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THE UNIVERSITY OF ALBERTA

TEST ANXIETY AND COGNITIVE INTERFERENCE

by

COLLEEN HAMMERMASTER

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled Anxiety and Cognitive Interference, submitted by Colleen Hammermaster in partial fulfillment of the requirements for the degree of Master of Education in Counseling Psychology.

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ABSTRACT

The major purpose of this study was to determine whether highly-test-anxious subjects, in situations that pose testlike challenges, perform at relatively low levels and experience relatively high levels of task-irrelevant thoughts.

214 students enrolled in an introductory psychology or sociology course at a post-secondary college in Alberta, Canada were administered the Test Anxiety Scale (TAS). On the basis of TAS scores, 21 and 18 subjects were operationally defined as high and low-test-anxious respectively. These subjects were individually administered the Wisconsin Card Sorting Test (WCST) as a measure of cognitive performance. Immediately after the completion of the WCST, subjects were asked to complete the Cognitive Interference Questionnaire (CIQ) which assesses task irrelevant thinking that interferes with concentration on a task.

The data were subjected to the following statistical procedures:

(1) Hotelling T^2 to test the significance of differences between high and low-test-anxious subjects' performance on the WCST.

(2) t-test to determine the significance of differences between levels of cognitive interference experienced by high and low-test-anxious subjects.

(3) Pearson Product-Moment Correlation Coefficient to determine the degree of relation between level of anxiety (TAS) and level of cognitive interference (CIQ).

Significant differences were found between the cognitive performance of high and low-test-anxious groups, with high-anxious subjects performing less adequately. The high-test-anxious subjects also experienced significantly more cognitive interference or task-irrelevant thinking than did their less anxious counterparts. A significant positive relationship between level of test-anxiety and amount of cognitive interference experienced was established.

Implications and suggestions for further research emphasized the need for continued investigation of variables that will alter test-anxious subjects' interfering responses in developing successful treatment approaches. A more indepth analysis of the nature of performance decrements experienced by test-anxious subjects was suggested as a means to further understand the relationship between anxiety and attention.

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CHAPTER I

INTRODUCTION

Although much remains unknown regarding the complexities of cognitive processes, we do know that what people think about in particular situations influences their behavior. Of increasing interest is the effect of unpleasant cognitions upon overt behaviors. For example, some cognitions have a worry component. The sexually-anxious individual is uncomfortable and functions awkwardly in moments of intensity at least in part because of repetitious, self-deprecatory cognitions ("I'm so unattractive. No man/woman would ever be attracted to me "), or concern about how the other person is perceiving the interaction ("He/she must be desperate to be interested in me"). The test-anxious person often fails to discriminate among the subtle differences in a test's multiple choice alternatives because of repetitive negative and distracting thoughts. ("I can't answer any of these questions; Everyone else is doing better than I am"). These cognitions draw attention away from the task to self-evaluative worry. For example, the automobile driver on the way home from work has a fender-bender because

work-related preoccupations interfere with attention to stoplights and the flow of traffic (Sarason, 1986).

In investigating observations such as these described, research has shown that negative self-evaluations play a particularly important role in both intellectual and social performance (Morris & Liebert, 1970; Houston, 1977; Schwarzer, 1986). The anxious individual is often in a dual-task situation, dividing his/her attention between task requirements and irrelevant cognitive activities such as self-criticism. Irrelevant cognitive processing functions as a distraction, inhibiting efficient completion of the task at hand. Although it is clear that anxiety does have impact upon cognitive functioning, a more thorough understanding of the relationship between these two factors is needed.

Background to the Study

Although contemporary interest in anxiety phenomena has historical roots in the philosophical and theological views of Pascal and Kierkegaard (May, 1950), it was Sigmund Freud who first attempted to explicate the meaning of anxiety within the context of psychological theory. In his early theoretical formulations, Freud believed that anxiety

resulted from the discharge of repressed, unrelieved somatic sexual tensions (libido). He held that when libidinal excitation produced mental images (lustful ideas) that were perceived as dangerous, these ideas were repressed. The libidinal energy, thus blocked from normal expression accumulated and was automatically transformed into anxiety, or into symptoms that were anxiety equivalents. Freud later modified this view in favor of a more general conceptualization of anxiety in which its functional utility to the ego was emphasized. He conceived of anxiety as a signal indicating the presence of danger in a situation and differentiated between objective anxiety and neurotic anxiety largely on the basis of whether the source of the danger was from the external world or from internal impulses. Objective anxiety, which was regarded by Freud as synonymous with fear, involved a complex internal reaction to anticipated injury or harm from some external danger. Neurotic anxiety differed from objective anxiety in that the source of the danger that evoked this reaction was internal rather than external, and this source was not consciously perceived because it had been repressed.

