksen (25); while nonsense syllables were learned in studies by Zeller (79), Sullivan (63), Deese, Lazarus, and Keenan (10), and Lazarus, Deese, and Hamilton (24). Perceptual motor skills have received a share of attention too. Recognition thresholds were studied by Postman and Bruner (48); Marquart (32) employed a visual discrimination task; Verville (71) and Wenar (72) measured reaction time ; Bayton and White (4) used a rate of manipulation test; and McClelland and Apicella (35) used card sorting as an experimental task, while an intensive series of studies by the Aviation Psychology Program of the Army Air Forces (41) measured the effects

of verbal threat and distraction upon performance of various psychomotor tasks such as steadiness, aiming, and the like. A study by Doris and Sarason (11) was concerned with the assignment of blame to self or elsewhere under failure stress. Finally, a large number of studies have been concerned with the effect of stress upon the recall or relearning of previously learned material. Typical of these are Alper (2), Ericksen (12), Glixman (15), Kendler (22), Marrow (33), and Zeller (79).

While the response measure is always specified in experimental reports, one gets the impression that not enough attention is given to the fact that different kinds of performance may be differently affected by stress (actually, by different kinds of stress). It is questionable whether various kinds of learning tasks, motor activities, and remembering skills are all valid operations of some genotypic concept called "performance." Ignoring the particular performance measure employed in stress studies supposes a maturity which this young area has not attained.

E. Attempts to Reduce Anxiety

A few efforts have recently been reported which try to reduce the effect of stress or anxiety. It is obvious that psychotherapeutic and counseling techniques might have some relevance to this goal. Experimental studies, however, have only begun to be presented in this area.

Haggard (18) used electric shock to induce stress. The effect of the stress was to cause certain disturbances in autonomic, motor, and verbal activity. He found that a "catharsis-information" combination was more effective in reducing the general level of disturbance than "experimental extinction" or "rest." He was unable to determine, however, whether either "catharsis" or "information" was the essential variable in accounting for the reduction. Pomeroy (47) induced stress in his subjects by distraction and verbal disparagement. The effect was to impair performance on a maze learning task. He reported that experimental counseling improved the subjects' subsequent maze performance.

Grossman (17) attempted to determine changes in insight following two psychotherapeutic techniques which he termed "deep" or "shallow" according to the therapist's responses. Although the results apparently favored the "deep" procedure, the findings are somewhat uncertain since the "shallow" group of subjects were discovered to be more resistant to the therapy procedures both during and before the application of the therapeutic technique. Finally, a recent experimental study is reported by Wiener (75). Stress was induced by telling subjects that their Rorschach responses indicated serious personality maladjustment. Stress and non-stress subjects then performed such tests as the Wisconsin Card Sorting Test, and a Mirror-Tracing task. After one of the following experimental therapy

sessions--"reassurance-interpretation," "catharsis-reflection," "talk," or "rest"--subjects again performed the tests. The counseled groups combined showed consistent although not always significant improvement in performance on the post-test measures in comparison with the combined noncounseled groups. There were no differences in effectiveness between the reassurance-interpretation and the catharsis-reflection techniques.

A somewhat different approach to relieving anxiety is that initiated by McKeachie at the University of Michigan. His research was based on the assumption that while a little anxiety may facilitate performance, excessive anxiety tends to disorganize the person and thus interfere with performance. The research setting in which McKeachie chose to work was the college classroom. The average student about to take an examination was seen as already carrying enough anxiety to put him beyond the point where anxiety begins to be disruptive. If this disruptive anxiety could be decreased in some way, it might then be possible to enable him to perform better on his examination. Initial experimentation showed a significant difference in the expected direction between experimental and control students who used different types of answer sheets in taking their multiple-choice examinations. Follow-up experiments revealed that the most effective type of answer sheet was one which provided a space after each question for student comments,

and which only indicated that the student could make any comments if he wished. While the making of comments might reduce anxiety by giving the student closure on each question, or by having a cathartic function, Teevan and McKeachie (69) believe that the anxiety reducing function of the impression of an interested, permissive instructor communicated to the student by the "free-comment" answer sheet is largely responsible for the improvement in performance.

A recent report on this research by McKeachie, Pollie, and Speisman (38) discloses that students who used the free-comment answer sheet scored better on the second half of an examination than control group students, but not on the first half. The authors conclude that the comments do not improve scores on the items about which they are written, but relieve anxiety, which has a later benefit. Reported also in this article is the relationship, in experimental subjects who used the free-comment answer sheet, between performance and score on the need for achievement measure. (36) Low need for achievement students made significantly lower scores on the first half of the test than did students with high need for achievement, it was found. They did not differ, however, on the last half of the test. This finding suggested that writing comments was more beneficial in improving the scores of the low need for achievement students than in improving scores of the high need for achievement students.

The most recent follow-up study in this area is one by Calvin, McGuigan, and Sullivan.(6) The free-comment answer sheet was used by the experimental group. Again these students scored significantly better than the controls on the second half of the examination. Taylor Scale scores were also obtained in this study. Analysis showed that in terms of gain from the first half of the examination to the second, the high anxiety experimental students were superior to the low anxiety experimental students. Considering this and the other studies in this section, it would seem that the reduction of anxiety in the classroom may be both possible and salutary.

F. Stress and Anxiety: Definitions and Some Resolutions

Throughout this chapter the terms "stress" and "anxiety" have been used with never a precise definition offered. It is not that the writer is unaware of the confusion which exists about these concepts. Rather, it has been judged wise to consider this problem after having displayed these terms in the manifold ways in which they are currently commonly used. It is now appropriate to discuss these concepts and to make some resolutions.

Stress has sometimes been used to refer to situations. Situation A, let us say, may be an experimental condition under which subjects are told they are doing more poorly on a task than they ought. Situation B may be another

condition where subjects are told that they are performing up to the average to be expected on such a task. Situation A may be described as a "stress" situation, while situation B may be described as a "non-stress" situation. Most subjects may feel and show signs of discomfort (anxiety?) under A and few may under B. But a poorly motivated subject under A may not "care" about his poor performance and fail to experience this discomfort. On the other hand, a highly motivated subject under B may be disgruntled to learn that he is performing only "up to the average" in the task and experience the discomfort. These inconsistencies have moved some writers to object to thinking of stress in terms of situations. (See Lazarus, et al., 26; p. 294)

Stress has also been defined by emphasizing the reactions or responses of an individual rather than a situation. But a difficulty arises when the time comes to decide what indices of stress will be employed. Is more rapid avoidance conditioning to be the "measure" of stress? Or changes in some skilled performance? Or subjective reports of stress? Since so many other variables may influence these reactions Lazarus, et al. (26) consider it impossible to regard them as determined by stress.

Following this argument, if stress cannot be defined either by stimulus or response operations alone, what alternative is there?

Lazarus, et al. (26) think it possible to conceive of stress as an intervening variable which mediates stimuli and responses. According to this view, somehow an internal state is established in a person which then exerts a specific effect upon his behavior. But it is necessary to account for the "somehow" of the establishment of stress. It may be helpful, then, to think of stress as itself a kind of response. Stress may be considered to be a state of tension which is an inner response to the blocking or anticipated blocking of motive satisfaction. To put it into other words, when a motivated individual perceives aspects of a situation which threaten to prevent his attaining a goal which he regards as necessary to his motive satisfaction, stress results. This inner tension state may then exert some effect on his resulting behavior. Clearly the key concept here is motivation, for if motivated behavior is not blocked, stress does not exist.

This way of thinking of psychological stress may be hard to argue with. But where do the concepts of anxiety and manifest anxiety fit into the scheme?

Taylor and Spence (67) have distinguished between manifest anxiety and internal anxiety state. By manifest anxiety they refer to certain overt behavior patterns such as reports of chronic worry or fatigue, excessive activity of autonomically controlled effectors, sleeplessness,

and the like. These reactions, however, are generally assumed to be an overt expression of an internal emotional state of the person. This internal anxiety state would seem to be the underlying condition which clinicians infer to account for defense reactions which seem to protect the individual against this anxiety. The internal anxiety state is thus a hypothetical construct devised to account for observable behaviors.

It would seem that the term internal anxiety state has the same connotations for Taylor and Spence as the term stress does for Lazarus, et al. And further, it seems that both of these terms have the same meaning as the general term "anxiety." What this leaves us with is one term which we may facetiously call stress—internal anxiety state—anxiety, and another term called manifest anxiety. We have no argument with the second term, but some decisions would seem appropriate with respect to the first. Since it is apparently a matter of taste which label one uses to designate the psychological tension state with which we are concerned, the present writer chooses to use the term anxiety. Since the present study did not employ the Taylor Scale, we have no use here for the term manifest anxiety. And since our study is one in which a situation has been manipulated with the intent of raising the level of anxiety in subjects, we choose to pervert the term stress by

referring to one of our experimental situations as a high stress condition.[1] When stress is used in this way it is with full knowledge that the situation may not have been anxiety inducing for all subjects. Our defense for this procedure is contained in the following:

> The solution of most experimenters who have studied the responses of groups under stress has been to produce situations which are thought to thwart the motives of most people. (Lazarus, et al. 26; p. 295)

G. Summary

In this chapter a review and discussion of studies and concepts relevant to the present investigation have been presented. We have noted a prevailing interest in the problem of stress or anxiety on behavior. We have observed that a variety of stimulus and response variables have been employed in studying this problem, and that some attempts have been made to determine personality variables which mediate stress and behavior. Finally, we have seen some efforts to perfect ways of reducing anxiety, and have defined terms. While the definitions are arbitrary, they are also useful.

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[1] Stress, then, is an adjective applicable to situations. Anxiety is an internal state. A stressful situation is one in which most of the subjects are made anxious, or are assumed to be anxious.

CHAPTER II

THE PROBLEM OF THIS STUDY AND FOUR PERSONALITY VARIABLES

A. The Problem

The problem to which this study was directed is that of determining the relationship of four personality variables to performance on course examinations under experimentally manipulated stress. We have seen a number of studies of the effects of stress situations upon performance which suggest that the anxiety which results in stress situations frequently has a rigidifying, disrupting, discrimination-reducing effect on the performer's complex behavior. Teevan and McKeachie (69) bring this into the course examination situation by assuming that when a certain level of anxiety is reached, the beneficial motivational effects of mild anxiety are lost and disruptive effects appear. They further assume that this "downhill" part of the curve of anxiety effectiveness is frequently reached by students taking course examinations. Multiple-choice tests frequently require the student to make fine discriminations between alternatives and to handle occasional "set-disturbing" questions such as "Which of the following is least incorrect?" If the student is experiencing emotions which interfere with his ability to discriminate between alternatives, to recall information, and to be flexible

in his set, his examination performance should be lower than if this condition were not present.

Many factors may contribute to the student's anxiety: the perceived fairness of the instructor who has power over him, the conditions of the testing situation (presence or absence of disturbances, etc.), the weight of the examination in determining final grades, apprehension over having others find out if he does poorly, and the like. But common to all these factors is anxiety resulting from a perceived threat to motive gratification.

The conceptual model which illustrates the relationships in this stress-anxiety-performance paradigm, then, is as follows: an increase in stress may result in an increase in anxiety, which, up to a point, may have a facilitating effect upon performance; after a certain level of anxiety is reached, however, further increases have an inhibiting effect upon performance. The assumption that threat to motive satisfaction constitutes the stress which provokes anxiety in the student, enables one to employ this model in the examination situation. This study, consequently, includes attempts to vary certain stress aspects of a classroom examination situation. The expectation was that the assumed consequent varying degrees of anxiety would have predictable effects upon students' performance on the examination. The stress was manipulated by several operations all of which were designed to appear

to the students as potential barriers to their assumed goal of doing well on the examination.

However, mere confirmation or refutation of the hypothesis that stress is related to examination performance was not the central purpose of this study. What kinds of students are more likely to display a performance decrement under high stress? It was this question which provided the basis on which this study was constructed.

When the psychologist speaks of "kinds" of people he is generally referring to people who have scored differently on one or more measures of personality. And when the question arose in this study of the way various "kinds of students" react to stress, the thought was one of determing how students who scored differently on certain personality measures would react to stress conditions during a classroom examination. Hence, the paradigm developed as follows: in the face of a potentially threatening situation, the student's personality characteristics determine both the degree of anxiety he experiences and the way he is able to handle his anxiety; that portion of his anxiety remaining then affects his performance on an examination. The addition of these personality aspects made our conceptual model a more complex one, but also

one of more potential fruitfulness.[1] By determining how certain personality aspects mediate the effect of stress upon performance, we obtain a more detailed knowledge of the stress-performance relationship.

B. Four Personality Variables

The assumption that certain aspects of personality may be significantly related to performance under stress raises the question "What aspects of personality are relevant?" In making such a choice a combination of guess and availability of instruments generally weighs heavily. In the present case it was decided to choose four available measures of personality variables which seemed to have some promise of being related to classroom examination performance under stress. These measures will now be discussed.

1. The SA-S Inventory

The SA-S (Social Approach-Stability) personality questionnaire is an 80 item test which evolved from studies by Smith and Wood (57) of the personality differences

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[1] Even in this form, however, the model is an oversimplification. It is recognized that the motivational involvement of the student in his work will determine to what degree he perceives an "objectively stressful" situation as potentially threatening to himself. A student who cares little about high grades may experience little anxiety in a stress situation in which a grade-oriented student feels severely threatened.

between groups of fast and slow improvers in a reading improvement program at the University of Michigan. Scores of slow and fast improvers were obtained on R.B. Cattell's Sixteen Personality Factor Questionnaire. Tau coefficients of profile similarity were derived for every subject with every other subject. The resulting matrix was analysed by inspection to reveal four relatively distinct clusters of subjects. An item analysis was then carried out to determine which of the test items reliably differentiated among the four clusters. Since the mean profiles of two of the clusters were similar in anxiety but different in sociability and "independent self-sufficiency" (58), an item analysis was employed to further define the two dimensions which apparently ran through the clusters. Forty items were found to define each dimension. These were then administered to 100 students in a first course in general psychology and an internal consistency analysis was made. After discarding items with a validity below .20, 33 items remained in what was labeled the SA dimension and 32 items in the S dimension. The two dimensions have been reported to have acceptable reliabilities between .70 and .80, while their practical validities have been demonstrated in work with students in reading improvement classes. The two dimensions are practically orthogonal; coefficients of correlation between them of the magnitude of .15 have been found.

Since this instrument is considered to be itself an experimental device, SA and S are temporary labels for the two personality variables measured by the inventory. Perhaps a more descriptive term for the SA variable is Lewin's concept "permeability" or ease of communication among "tension system" boundaries. According to the Manual for the SA-S Inventory, (56) the high permeable (high SA) scorer is sensitive to external and internal stimuli, impulsive, somewhat dependent upon others for help in his decision making, tends to like social approval, and has less ego strength than the low SA scorer. The second dimension, stability at the high end and anxiety at the low end, is said to reflect free-floating anxiety, nervous tension and desurgency.

The possible relevance of these measures to the present study should be evident. If the highly permeable student is placed in a testing situation which carries a large potential threat, his increased sensitivity may result in the production of a level of anxiety which will cause a lower level of performance than that of the relatively impermeable student. And if the stability dimension is able to tap a basic anxiety in the low stability student, we might expect the addition of situation-induced anxiety to result in poorer performance than that displayed by the high stability student. It was on the basis of these expectations that the decision was made to include the SA and S personality variables in the present study.

2. The Need for Achievement and Need for Affiliation Measures

These measures, customarily abbreviated to n Ach and n Aff respectively, probably need less introduction and explanation than the previous two variables. In The Achievement Motive, (36) McClelland, et al. give an adequate explanation of the theory and technique involved in the n Ach measure. Essentially, the theory and technique of the n Aff measure differ from the n Ach measure only in content, rather than in form. Both are based upon the assumption behind any "projective" measure, namely, that the responses of a subject to rather ambiguous stimuli will be in part determined by the perceiver's motives. Consequently, in both the n Ach and n Aff measures, subjects are exposed to a series of pictures about which they immediately answer questions based upon their own imaginative interpretation of each picture. In scoring the subject's written responses, skilled judges read the answers for evidence of certain themes which are presumed to reflect the presence of the motive in the subject. Hence, if a judge were scoring for evidence of need for achievement in the subject, a "story" which reported that in a picture of a boy at a desk, "the boy is thinking that someday he will have a good job," would receive a "point" on the achievement score. Other such comments would, of course, add to the score of a subject.

Similarly, if a judge were scoring for need for affiliation, a story which interpreted a picture of four people talking around a table as "a meeting to make plans for a dance " would earn a point for n Aff for the subject.

The need for achievement is defined by McClelland, et al., as follows:

> By achievement goal is meant success in competition with some standard of excellence. That is, the goal of some individual in the story is to be successful in terms of competition with some standard of excellence. The individual may fail to achieve this goal, but the concern over competition with a standard of excellence still enables one to identify the goal sought as an achievement goal. This, then, is our generic definition of n Achievement.
> (36; pp. 110-111)

Research relating n Ach scores to recall of incompleted tasks has not been conclusive. But one (36; pp. 215,271) current interpretation of results argues that subjects scoring in the middle range of the n Ach distribution recall relatively more completed than incompleted tasks because they are defensive about their failures. On the other hand, subjects with high n Ach scores recall more incompleted tasks because they are primarily success oriented and want to finish the tasks. This suggests that high n Ach scorers are motivated chiefly by "hope of success," while moderate n Ach scorers are motivated chiefly by "fear of failure."

These results and interpretations apply only to males. Efforts to investigate the achievement motive of female subjects have been less successful. Attempts to arouse experimentally achievement motivation in females with the same technique used with males prcved unsuccessful (36; p. 178). However, research by Field (14) suggests that the achievement motive may be aroused in female subjects by referring to their social acceptability. In spite of this finding, workers in this area are much less certain of their findings and interpretations regarding females than they are regarding males.

In view of the suggestion that the n Ach measure discriminates between success oriented and failure fearing persons, it was considered likely that it might usefully distinguish subjects in this study who reacted differently to stress during an examination.[1] These differently oriented kinds of persons might differ both in the kinds of attitudes they brought to the testing situation, and in

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[1] The n Ach measure may also discriminate between persons strongly desiring achievement and those relatively unconcerned with achievement. One would expect high stress to have the most threat for those persons most concerned with achievement--the high and middle n Ach scorers. The low n Ach scorers, being less involved, may even be motivated to some improvement in performance by stress conditions.

their abilities to handle the stressful aspects of it. If either or both possibilities were true, the n Ach measure might help explain students' examination performance under stress. In view of this possibility, it was decided to use the n Ach measure in this study.