Other personality theorists have since attempted to clarify the anxiety phenomenon. However, lack of agreement

regarding the nature of anxiety, the particular stimulus conditions that arouse it, and the sorts of past experiences that make individuals more or less vulnerable to it, is the rule rather than the exception. Consider, for example, the differences among the concepts of anxiety advanced by Mowrer (1950), Sullivan (1953), and May (1950):

1. As an alternative to Freud's theory of anxiety, Mowrer has proposed a "guilt theory" in which it is contended that "...anxiety comes, not from the acts which the individual would commit but dares not, but from acts which he has committed but wishes that he had not" (1950, p.537). If one behaves irresponsibly, with too much self-indulgence and too little self-restraint, then anxiety is experienced.

2. For Sullivan, anxiety was an intensely unpleasant state of tension arising from experiencing disapproval in interpersonal relations. Through an empathic linkage between an infant and its mother, "the tension of anxiety, when present in the mothering one, induces anxiety in the infant" (Sullivan, 1953, p. 41). Once aroused, anxiety distorts the individual's perception of reality, limits the range of stimuli that are perceived, and causes those aspects of the personality that are disapproved to be dissociated.

3. According to May, anxiety was "the apprehension cued off by a threat to some value which the individual holds essential to his existence as a personality" (1950, p.191). While the capacity to experience anxiety was innate, the particular events or stimulus conditions which evoked it were largely determined by learning. An anxiety reaction was "normal" if it was proportionate to the objective danger and did not involve repression or other defense mechanisms. Neurotic anxiety reactions were disproportionate to the objective danger and involved repression and neurotic defenses. Fear was a learned response to a localized danger which did not constitute a threat to the basic values of the individual.

Contemporary theories further differentiate between fear and anxiety. Anxiety is largely conceptualized as a vague fear stemming from a source that is unknown to the stricken individual. When, however, the threatening object or situation is identifiable, we should speak of fear rather than anxiety (Levitt, 1980). Although this view has influenced the training of clinical practicioners for decades, both the specific and diffuse occur far less often than most anxiety reactions in modern society, which are neither highly specific nor completely diffuse. The mother who worries incessantly about her children's welfar is

afraid of a multitude of occurrences of very different kinds. A man may fear that he will be injured in one of a variety of different mishaps. At any particular moment, the fearsome stimulus may be specific; in general, it is a more diffuse category of stimuli.

What is the nature of anxiety? Is anxiety learned or innate? How many different kinds of anxiety can be identified, and by what operational criteria may these be distinguished? The answers to such questions will differ depending upon one's theoretical conception of anxiety, and this, in turn, will determine the inferences and operations which give anxiety empirical meaning in the clinic and the laboratory. Given the conceptual ambiguities in anxiety theory, it is perhaps not surprising that anxiety research is characteried by semantic confusion and contradictory findings.

For the purposes of the present study, anxiety is a type of cognitive response involving self-doubt, feelings of inadequacy, and self-blame (Sarason,, 1978). Anxiety may be experienced, when in a given situation, a person does not feel up to the situational requirements, that is, his or her available responses are perceived as less than adequate. Anxiety is a response to perceived inability to handle a challenge in a satisfactory manner and is

experienced when one feels unable to do anything significant about one's immediate concerns.