The need for affiliation has been defined as follows:

> Any evidence of concern over establishing or maintaining a positive affective relationship with another person(s) (in addition to concern over restoring broken relationships) is viewed as symptomatic of motivation to affiliate.... (3; p. 407)

Although the n Aff measure is newer and less well understood than the n Ach measure, there is the suggestion in the definition of this variable that high n Aff persons should be made more anxious by being deprived of their affiliative ties than low n Aff persons. In terms of the examination situation, then, it may be reasonable to expect that if a high n Aff student were removed from some of his fellow students, from his teacher, and from his usual classroom, and required to take an important examination in a strange room with a strange "unaffable" teacher, he would experience more anxiety than a comparable low n Aff student. It was in the light of such reasoning that the n Aff measure was included as one of the personality measures of this study.

The expected relationships of the personality variables used in this study to course examination performance under stress were formalized in a number of hypotheses:

1. Re SA: High SA (permeability) students in a high stress situation will score lower than high SA students in a low stress situation; no differential response to stress will be shown by moderate or low SA students.

2. Re S: Low S (stability) students in a high stress situation will score lower than the low S students in a low stress situation; no differential response to stress will be shown by moderate or high S students.

3. Re n Ach: Moderate n Ach (need for achievement) male students in a high stress situation will score lower than moderate n Ach males in a low stress situation; no differential response to stress will be shown by low or high n Ach males. (No prediction is made for female students.)

4. Re n Aff: High n Aff (need for affiliation) students in a high stress situation will score lower than high n Aff students in a low stress situation; no differential response to stress will be shown by moderate or low n Aff students.

One hypothesis is stated for each of the personality measures. The objective in devising them was to select the one subclassification of students within each personality variable (e.g., high SA) which would most likely show a performance decrement under high stress, as compared with performance under low stress.

Most students were assumed to be more anxious under high stress than under low stress. But, because of certain personality characteristics, some students were hypothesized to show a greater deterioration of performance under stress than other students with different personality characteristics. For example, stress was believed to have a greater detrimental effect upon the performance of high SA scorers than upon that of moderate or low SA scores. The test of this was whether high SA students under high stress performed significantly more poorly than comparable high SA students under low stress, whereas no such significantly different responses to stress conditions were expected for moderate or low SA scorers. If the hypothesis predicting such a finding were confirmed, the relevance of the SA dimension to performance under stress would be demonstrated. The predictions of significant findings for low S, moderate n Ach (males), and high n Aff students were based upon similar reasoning.

While these predictions seemed reasonable, because of the newness and consequent imprecise meaning of the personality measures employed here, it was felt that these hypotheses should be considered tentative. As a result, it was decided that significance of differences between groups should be tested with a two-tailed test.

The logic of this would then permit the exploratory testing for significance of differences wherever they were observed either within or outside of the structure of the stated hypotheses.

D. Summary

The problem of this study was to determine the relationship of four personality variables to performance on course examinations under experimentally emphasized stress. The four personality variables were need for achievement, need for affiliation, SA (a "permeability" dimension,) and S (a "stability" dimension.) The stress was conceived as the sum of certain operations calculated to be perceived by the student as a potential barrier to his goal of doing well on a course examination. This stress was considered to increase the level of anxiety of the student taking the examination, which would in turn interfere with his performance. Four tentative hypotheses were generated out of the supposed relationship of the four personality variables to examination performance under stress.

The specific procedures and operations by which this conceptual structure was activated are presented in the next chapter.

CHAPTER III

PROCEDURE

The following operations are presented in an order closely approximating the sequence in which they were actually performed.

A. Subjects

The subjects in this experiment were all students enrolled in 12 sections of the elementary psychology course at the University of Michigan during the Spring 1955 semester.[1]

Two levels of stress were used. One of these was a high stress condition in which every reasonable attempt was made to raise the stress of the examination situation. The second was a low stress condition in which an effort was made to make the situation as unstressful as an examination can be. The details of the operations by which these two conditions were created are given later.

Students were assigned to high and low stress groups on the basis of their performance on four measures:

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[1] The writer gratefully acknowledges the cooperation of the teachers of these sections. They are: Robert Davage, Philip Diem, Charles Kepner, Richard Teevan, and Morton Wagman.

American Council on Education (ACE) test total score, grade-point average (GPA), and scores on their first examinations (Exam I and Exam II) in the elementary psychology course. A multiple regression equation combining these four measures was used as a basis for matching and assignment to groups on the basis of predicted score on the third examination. The multiple regression was computed on the basis of correlations obtained from students taking elementary psychology in the Fall 1954 semester. The intercorrelations among the independent variables of the multiple regression equation (ACE score, GPA, Exam I score, and Exam II score) for the Spring semester were not markedly different from those of the Fall semester. Table 1 presents these correlations.

TABLE 1

INTERCORRELATIONS AMONG THE INDEPENDENT VARIABLES OF THE MULTIPLE REGRESSION EQUATION FOR FALL AND SPRING SEMESTERS

Correlation Between:	Fall	Spring	Difference
ACE & GPA	.499	.413	.086
ACE & Exam I	.359	.347	.012
ACE & Exam II	.237	.294	.057
GPA & Exam I	.376	.511	.135
GPA & Exam II	.349	.454	.105
Exam I & Exam II	.505	.466	.039

Since the differences between the Fall and Spring correlations were small, the beta weights obtained by computing the multiple regression equation with the Fall semester data were used to predict the third examination scores of Spring semester students.[1]

By means of this device it was possible to control the composition of high and low stress experimental groups for general ability and past academic performance. It necessitated only a procedure for assigning students to these groups on the basis of their predicted score. This was accomplished by randomly placing each member of pairs of students who had identical predicted scores in the high or low stress group. The remaining "non-matched" students were then ranked by predicted score and assigned to high or low stress groups by the following kind of serpentine procedure: In the classes of Carrier, Davage, and Diem, the student ranking 1 was placed in the high group, 2 and 3 were placed in the low, 4 in high, 5 in low, 6 and 7 in high,

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[1] Appendix A presents the regression equation and R.

and so on until all students had been assigned. With the classes of Kepner, Teevan, and Wagman a similar procedure was employed, the only difference was that the student ranking 1 was placed in the low group, 2 and 3 in the high group, and so on.

While the use of the regression equation permitted a general control of whatever ability, motivational, and other factors contributed to the past performance of our subjects, it also meant that some subjects would be lost. Any student for whom an ACE score, GPA, Exam I or Exam II score could not be obtained would be lost to the study, since no predicted score could be computed without all of these independent variables. This means that the sample of subjects on which this study is based, aside from whatever limitations on generalization the use of college students imposes, was further distinguished by containing no first semester freshmen (no GPA available), no transfer students (no ACE score available), and none of the kind of student who "misses" course examinations.

The final sample of this study was composed of 125 students in <u>each</u> of the experimental groups. The high stress group consisted of 43 male and 82 female students. The low stress group contained 60 male and 65 female students. In assigning subjects to the two groups no thought was given to their sex. The resulting discrepancy between the number of males in the high and low stress groups must be attributed to the perversity of chance.

B. Administration of the Personality Measures

The n Ach and n Aff measures were administered to all 12 classes of students during the first week of the Spring semester. The administration and scoring of these measures was done under the supervision of Dr. John W. Atkinson.[1]

The SA-S questionnaire was administered in each of the 12 classes at sometime during the middle third of the semester. In all classes this was done before the experiment was performed. The questionnaire was scored by the writer.

C. The Stress Situations

Approximately one week before each class was to take part in the experiment, each student received a sheet of paper notifying him where he would take his next examination. An attempt was made to keep the perception of this unusual procedure as "another experiment" from forming. When occasionally pressed for an explanation, instructors generally stated that it was a departmental plan for relieving room congestion during examinations.

All of the "third" examinations by each of the six

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[1] The stimulus pictures for males were 1B, 1A, 1H, and 1G for n Ach, and 3A, 3I, 3C, and 3F for n Aff. Those for females were 126, 127, 131, and 132 for n Ach and 3, 4, 5, and 6 for n Aff.

instructors were given during a three week period from May 4, 1955 to May 25, 1955.

The following operations were performed to create the high and low stress conditions.

1. High Stress

a. High stress students took their examination in a strange room. This manipulation was intended to provide more distracting cues to the highly permeable high SA scorers.

b. Students were very closely proctored by a strange instructor.[1] Students with high affiliation needs were presumed to be detrimentally affected by being deprived of their usual instructor.

c. An instruction sheet at the beginning of the examination stated that a "guessing penalty" of one point would be deducted for each wrong answer, although no question was to be left unanswered. The students' achievement was seen as potentially threatened by this rule. (A copy of this instruction sheet will be found in Appendix B).

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[1]The present writer served as the strange instructor in all of the experimental sessions except those with his own two classes. In these, this role was played by Dr. W.J. McKeachie and by Mr. Charles P. Smith.

d. Two five alternative, multiple-choice practice questions were answered before beginning the examination. (See Appendix C). After everyone had answered these, the instructor announced the "correct" answers and instructed the students to indicate on their papers whether they got each question right or wrong. Both of these questions were very difficult. It is assumed that a correct answer could be obtained on the first only by chance. Since an unlikely-sounding wrong answer was announced as correct for the second question, few people got this one "correct." The resulting failure experience on these practice questions was calculated to add to the student's expectancy of a difficult examination constituting a barrier to his achievement goal.

e. The instructor maintained a cold, abrupt and rather severe demeanor throughout the period. His explicit statement that absolutely no questions would be answered by him after the test began was intended to present him as refusing to facilitate the goal movement of the student by removing potential barriers in question wording, interpretation, etc., that might arise during the course of the examination. This manipulation was considered to be threatening especially to the highly permeable students (who tend to be dependent on others in their problem solving), and to the high need for affiliation students.

2. Low Stress

a. Low stress students took their examination in their usual classroom.

b. Their usual instructor was in the room with them.

c. They were told that there would be no guessing penalty for incorrect answers.

d. No formal instruction sheet or practice questions were given to these students.

e. A special answer sheet was used by students in the low stress situation. It provided a space after each question in which the student could make any comments if he wished. It was the same type of answer sheet found to be most effective in improving examination scores by McKeachie, et al. (38) (A copy will be found in Appendix D).

f. Throughout the examination the instructor tried to maintain a warm, interested, relaxed manner. He did his best to give the students the impression that he was sincerely interested in assisting them to do well in every way he legitimately could.

As each student finished his examination he answered a question which asked whether he had "clutched" at any time during the examination. This question was included in an attempt to determine if subjective reports

of anxiety would accompany the stress conditions under which the subjects worked.[1]

D. Preparation of Data

Since the examination given by each of the instructors did not contain the same number of items, each instructor's test scores were transformed into "z-scores." This permitted the comparison of test performance of students in each of the different classes.

It was discovered early in the analysis of the data that the mean predicted z-score for the high and low stress groups was not the same in spite of the "matching" procedure. Since it was considered desirable to begin analysis of the data with the same N and mean predicted z-score in the two experimental groups, a minimum number of subjects from each instructor's classes was discarded to bring the mean predicted scores to equality in the low and high stress groups. This operation was done without knowledge of the personality scores of the students. This resulted in the elimination of 23 subjects, and left a final sample of 125 subjects in each of the experimental groups.

The subsequent analyses and findings with these data will be presented in the next chapter.

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[1] See Appendix E for a copy of the questions asked and for other attempts to detect anxiety.

CHAPTER IV

ANALYSIS OF DATA AND DISCUSSION OF RESULTS

A. Performance of Low and High Stress Groups

The data from the question on whether the students had "clutched" during the examination were analyzed to determine whether clutching had been more prevalent in one of the experimental situations. The expectation was, of course, that more clutching would have been reported by students in the high stress situation than by students in the low stress situation. Table 2 presents the relevant data.

TABLE 2

REPORTS OF "CLUTCHING" BY STUDENTS IN THE HIGH AND LOW STRESS GROUPS

		Clutch?			
		Yes	No	Totals	
Stress	LOW	36	87	123	$X^2=5.99$
	HIGH	55	69	124	(2% level)
	Totals	91	156	247	

The Chi square test shows significance at the 2% level. It would appear from this that there was proportionately more clutching in the high stress situation than in the low stress situation. This would seem to provide some support for the differential "stressfulness" of the two experimental conditions.

A gross comparison of the performance of students in the low and high stress situations was made for males and females. The following results were observed.

TABLE 3

EXAMINATION SCORES OF MALES AND FEMALES UNDER THE HIGH AND LOW STRESS CONDITIONS

Stress	Sex	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Male	60	.04	.21	.17
	Female	65	.07	.14	.07
HIGH:	Male	43	.08	.17	.09 t=1.71
	Female	82	.04	-.13	-.17 (10%;2 tails)

It is apparent from this table that relative to their mean predicted z-score, the mean test z-score of the females in the high stress situation showed a smaller gain (actually a loss) than that of the females in the low stress situation. These results suggest that the performance of female students may have been more detrimentally affected by the stress factor than that of the male students.

Taking this as a lead, the data were examined to see if female subjects in the high stress situation showed large losses from their predicted z-score more

frequently than males. For this purpose it was arbitrarily decided to take subjects whose "gain" scores were at least -.70, that is, students whose test z-score was at least .70 less than their predicted z-score. These were called "big losers." If there had been no difference between sexes, 9 male and 17 female big losers would have been expected by chance on the basis of their proportional representation in the high stress half of the sample. Actually, four male and 22 female big losers were observed. The Chi square test of significance showed these differences to be significant at the 5% level (X^2=4.25).

There seemed, then, to be evidence of a differential reaction to the stress situation on the basis of sex. In view of this interesting and unanticipated finding, all further analyses were made separately for males and females.

B. Personality and Response to Stress

Finding an over-all effect on performance of the stress conditions was not the main objective of this study, however. The important goal was to determine whether certain "personalities" were more affected by the stress than others. The data on the four personality variables used here must be brought into the analysis to answer this question.

Interpretation of results could depend upon the extent to which the four personality measures may be correlated. The following two tables present these product-moment correlation coefficients.

TABLE 4

INTERCORRELATIONS OF SA, S, n ACH, AND n AFF - MALES ONLY

	SA	S	n Ach	n Aff
SA	-	.12	.05	.04
S		-	.06	.05
n Ach			-	.08
n Aff				-

TABLE 5

INTERCORRELATIONS OF SA, S, n ACH, AND n AFF - FEMALES ONLY

	SA	S	n Ach	n Aff
SA	-	.11	.08	.12
S		-	.02	.08
n Ach			-	.10
n Aff				-

It may be inferred from the apparent independence of each of the four personality variables employed in this study that the results obtained with any one can hardly be attributed to its relationship to one of the others.

1. The SA (Permeability) Dimension

The mean score on the SA test for males was 15.78, and for females 15.74. Since the means and the form of

the distributions were very similar, the same "breaks" were employed for males and females.

In order to obtain the necessary breaks the SA scores were divided into three groups composed of almost equal numbers. An SA score of 19 or greater was called a Hi SA score, those of from 14 through 18 were called Mid SA scores, and one of 13 or lower was called a Lo SA score. Test performance for each of these groups of students was then analyzed under the two experimental conditions. Tables 6 and 7 present these data for males and females respectively.

TABLE 6

EXAMINATION SCORES OF HI, MID, AND LO SA SUBJECTS UNDER HIGH AND LOW STRESS (MALES ONLY)

Stress	SA	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	17	.29	.57	.28
	Mid	17	-.03	-.21	-.18
	Hi	20	-.20	.19	.39
HIGH:	Lo	11	.10	.44	.34
	Mid	20	.04	.12	.08
	Hi	12	.13	.00	-.13

t=2.26 (2%-5%; 2 tails)

From Table 6 it is apparent that there was a significant difference at the 2% to 5% level of confidence

between the gain scores of the Hi SA males in the high and low stress groups. The stress had a more detrimental effect upon the Hi SA person than on the other two groups of SA scorers. Although the predicted scores of the two Hi SA groups were unequal, this hardly seems sufficient to account for the significant difference between the increment of the low stress group and the decrement of the high stress group.

TABLE 7

EXAMINATION SCORES OF HI, MID, AND LO SA SUBJECTS UNDER HIGH AND LOW STRESS (FEMALES ONLY)

Stress	SA	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	22	.26	.21	-.05
	Mid	21	.12	.05	-.07
	Hi	18	-.17	.14	.31
HIGH:	Lo	21	.28	.26	-.02
	Mid	27	.08	-.16	-.24
	Hi	33	-.13	-.38	-.25

t=2.43 (2%;2 tails)

The importance of the SA dimension is apparent with the female subjects too. Results as discrepant as those observed here could be expected by chance only twice in a hundred repetitions of the conditions of this

experiment. As was found with the male subjects, the stress had the most detrimental effect upon Hi SA female subjects, as compared with Mid and Lo SA female subjects.

These findings with regard to the SA dimension would seem to provide support for our hypothesis that high permeability students in a high stress situation would score lower on a course examination than high permeability students in a low stress situation.

2. The S (Stability) Dimension

The mean score on the S test for males was 18.1, and for females 16.7. In view of this difference, it was decided to employ different breaks to obtain Hi, Mid and Lo S groups for male and female subjects. For males: an S score of 21 or greater was termed a Hi S score, scores of 16 through 20 were called Mid S scores, and a score 15 or lower was called a Lo S score.

The following table presents the data relevant to the performance of Hi, Mid, and Lo Stability male subjects.

There is a suggestion from these results that low stability male students performed more poorly under high stress than low stability male students under low stress.

TABLE 8

EXAMINATION SCORES OF HI, MID, AND LO S SUBJECTS UNDER HIGH AND LOW STRESS (MALES ONLY)

Stress	S	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	19	-.03	.37	.40
	Mid	17	-.01	.03	.04
	Hi	19	.08	.15	.07
HIGH:	Lo	15	.13	.10	-.03
	Mid	15	.03	.37	.34
	Hi	13	.08	.01	-.07

t=1.97 (5%-10%; 2 tails)

The breaks on S for the female subjects resulted in subjects who scored 19 or more being referred to as Hi S subjects, those who scored from 15 through 18 being called Mid S subjects, and those scoring 14 or below being called Lo S subjects. The data relevant to the performance of Hi, Mid, and Lo stability female subjects is shown in Table 9.

Little may be inferred from these data except for the fact that the unfortunate appearance of only 9 Mid S females in the low stress group renders the relationship between Mid S and performance under two degrees of stress highly suspect. Although the Mid S females seem to have done better under low stress than under high stress, little confidence can be placed in such a finding.