Sarason (1978) outlined some characteristics of anxiety responses:

1. The situation is seen as difficult, challenging, and threatening.

2. The individual sees himself or herself as ineffective in handling, or inadequate to handle, the task at hand.

3. Self-depreciatory preoccupations are strong and interfere or compete with task-relevant cognitive activity.

4. The individual expects and anticipates failure and loss of regard by others (p. 196).

In identifying the origin of the anxiety, the emphasis should be upon subjective, individual interpretations of a situation. Regardless of the objective situation, it is one's personal interpretation of the situation that leads to behavior. An apple in the refrigerator will not be eaten unless it is noticed. Someone who is insulted, but isn't aware of it, will not become upset. A person who has lung cancer, but is unaware of it, will not worry. A person whose lungs are in good condition, but who is afraid he has lung cancer, may experience tension or even panic when some minor congestion associated with a cold becomes

evident.

Test anxiety is a widely studied variable, in part because it provides a measure of the subjective salience of one important, definable class of threatening situations, those in which people are evaluated. Research on test anxiety has proven to be a convenient vehicle for investigating the impact of perceived threat upon behavior, more specifically, task performance (Sarason, 1980). When confronted with a situation, each of us processes information provided in a distinctive way. Although valuable contributions have been made within the last decade as to how individuals process relatively discrete stimuli (i.e. visual displays), investigation of how information from complex situations is processed (i.e. concept formation) has only recently begun (Mischel, 1973).

Significance of the Study

We live in an ever-changing society which is characterized by rapid technological change, high unemployment, increasing occupational mobility, high divorce rates, the dissolution of traditional family structures, and the changing roles of men and women. People in this society are challenged to keep pace, by

marching boldly and confidently, with the reassurance of a better future. In a Darwinistic sense, there is no room nor time for self-doubt or feelings of inadequacy--in essence there is no room for anxiety.

The fact is, however, anxiety does exist and it is becoming increasingly prevalent, leaving individuals alienated from the society which they created. To avoid becoming prisoners of our own society, further research is necessary in understanding the relationship between negative cognitive responses and behavior. A delineation of the ways in which anxiety becomes manifest would provide further insight into:

(a) the successful treatment of a particular "anxiety attack",

(b) the prevention of recurrent episodes of test anxiety, and

(c) the prevention of affective disorders in general.

Purpose of the Study

This study was designed to investigate the following:

(1) Whether the performance of high-test-anxious subjects is significantly lower than their low-anxious counterparts on an objective test of concept formation.

This study focused not only on overall success, but on particular sources of difficulty on the task:

a) per cent of conceptual level responses,

b) perseveration,

c) failure to maintain set, and

d) improvement in successive test categories due to learning (learning to learn).

(2) Whether, under testlike conditions, high-test-anxious individuals, moreso than low-test-anxious individuals, report being preoccupied with how poorly they are doing, how other people are doing, and what the examiner will think about them.

The sample consisted of 214 students enrolled in an introductory psychology or sociology course at Grant MacEwan Community College. Subjects were administered the Test Anxiety Scale as a group, and were individually tested with the Wisconsin Card Sorting Test. Immediately after this, subjects responded to the Cognitive Interference Questionnaire.

In essence, this study was designed to investigate whether highly test-anxious subjects, in situations that pose testlike challenges, perform at relatively low levels

and experience relatively high levels of task-irrelevant thoughts.

Definitions

Anxiety - The definition of anxiety accepted in this study is that employed by Spielberger (1972) who described anxiety as : "unpleasant, consciously perceived feelings of tension and apprehension, with associated activation or arousal of the autonomic nervous system" (p. 29).

Test Anxiety - Test Anxiety will be interpreted as the tendency to view with alarm the consequences of inadequate performance in an evaluative situation (Sarason, 1978).

Cognitive Interference - As defined by Sarason (1984), Cognitive interference consists of "intrusive thoughts that keep the individual from directing full attention to the task at hand."

Limitations and Delimitations of the Study

Delimitations - This study, which is exploratory in nature is designed to investigate whether highly-test-anxious

subjects demonstrate low levels of performance and experience high levels of distracting thoughts which are inconducive to efficient task performance. Subjects were defined as test-anxious by the criterion of the Test Anxiety Scale. The study sample consisted of volunteer College students and factors not controlled include: social class status, intelligence and sociability.

Limitations - (1) As previously mentioned, the sample consisted of volunteer College students and is therefore exposed to all limitations of such a sample.
(2) Some individuals may tolerate distraction associated with anxiety better than others, either because of personality characteristics (i.e. introversion-extroversion) or because of coping strategies. This study neglected to focus upon such individual tolerances.
(3) For the purposes of stability and reliability, it would be useful to check research results over a longer period of time. However, due to the limitations of time and finance, a longitudinal survey is impossible.

Overview of the Study

Following the introduction of the nature and purpose of the thesis in Chapter I, a review of related literature is presented in Chapter II. In Chapter III the design of the study is outlined, with details of subject selection, instruments utilized and procedure followed. The results of data collection and analysis have been presented in Chapter IV. Finally, a summary of findings, considerations to be drawn from these findings and implications for further research have been presented in Chapter V.

CHAPTER II

THEORY AND RESEARCH

Defining Anxiety

Although some disagreement exists as to whether anxiety is a motivational state, an emotion, or a combination of the two, most would probably agree with the definition of anxiety that was proposed by Spielberger (1972), which states that anxiety constitutes: "unpleasant, consciously perceived feelings of tension and apprehension, with associated activation or arousal of the autonomic nervous system" (p. 29).

Russell and Mehrabian (1977), on the basis of results obtained with six scales measuring fear or anxiety, claimed that easily the major component of anxiety is displeasure, followed by high arousal and submissiveness.

A necessary clarification in defining what is meant by anxiety is that the degree of arousal and pleasure-displeasure are independent factors. High arousal does not presume disturbance, nor does it suggest a euphoric state. However, displeasure is a defining

component of anxiety. Disregard for this diffentiation in terms has led many investigators to conclude that unpleasant emotional states such as anxiety are inevitable consequences of high arousal, or conversely, that high arousal automatically assumes a dissatisfied or unpleasant state. The research of Eysenck (1982) has revealed a small but significant curvilinear relationship between pleasure and arousal, but it accounted for less than 5% of the variance in pleasure-displeasure scores. His findings further discovered that high arousal has an "augmentation" or "enhancement" effect: for an unpleasant emotion, high arousal tended to increase the experienced displeasure, whereas for a pleasant emotion, feelings of pleasure were enhanced.

In further defining anxiety, Spielberger et al. (1970) differentiated between trait anxiety as "relatively stable individual differences in anxiety proneness," and state anxiety which is "chacterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity" (p. 2). According to this state-trait conceptualization, state anxiety is transitory and affected by the degree of environmental stress, whereas trait anxiety is more consistent or stable across situations of varied

stressfuless. It follows that under non-stressful conditions there should only be a small difference in the level of state anxiety between those high and low in trait anxiety, but there should be a much greater difference under conditions of stress.

Two prominent, experimentally-justified theories have attempted to explain the effect of anxiety on learning and task performance. Each theory conceptualizes anxiety in a unique way. Drive Theory defines anxiety as an energizing drive, whereas Cognitive-Attentional Theory depicts anxiety as a situationally determined reaction.

A Brief Discussion of Drive Theory and Anxiety

Kenneth W. Spence is responsible for a great deal of experimental work dealing with the effect of anxiety on learning and task performance. Spence conceived of anxiety as an acquired "drive" that has the capacity to energize the organism (Spence & Spence, 1966). For this reason, Spence's formulation has been called Drive Theory. Anxiety, conceptualized as drive, ought to increase the speed of learning and thereby facilitate performance.

Drive Theory is straightforward when applied to situations in which only one response is possible and

occurs invariably, as is the case with the conditioning of a reflex, like the eyeblink reflex. The individual either responds to the conditioned stimulus with the reflex act, or he/she does not respond; there is no choice of responses. In this kind of situation, a high anxiety level should, by energizing the individual to respond, facilitate performance.

However, the one-response learning situation does not occur frequently in human life. In most circumstances a variety of possible responses are available to the individual. Each of these response tendencies or "habits" has a certain strength or probability of occurrence, depending on the individual's past experience. These responses could, theoretically, be arranged in a "hierarchy" of habit strength.

Spence's theory holds that anxiety will energize or strengthen each of the habits in the hierarchy in proportion to the initial strength of the habit.

In some situations the correct response tendency will initially rank high in the hierarchy for most people. Suppose that the task is to learn to associate the word "low" with the stimulus word "high". Most people have been exposed to other associations with the stimulus word, like "high"--"mountain", but the association with "low" has

undoubtedly occurred many more times in the past and thus has a greater habit strength. Anxiety will energize the correct response to a greater extent than it will the incorrect ones, and will thus increase the speed of response.