TABLE 9

EXAMINATION SCORES OF HI, MID, AND LO S SUBJECTS UNDER HIGH AND LOW STRESS (FEMALES ONLY)

Stress	S	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	22	-.02	-.04	-.02
	Mid	9	.14	.49	.35
	Hi	30	.14	.16	.02
HIGH:	Lo	26	.09	-.07	-.16
	Mid	33	.02	-.28	-.30
	Hi	22	.04	-.01	-.05

t=1.55 (10%-20%; 2 tails)

The results with regard to the S dimension, then, fail to provide convincing support for the hypothesis that low stability students in a high stress situation will perform more poorly on a course examination than low stability students in a low stress situation.

3. The n Ach Variable

Since the n Ach measure administered to males was different from that given to females, analysis must be done separately for males and females here too. When the male n Ach distribution was broken into thirds, the following breaks resulted. Scores of 8 or greater were called Hi n Ach, scores of 4 through 7 were called

Mid n Ach, and scores of 3 or lower were called Lo n Ach. When the female n Ach distribution was broken into thirds, scores of 6 or greater were called Hi n Ach, scores of 2 through 5 were called Mid n Ach, and scores of 1 and below were called Lo n Ach. Table 10 presents the performance data of Hi, Mid and Lo n Ach males.

TABLE 10

EXAMINATION SCORES OF HI, MID, AND LO n ACH SUBJECTS UNDER HIGH AND LOW STRESS (MALES ONLY)

Stress	n Ach	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	23	.01	.23	.22
	Mid	13	.08	.25	.17
	Hi	18	.06	.06	.00
HIGH:	Lo	9	.13	.42	.29
	Mid	13	.05	.12	.07
	Hi	14	.11	.20	.09

None of the apparent gains in this table between n Ach groups under two stress conditions are significantly different. The improvement beyond the predicted mean z-score of the Lo n Ach group in the Low stress situation is reliable at about the 11% level, but this may have been due to a suspected "late-comer" phenomenon in Lo n Ach males by which they show academic achievement rather late in the term when the "pressure" begins to prod them into it.

This may be illustrated further by the apparent improvement of Lo n Ach males in the High stress group too. None of the data, however, indicate n Ach to be significantly related to the male subjects' performance under stress.

The findings are quite different, however, when the female n Ach data are examined. Table 11 presents these.

TABLE 11

EXAMINATION SCORES OF HI, MID, AND LO n ACH SUBJECTS UNDER HIGH AND LOW STRESS (FEMALES ONLY)

Stress	n Ach	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	21	.07	.34	.27
	Mid	14	-.01	.12	.13
	Hi	20	.01	.15	.14
					t=2.96 (1%;2 tails)
HIGH:	Lo	21	-.04	-.54	-.50
	Mid	24	-.10	-.21	-.11
	Hi	21	.17	.11	-.06

The discrepancy between gain scores of Lo n Ach females in the Low and High stress groups that is observed here is a stable one at the 1% level of confidence. It would seem that stress had a particularly detrimental effect on the Lo n Ach female subjects.

The tentative hypothesis regarding an association of moderate need for achievement and poor performance by males under stress has not been supported. In the case of male subjects, no relationship at all has been reliably observed. In the case of female subjects, a significant tendency has appeared for low need for achievement to be related to poor performance under stress.

4. The n Aff Variable

When the distribution of n Aff scores for males was broken into thirds, scores of 4 or above became Hi n Aff scores, scores of one through 3 became Mid n Aff scores, and scores of zero became Lo n Aff scores. When the female n Aff distribution was split into thirds, scores of 6 or above became Hi n Aff scores, those from 3 through 5 became Mid n Aff scores, while scores of 2 or less became Lo n Aff scores.

The findings with regard to the n Aff variable were generally negative. Table 12 presents the findings for the males.

The apparent gains in this table between Mid n Aff groups under Low and High stress are not different at an acceptable level of confidence. Since t=1.26, not even the 20% level is attained. The findings may hardly be regarded as suggestive, since the small N's and the apparent discrepancy between predicted scores of the two

Mid n Aff groups render analysis here a questionable procedure. Further, the suggestion in this table that Hi n Aff males responded differently under the two stress conditions is an uncertain one. The discrepancy between the predicted scores for the two Hi n Aff groups precludes certainty on this point.

TABLE 12

EXAMINATION SCORES OF HI, MID, AND LO n AFF SUBJECTS UNDER HIGH AND LOW STRESS (MALES ONLY)

Stress	n Aff	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	17	.12	.41	.29
	Mid	19	.00	.14	.14
	Hi	18	.02	.00	-.02
HIGH:	Lo	15	.19	.32	.13
	Mid	10	-.21	.27	.48
	Hi	11	.27	.06	-.21

The female results with regard to n Aff are scarcely more illuminating. Table 13 displays these data.

Interpretation of these results is difficult. Comparisons of the gain scores of Lo, Mid, and Hi n Aff students in low and high stress groups revealed no statistically reliable differences. While the Lo n Aff variable would seem important were only gain scores examined, the difference in mean predicted score between the two Lo n Aff groups renders this interpretation dubious.

The discrepancy between gains of the Mid n Aff groups is noticeable, but is not significant. The suggestion that Hi n Aff females showed a performance decrement in both stress conditions is also unreliable.

TABLE 13

EXAMINATION SCORES OF HI, MID, AND LO n AFF SUBJECTS UNDER HIGH AND LOW STRESS (FEMALES ONLY)

Stress	n Aff	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	Lo	17	.23	.42	.19
	Mid	27	.09	.32	.23
	Hi	20	-.08	-.22	-.14
HIGH:	Lo	25	-.03	-.20	-.17
	Mid	30	.16	.10	-.06
	Hi	23	.01	-.32	-.33

In view of the results with regard to the need for affiliation variable, the hypothesis that high need for affiliation students in a high stress situation show poorer performance on a course examination than similar students in a low stress situation has received no support.

5. The SA-S Types

Another way of extracting meaningfulness from the SA and S variables is to treat them as uncorrelated dimensions defining four personality "types." If these

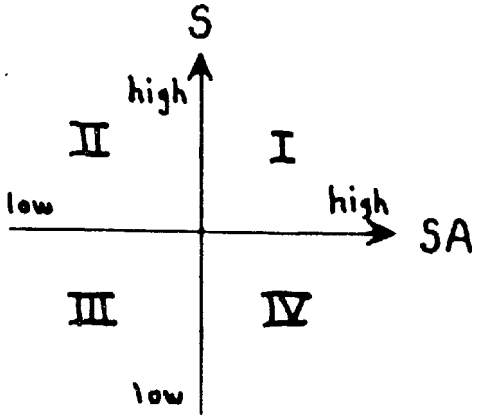
two dimensions be pictured at right angles to each other, the resulting four quadrants represent four personality types. A person's position within one of these types is determined by his SA and S scores.

The computed product-moment correlation of SA and S for 98 males of this study was .12; that for 142 females was .11. For our purposes, then, SA and S may be treated as uncorrelated.

The following diagram shows the SA-S types.

FIGURE 1

SA-S PERSONALITY TYPES



It may be seen that a person with a high SA score and a high S score would be classed as a Type I, a low SA score and a high S score would classify one as a Type II, and so on for Type III and Type IV.

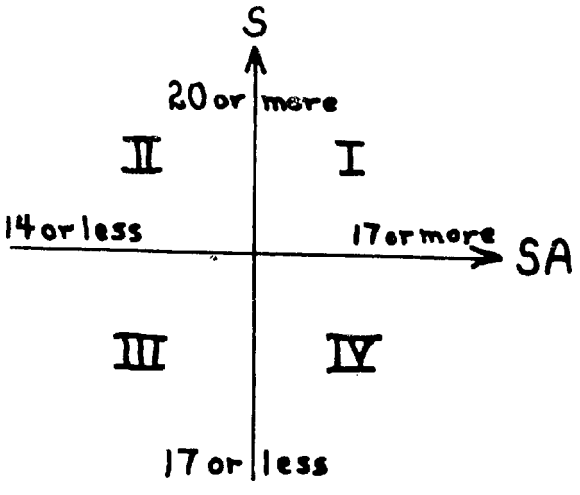
The question may now be raised of the performance under stress of these types of subjects. To make such an analysis it was necessary to break the SA and S distributions into a low half and a high half. Breaks were first

made as close to the median as possible. Then further breaks were arbitrarily made so as to eliminate those "borderline" subjects who would have otherwise been classified as one Type rather than another because of only one point present or lacking in their SA or S score (or both).[1] These breaks for males and females are presented in the following diagrams. It may be seen that a central range of two points was thereby eliminated on each dimension. Although this cut into the number of subjects of each type available for analysis, it was felt that the resulting "purity" of types would produce more dependable results.

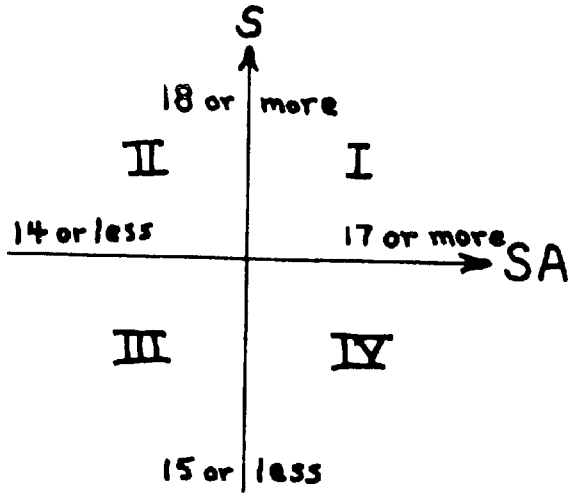
FIGURE 2

SA-S PERSONALITY TYPES IN THIS STUDY

Breaks for SA-S Type Males



Breaks for SA-S Type Females



[1] This procedure was employed to follow a somewhat similar precedent established by Smith in his work with the SA-S types.