The particular learning task is evidently a simple one. In fact, one way in which to define a "simple task", according to Drive Theory, is to say that for most people the correct response initially ranks high in the habit hierarchy. Most human learning, however, is complex. A complex situation is one in which there are a number of competing response tendencies, all of which are equally weak in habit strength. The effect of anxiety as an energizer is to increase the habit strength of the many incorrect response tendencies to the disadvantage of the lone correct response. Learning and performance rate will thus proceed more slowly.

If there is enough practice, sooner or later the correct response will begin to occur more frequently, and its position in the hierarchy will be improved. As this happens, the effect of drive will be to increase the habit strength of the response more and more, so that eventually a point is reached at which learning is facilitated.

A simple mathematical formula describes the effect of

anxiety on any one response tendency: R(esponse) = D(rive) x H(abit strength). But Spence has never been able to proceed to the point of formulating an equation to predict the effect of anxiety in a learning situation involving more than one habit. Levitt (1960) suggests that the reason is that it is difficult to establish habit hierarchies for learning tasks. The habit hierarchy is likely to be a function of the individual's past experience; for each task and within each group of people, the hierarchy will be a variable. An investigation of the effects of anxiety as a drive on complex learning would thus be an exceedingly complex task itself. It is more feasible to deal with the learning tasks themselves, and much of the Drive Theory experimentation has therefore been concerned with measuring the effect of anxiety as a function of task difficulty.

The Cognitive-Attentional Model of Anxiety

According to Drive Theory, anxiety is evidently used in the sense of a constant characteristic or trait of the individual. Anxiety scales developed in adherence with Drive Theory measure an energizing drive and are built around the contention that the evoking of anxiety in the

anxiety-prone individual is primarily a function of a condition of the individual, and secondly is a function of external stimuli. An opposing view has been advanced by Mandler and Sarason (1952):

1. Anxiety is a strong learned drive that is situationally evoked. A particular circumstance or class of circumstances may be stressful for a person, although he/she is not made anxious by other situations. Individuals may react differently to the same circumstances.

2. The individual has learned or developed characteristic responses to anxiety that he/she brings with him/her to the current situation. These reactions may be "task-irrelevant"--that is, tending to disrupt performance. Examples are feelings of inadequacy or fear of failure. Or they may be "task-relevant"--facilitative of performance, because they move the person to reduce anxiety by completing the task successfully.

3. The effect of anxiety is also a function of such aspects of the situation as the attitude of the experimenter or teacher and the meaning of the task as perceived by the individual. These are of greater significance than the complexity or difficulty of the task.

4. Attention should be focused on specific anxiety traits rather than on a global concept of anxiety because of the intrinsic value of studying more specific anxiety traits, and the "nebulous character of the concept of general anxiety" (Sarason, 1975).

Theoretically, there is a limitless pool of situation-specific anxieties. Most, however, lack the requisite intrinsic value; few of us have confronted a charging lion or teetered on the edge of the top of a tall building. Nor can such situations be studied in the laboratory. One significant anxiety of modern life that does lend itself to empirical study is one that is built around a pervasive fear of not achieving, of failing, of being evaluated. "Achievement anxiety" is a meaningful trait in civilized societies. Many specific situations might evoke achievement anxiety, depending on the individual's personal goals and values. Achievement anxiety although narrower in scope than general anxiety, was still to broad a concept for Sarason and Mandler. They selected for study a limited area of the concept, called "test anxiety". In this context, "test" refers primarily to the ordinary classroom evaluation. Test anxiety is a "near universal" experience, especially in this country,

which is a "test-giving" and "test-conscious" culture. Test performance has great significance for the individual; not infrequently it may seriously affect the course of his/her life. The demands implicit in a test may be appraised as challenging, ego-threatening or harmful (Lazarus & Launier, 1981). The appraisal of the task as ego-threatening gives rise to test anxiety if the person perceives a lack of coping ability, and thus, feels unequipped in completing the task.

If one accepts the assumption that the most fruitful approach to the analysis of anxiety should begin with the study of specific stressful situations, test anxiety appears to be an ideal area of investigation. Even if the assumption is rejected, the study of test anxiety is potentially profitable in its own right.