The performance data for the SA-S Types are presented in the following two tables.

TABLE 14

EXAMINATION SCORES OF SA-S TYPE SUBJECTS UNDER HIGH AND LOW STRESS (MALES ONLY)

Stress	SA-S Type	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	I	12	-.14	.07	.21
	II	9	.23	.14	-.09
	III	12	.15	.44	.29
	IV	8	-.08	.24	.32
HIGH:	I	9	-.09	-.29	-.20
	II	3	.05	.48	.43
	III	9	.19	.42	.23
	IV	9	.27	.25	-.02

There is little evidence of a Type difference in response to stress in this table. The apparent differences between the gain scores of the Low and High stress Type I's and between those of the Low and High stress Type IV's are far short of statistical significance, while the discrepant predicted scores of the latter render comparison a questionable procedure. And, of course, the small N of the High stress Type II group precludes any analysis.

TABLE 15

EXAMINATION SCORES OF SA-S TYPE SUBJECTS UNDER HIGH AND LOW STRESS (FEMALES ONLY)

Stress	SA-S Type	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	I	14	-.06	.25	.31
	II	13	.31	-.09	-.40
	III	10	.12	.29	.17
	IV	9	-.25	-.30	-.05
HIGH:	I	19	-.15	-.41	-.26
	II	9	.43	.36	-.07
	III	11	.22	.25	.03
	IV	19	-.18	-.49	-.31

t=2.04 (5%; 2 tails)

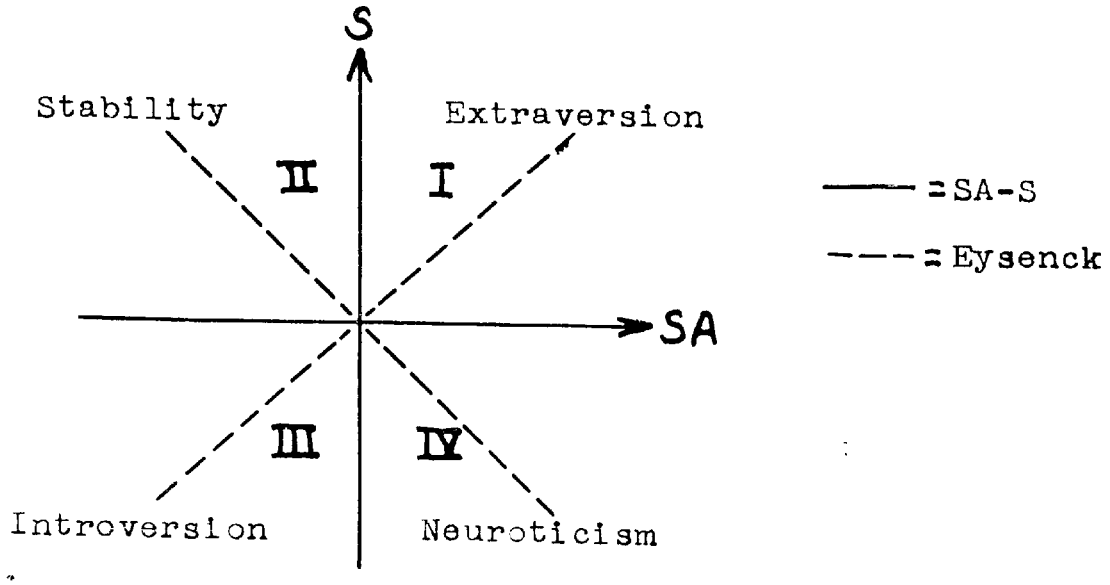
With the female subjects, it would seem that the Type I's made the greatest differential performance response to the stress conditions of all the Types. This indicates that the Hi SA, Hi S female was the SA-S Type most affected by the stress conditions of this experiment.

Another interesting analysis in terms of the SA and S dimensions may be made in the light of a comparison between the SA and S dimensions and Eysenck's Extraversion-Introversion and Neuroticism dimensions made by Roger L. Wood of the Bureau of Psychological Services at the University of Michigan. (78) After examining Eysenck's description of Cattell's factors (13; pp. 63-67), Wood has asserted that Eysenck's dimensions have a certain

correspondence to the SA-S dimensions.[1] In brief, Wood's analysis seems to indicate that the SA-S Type I corresponds to Eysenck's extravert, Type III to the introvert, Type II to Eysenck's stable personality, and Type IV to the neurotic personality. In effect, this means that Eysenck's uncorrelated dimensions and the uncorrelated SA-S dimensions may be superimposed one on the other as in Figure 3.

FIGURE 3

SA-S AND EYSENCK PERSONALITY DIMENSIONS COMPARED



It would seem that the Type I females who gave a significant response to the experimental conditions of this study may be described as extraverts in Eysenck's

[1] It should be recalled that the SA-S questionnaire was derived from the Cattell 16 PF Test.

sense. The Type IV's or "neurotic" female subjects, did not display a significant difference between experimental conditions, although a suggested "drop" under high stress is indicated.

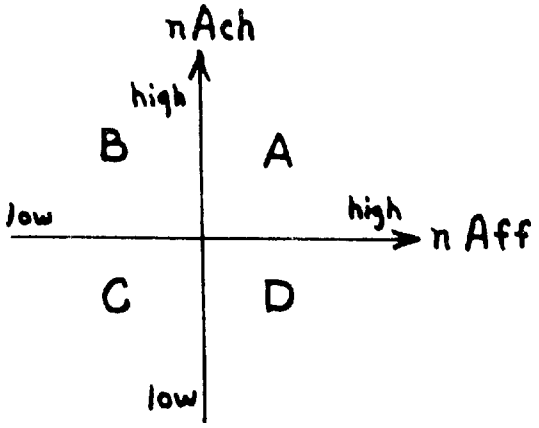
6. The Ach-Aff Types

In a manner similar to the SA-S type analysis, n Ach and n Aff scores may be combined to generate four personality types. Since the computed product-moment correlation of n Ach and n Aff for the males of this study was .08, and for the females .10, we may regard these variables as essentially uncorrelated.

The Ach-Aff personality Types are located by the following diagram. For convenience, the four Types will be designated by the letters A,B,C, and D.

FIGURE 4

ACH-AFF PERSONALITY TYPES

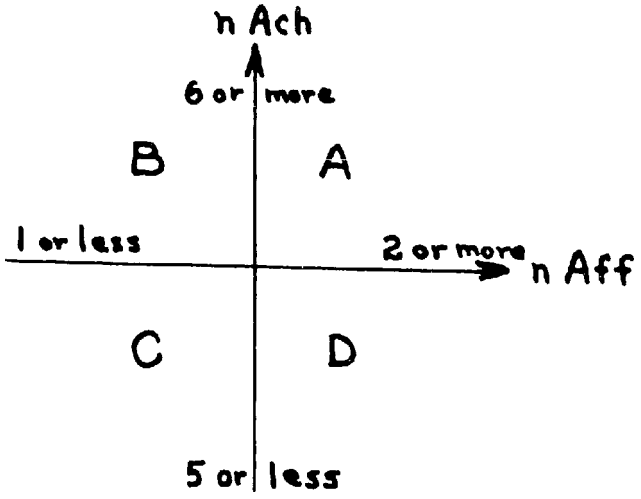


The Ach-Aff Types were formed by a simple median break on each of the two variables. The following diagrams show these breaks for males and females.

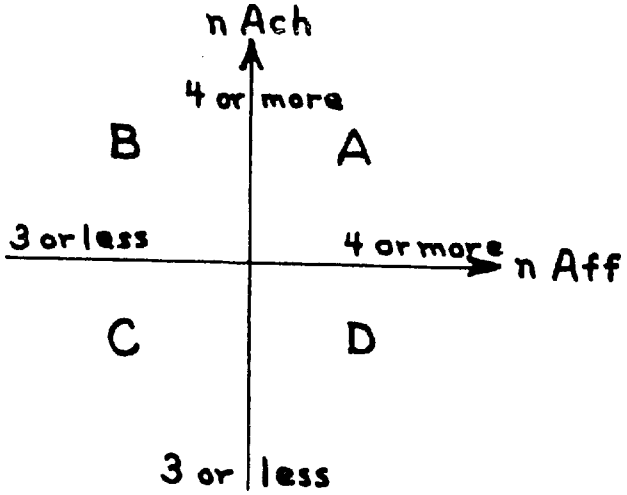
FIGURE 5

ACH-AFF PERSONALITY TYPES IN THIS STUDY

Breaks for Ach-Aff Type Males



Breaks for Ach-Aff Type Females



The performance data for these Types are given in the following two tables.

TABLE 16

EXAMINATION SCORES OF ACH-AFF TYPE SUBJECTS UNDER HIGH AND LOW STRESS (MALES ONLY)

Stress	Ach-Aff Type	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"
LOW:	A	13	-.09	-.16	-.07
	B	9	.36	.44	.08
	C	17	-.07	.37	.44——t=2.75
	D	15	.10	.11	.01 (2%; 2 tails)
HIGH:	A	12	.08	.04	-.04
	B	9	.18	.22	.04
	C	10	.00	.39	.39——t=1.70
	D	5	.24	.35	.11 (10%-15%; 2 tails)

Comparing the gain scores of a given personality type under the two stress conditions we find that these types have no explanatory value as far as the performance under stress of our male subjects is concerned. It is notable, however, that Type C males (Lo n Ach, Lo n Aff) showed gains under both experimental conditions. Under Low stress the gain is statistically reliable at the 2% level. Under High stress a gain is strongly suggested. This evidence may provide further clarification of the earlier inference that Lo n Ach males are "late comers." It may be a reasonable guess that Lo n Ach, Lo n Aff male students tend to "put off" study effort until rather late in a semester when the threat of failure induces motivation to study.

TABLE 17

EXAMINATION SCORES OF ACH-AFF TYPE SUBJECTS UNDER HIGH AND LOW STRESS (FEMALES ONLY)

Stress	Ach-Aff Type	N	Mean Predicted z-score	Mean Exam z-score	Relative "gain"	
LOW:	A	16	-.12	-.01	.11	
	B	10	.26	.41	.15	
	C	12	.29	.82	.53	
	D	17	-.15	-.07	.08	t=2.60 (2%; 2 tails)
HIGH:	A	14	.04	-.05	-.09	
	B	14	.21	.19	.02	
	C	19	.07	-.32	-.25	
	D	19	-.10	-.40	-.30	

Type C (Lo n Ach, Lo n Aff) females seem to have responded in a way consistent with the expected effects of the stress conditions of this experiment. Between the stress conditions a difference in performance significant at the 2% level was observed. Our previous analyses showed low achievement to be related to stress performance, and low affiliation to be unclear on this point. When combined in Type C, however, low achievement and low affiliation would seem to produce the emergence of a personality sensitive to stress under the conditions employed here.

C. Discussion and Conclusions

This study was conceived in the belief that individual performance differences in response to stress during examinations are related to detectable personality variables. The foregoing analyses seem to provide some supporting evidence.

One overall conclusion which is strongly suggested by our analysis is that there may be a sex difference in response to stress. The greater frequency of significant findings in this chapter for females stands out.

Mead (40) has proposed that the role of the American female is social and dependent behavior, not career accomplishment in competition with males. Field (14) and McClelland, et al., (36) have reached a similar

conclusion and have proposed that achievement motivation in females is tied up with social acceptability. It may be that inasmuch as the performance task in this study was a relatively "non-social" one, that female subjects under stress found themselves less well "equipped" by experience for academic achievement in the face of threat. This implies a relatively greater facility within males for this kind of performance under pressure. The female student in a (so to speak) male achievement area, is more detrimentally affected by stress than is the male.

The SA (Permeability) dimension has some promise as a means of differentiating individual performance response to stress. Our results indicate that Hi SA scorers in a High stress examination situation have performed less well than Hi SA scorers under low stress examination conditions. The greater sensitivity to internal and external stimuli and dependency upon others in his decision making of this highly "permeable" individual, may suggest something of the inner state which interferes with his performance when he is exposed to stress conditions such as those employed in this study. It must be concluded that the hypothesis with regard to the SA dimension (p. 33) has found support in this study.

The S (Stability) dimension has shown less discrimination. While there is an implication in our data that stress has more of a detrimental effect upon the

examination performance of Lo S male students than upon that of Mid or Hi S male students, the statistical analyses do not warrant placing much confidence in these appearances. The hypothesis with regard to the S dimension (p. 33) must be regarded as having received only tentative support.

The n Ach (need for Achievement) variable has shown a sex interaction. Contrary to the prediction with which analysis began, the data show no differential performance response of male students of a given n Ach level. One inference from these data has been gleaned, however. It is that an apparent improvement of Lo n Ach males under both experimental conditions may reflect a tendency of these students to "achieve" academically only late in the semester when the "pressure is on."

The Lo n Ach females gave a clear differential response to the stress conditions. Morrison (43) has reported a positive correlation with female n Ach scores of certain behavioral manifestations of achievement, such as scholastic average, ACE score, and production on an experimental achievement task. In a personal communication to the writer, Morrison indicated that under conditions of moderate involvement in an experimental task there appears a rather steep linear gradient in the positive relationship of female performance to n Ach score. Under high task involvement, however, the relationship gradient becomes much less steep as Lo n Ach females show a large

improvement, Mid n Ach females show a moderate improvement, and Hi n Ach females show a slight improvement. The pressure of the high stress situation in the present study apparently re-established the "steep" relationship between n Ach and performance which may be observed in Table 10. It may be that the earlier proposal that female subjects are less well "equipped" to handle anxiety in an academic performance situation is especially true of Lo n Ach females who either have denied or have not accepted achievement as one of their strong motives.

Speculations about the meaning of need for achievement frequently involve the assumption that Mid (or Lo) n Ach scorers have a high fear of failure. (36) If it were true that Lo n Ach in females equals high fear of failure, then the results we observed might be accounted for as the effect of stress on subjects who were already failure sensitive and hence prone to disorganization under pressure. Some evidence in support of this assumption would exist if it were found that some relationship exists between the S and n Ach variables. The rationale for this is that if high fear of failure is an anxiety state that can be measured by the S measure, then a relationship between S and n Ach might reveal a relationship between n Ach and fear of failure. There is, of course, no certainty in this logical circuity. However, contingency table comparisons of the three categories of the S and n Ach variables for both sexes were prepared.

They appear below.

TABLE 18

RELATION OF S TO n ACH - MALES ONLY

		n Ach		
		Lo	Mid	Hi
S	Lo	10	8	10
	Mid	12	7	11
	Hi	8	9	11

TABLE 19

RELATION OF S TO n ACH - FEMALES ONLY

		n Ach		
		Lo	Mid	Hi
S	Lo	13	11	16
	Mid	11	12	8
	Hi	16	13	16

In neither of these comparisons is a relationship between S and n Ach indicated. The assumption, then, regarding the influence of fear of failure in determining the observed relationship of performance under stress and need for achievement is not supported.

It must be concluded that the tentative hypotheses with regard to male need for achievement (p. 33) is unverified, and that exploratory analysis has disclosed a

seemingly reliable relationship in female students between low need for achievement and poor performance under stress.

The n Aff (need for affiliation) variable has shown no discriminatory value. Neither with male nor with female subjects was anything like a dependable relationship observed in the data of this study. It is concluded that the hypothesis regarding need for affiliation (p. 33) remains unverified.

The extra-hypothetical analyses which have explored further the data of this study stimulate some additional conclusions.

The SA-S Type analysis has shown that Type I (Hi SA-Hi S) female subjects suffered a significant performance decrement under stress. The performance of Type I male subjects suggested a similar relationship, but its strength was not sufficient to be statistically reliable. The SA-S Type I female must be regarded as a student likely to be detrimentally influenced by stress in the examination situation.

The finding that the Type I student showed the greatest performance decrement under stress of all the SA-S Types is somewhat contrary to what might have been expected. The Type IV (Hi SA, Lo S) student has been described as "sensitive, imaginative, dependent, disorganized, uncontrolled, and cycloid." (58; p.2). The Type I student has such

characteristics as sensitivity, changeability, sociability, impulsivity, and stability. Both of these types are high on SA, and hence might be expected to show performance decrement under stress. But the Type I person is relatively stable while the Type IV person is relatively anxious. It might have been predicted, then, that the Type IV's would have performed less well under stress than the Type I's. The results indicate just the reverse. It may be that the Type IV's were already so near maximal tension that a little more had no effect--hence their failure to show a performance difference between the stress groups.

The Ach-Aff Type analysis revealed no relationship of these types to examination performance under stress for males. The Type C (Lo n Ach-Lo n Aff) male, however, gave results indicating an improvement regardless of the degree of stress. This may be interpreted in line with the previously mentioned "late comer" assumption about Lo n Ach males.

The Type C females seem to have responded differentially to stress. It is suggested that here is another type of female student which must be regarded as prone to detrimental influence by stress during course examinations.

This study has demonstrated that certain personality variables are reliably related to course examination performance under stress. It is recognized that a student's performance on an examination is determined by many factors. Intelligence, amount of knowledge of the subject matter, and familiarity with test taking procedures are commonly accepted as determining variables. Our results indicate that personality characteristics of the student and the stressfulness of the testing situation must also be considered to determine performance.

Under stress conditions similar to those of this experiment, one would expect the students who would show the greatest performance decrement to be: Hi SA females or males, Lo S males, Lo n Ach females, Hi SA-Hi S females, Lo n Ach-Lo n Aff females, and females rather than males.

CHAPTER V

SUMMARY

The problem of this study was to determine the relationship of four personality variables to performance on course examinations under experimentaly manipulated stress.

The four personality variables were:

1. The SA (Permeability) dimension--a measure of tendency to influence by internal and external stimuli and to dependence upon others in decision making.

2. The S (Stability) dimension--a stability-anxiety dimension reflecting nervous tension and desurgency.

3. The n Ach (Need for Achievement) variable--a measure of need for success in competition with some standard of excellence.

4. The n Aff (Need for Affiliation) variable--a measure of need to establish or maintain positive affective relations with others.

Scores on these measures were obtained from students in twelve sections of the Introductory General Psychology course at the University of Michigan during the Spring 1955 semester.

A regression equation prediction technique was devised to predict the score these students would make on a third examination in their course. The independent variables in the regression equation were the student's

grade-point average, American Council on Education total test score, and his point scores on his first two examinations in his course. The weights for these independent variables had been devised from data obtained on students in the same course during the previous semester.

When the predicted third examination scores were computed, two equated groups were formed by assigning students to a Low or High stress experimental group where they would take their third examination. The purpose of this "matching" procedure was to control for whatever intellectual and motivational factors might ordinarily influence performance.

Stress was conceived as situational conditions which a student perceives as erecting potential barriers to his movement toward the goal of doing well on the examination. A High stress group was created by certain operations calculated to raise stress to a reasonable maximum. A Low stress group took the test under conditions in which attempts were made to reduce stress as much as possible. The final sample of subjects consisted of 125 students who took their third examination under High stress conditions, and 125 students who took their third examination under Low stress conditions.

The data were analyzed to determine whether students who obtained certain scores on the personality measures had shown a differential performance response

under the two stress conditions. The concern was thus with the extent to which certain personality characteristics may mediate the influence of stress upon examination performance.

The findings are as follows:

1. The examination scores of female subjects were more detrimentally affected (lowered) by the stress than were those of male subjects.

2. The examination scores of Hi SA students were more detrimentally affected by stress than those of Mid or Lo SA scorers. This was predicted.

3. An hypothesis predicting greater detriment to the performance of Lo S than to that of Mid or Hi S students under stress received tentative support for male subjects only.

4. The n Ach variable showed no relationship with performance under stress for male subjects. The prediction that Mid n Ach male subjects would show a greater performance decrement than Lo or Hi n Ach males was not validated. However, Lo n Ach females were more detrimentally affected by stress than Mid or Hi n Ach female students.

5. The prediction that Hi n Aff subjects would show a greater performance loss than Mid or Lo n Aff subjects was not verified.

6. When the virtually uncorrelated SA and S dimensions were combined to produce four personality "types," the Type I (Hi SA-Hi S) female subjects displayed a significant performance decrement under stress. Type I male subjects gave results indicating a similar but statistically unreliable effect. The Hi SA, Hi S student is regarded, therefore, as very likely to be detrimentally affected by stress during examinations.

7. Analysis of combinations of n Ach and n Aff showed no performance differences between stress conditions by male subjects. The examination scores of the Lo n Ach-Lo n Aff females under the two stress conditions were significantly different. The Lo n Ach, Lo n Aff female student may be regarded as prone to detrimental influence by stress during course examinations.

Performance on course examinations is determined not only by intelligence and knowledge of materials, but also by the interaction of stress conditions and personality factors. Students most detrimentally affected by stress conditions similar to those in this experiment are likely to be: highly permeable females or males, low stability males, females with low achievement motivation, females of high permeability combined with high stability, and females of low achievement motivation combined with low affiliation motivation. Those most detrimentally affected are also likely to be females rather than males.

APPENDIX A

The regression equation employed is as follows. A=ACE score; B=Grade-point average; C=Exam I score; D=Exam II score; E=Exam III Predicted score.

$$T = \frac{10(X-M)}{\sigma} + 50$$

$$E = \beta_A\left(\frac{X_A - M_A}{\sigma_A}\right) + \beta_B\left(\frac{X_B - M_B}{\sigma_B}\right) + \frac{\beta_C}{10}(T_C) + \frac{\beta_D}{10}(T_D) - [5\beta_C + 5\beta_D]$$

$$= .0249\left(\frac{X_A - 117}{21.5}\right) + .2880\left(\frac{X_B - 2.3}{.6}\right) + .02252(T_C) + .02348(T_D) - [2.3]$$

The multiple correlation is as follows.

$$R = \sqrt{\beta_A r_{EA} + \beta_B r_{EB} + \beta_C r_{EC} + \beta_D r_{ED}}$$

$$= \sqrt{.0249(.305) + .2880(.467) + .2252(.461) + .2348(.455)}$$

$$= \sqrt{.352787}$$

$$= .593$$

APPENDIX B

INSTRUCTIONS

READ THIS FIRST

The following rules will govern the administration of this examination.

1. There is only one best answer to each question.
2. A "guessing penalty" of one point will be deducted for each incorrect answer, so be careful of each choice you make.
3. You must answer every question--leave none blank.
4. No discussion of questions will be permitted after the test has begun.

NOW

Study the example questions on the following page.

APPENDIX C

EXAMPLE QUESTIONS

Study these examples carefully.

Question 1: The contradictions apparent in the findings of Dennis and Spitz

(a) are irreconcilable in terms of learning theory
(b) raise doubts that the question of how heredity and environment interact can ever be answered
(c) suggest that hereditary dispositions and environmental effects are two entirely different processes
(d) may be reconciled from a sign-gestalt theoretical position
(e) none of the above are correct

Put a large X through the letter <u>below</u> corresponding to the correct answer.

Question 2: Suppose you had devised a series of tests concerned with the various functions involved in pitching baseball (e.g., speed of reaction, motor coordination, strength, accuracy, etc.) and are now interested in discovering whether there is such a thing as general pitching ability. Which of the following methods of analysis would you employ?

(a) validation analysis
(b) factor analysis
(c) reliability analysis
(d) criterion analysis
(e) generalization analysis

Put a large X through the letter <u>below</u> corresponding to the correct answer.

1. a b c d e

2. a b c d e

The above questions are examples of the type of items you will find in this examination. Answer them as you did these.

APPENDIX D

ANSWER SHEET FOR PSYCHOLOGY 31

Name_____Section____Instructor_____

Place a large X through the letter corresponding to the correct answer.
You will be given one point for each correct choice.
Please feel free to write any comments you may have in the space provided.

1 a b c d e_____

2 a b c d e_____

3 a b c d e_____

4 a b c d e_____

5 a b c d e_____

6 a b c d e_____

7 a b c d e_____

8 a b c d e_____

9 a b c d e_____

10 a b c d e_____

Etc.

APPENDIX E

It was considered desirable to attempt some independent measure of the effectiveness of the experimental manipulations in actually increasing or decreasing student anxiety. Pages 85 and 86 present two measures which were devised for this purpose.

A preliminary form of the "Pre-Examination Check Scale" had been given to 142 students in the Introductory General Psychology course during the Fall 1954 semester. (The items had been selected from the Sarason Test Anxiety Questionnaire.) A factor analytic procedure was then applied to the resulting data. It was found that the first factor loadings of four of the items left residual variance of encouragingly small magnitude. These four items were felt to be sufficiently homogenous to warrant their use. Consequently, all students in the present study filled out the Pre-Examination Check Scale immediately before they began their examination.

Scoring and analysis of the data found no significant difference between the mean "anxiety scores" of the High and Low stress groups. It may be that the measure, regardless of the homogeniety of its items, is not valid as a measure of anxiety. It is also possible that the mere necessity of having to answer such questions as those in the scale makes one more aware of one's anxiety and thereby

increases anxiety via the "vicous circle" phenomenon reported by Doppock. (8) If this happened in the present experiment, it means that our efforts to measure anxiety may have actually increased it. If one assumes that anxiety could have been less easily increased in the High than in the Low stress situation, then this means that the desired difference in amount of anxiety between the two experimental groups was somewhat less than it would have been without the check scale. There are a lot of "ifs" in this argument, but its warning to future investigators is clear.

A similar instrument (Post-Examination Check Scale) was filled out by students immediately after their examination. It was devised in the same way as the Pre-Examination Check Scale and also showed no discrimination of the High and Low stress groups. The fifth question in the scale was different from the others in that it simply asked whether the student had "clutched" during the examination or not. The data from this question are reported in Chapter IV.

Name_____

Section No._____

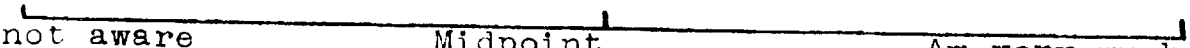
PRE-EXAMINATION CHECK
SCALE

CAREFULLY fill out this sheet before preceeding with this exam.

Place a large X at a place along the line which will best indicate the strength of your feeling on the question.

---

1. As you begin this examination, to what extent are you aware of an "uneasy feeling"?



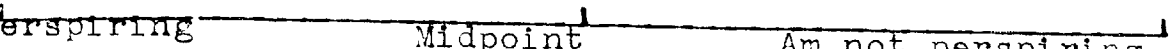
Am not aware of it at all — Midpoint — Am very much aware of it

2. To what extent do you notice an accelerated hearbeat at the moment?



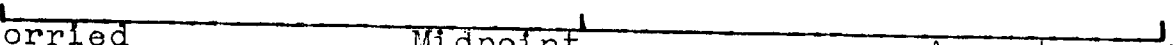
Hearbeat is not accelerated at all — Midpoint — Heartbeat is noticeably accelerated.

3. Are you perspiring more than is usual for you right now?



Am perspiring a lot more — Midpoint — Am not perspiring at all

4. To what extent do you feel worried about this exam?



Am worried a lot — Midpoint — Am not worried at all

Name_____

Section No._____

POST-EXAMINATION CHECK
SCALE

Place a large X at a place along the line which will best indicate the strength of your feeling on the question.

---

1. While you were taking this exam, to what extent did you experience an accelerated heartbeat?

Hearbeat did not accelerate at all — Midpoint — Hearbeat was noticeably accelerated

2. While you were taking this exam, to what extent did you worry about how well you were doing?

Worried a lot — Midpoint — Did not worry at all

3. While you were taking this exam, to what extent did you perspire?

Perspired a lot — Midpoint — Did not perspire at all

4. While you were taking this exam, to what extent were you aware of an "uneasy feeling"?

Was not aware of it at all — Midpoint — Was very much aware of it

5. At any time during this exam did you find yourself "clutching"--that is, did you "go blank" for a moment or two as a result of tenseness?

☐ Yes ☐ No

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