Worry and Emotionality as Components of Anxiety

Liebert and Morris (1967) suggest that the process of test-anxiety is a complex amalgam of worry and emotionality. The worry component is described as cognitive concern over performance or the consequences of failure, and emotionality is the autonomic arousal aspect of anxiety. The evidence supporting a distinction between

the physiological (i.e. emotionality) and the cognitive (i.e. worry) components was discussed by Morris et al. (1977). They noted that several factor analyses of Mandler and Sarason's (1952) Test Anxiety Questionnaire have produced conceptually distinct worry and emotionality factors.

With regard to specific testing situations, worry scores are fairly constant across time, but emotionality scores reach a peak immediately before the testing situation and decline rapidly immediately after. Worry scores are reduced by performance feedback, while emotionality scores are not. Studies exploring the relationship between worry and emotionality and task performance (Doctor and Altman, 1969; Morris and Liebert, 1969; Sarason, 1984) have discovered significant interactions between worry scores and both task difficulty and time to complete a task. Worry scores are negatively related to performance expectancies and to actual performance, while emotionality scores bear no consistent relationship to expectancies or test performance. On the basis of these results, it has been suggested that it is specifically the worry aspect of anxiety which affects performance on intellectual-cognitive tasks.

Attentional Explanations of Anxiety and Task Performance

Upon accepting the notion that it is the worry component of anxiety that interferes with effective performance, the next question which naturally follows is how does worry interact with the demands of a task, causing a decrement in performance? The explanation for differential performance between highly test-anxious and low test-anxious persons involves an attentional interpretation of the adverse effects which anxiety has on task performance.

Broadbent's (1958,1971) formulation that humans have a limited capacity information processing system provides a useful point of departure from which the cognitive-attentional interpretation can be conceptualized. Ample research exists in support of the notion that test-anxious students have elevations of affect characterized by unfavorable self-perceptions, fear of failure, and similar negative self-preoccupations.

The cognitive representation of such preoccupations must absorb some portion of the person's information processing capacity leaving less capacity for coping with task demands. This conceptualization is similar to that

proposed by Hamilton (1975). When an individual feels that he/she lacks the ability required to meet task demands, in a flurry of self-related cognitions the individual searches for information about his/her specific competencies to handle the situation. The coping resources looked for could be one's ability to solve the kind of problem at hand or the amount of time available to complete the task. As concisely stated by Schwarzer (1984), a lack of confidence in one's ability to create a successful action "leads to an imbalance between the appraised subjective coping resources and results in test anxiety which inhibits the on-going person-environment transaction and decreases performance" (p. 6). According to Wine (1971), the low test-anxious person is focused on task-relevant variables while performing the tasks, whereas the highly test-anxious subject is internally focused on self-evaluative, deprecatory thinking, otherwise labeled worry. It is argued that anxious individuals divide their attention between task requirements and irrelevant cognitive activities such as worry and self-criticism.

Marlett and Watson (1968) have stated this proposition rather well:

The high-test-anxious person spends a part of

> his task time doing things which are not task oriented. He worries about his performance, worries about how well others might do, ruminates over choices open to him, and is often repetitive in his attempts to solve the task. (p. 203).

It has often been observed (Sarason, 1954; Wine, 1980; Deffenbacher, 1978) that the performance of individuals preoccupied with negative self-concerns is debilitated on learning tasks. When cognitive capacity is partially engaged in negative self-preoccupations, less capacity is available for performance on cognitive tasks, thus reducing learning and performance efficiency.

Selected Studies on Anxiety and Performance

Test Anxiety and Self-focusing

According to the theoretical position adopted for this research, worry and other task-irrelevant cognitive activities associated with anxiety impair the quality of performance because the task-irrelevant information involved in worry and cognitive self-concern competes with task-relevant information for space in the processing system. As a consequence of critical self-focusing, highly

test-anxious subjects are in effect in a dual-task or divided attention situation in contrast to non-test-anxious subjects who primarily process task-relevant information.

Deffenbacher (1978) investigated sources of interference in highly test-anxious subjects solving difficult anagrams. Major findings were that, under evaluative stress, the high-anxiety group: (a) reported more anxiety during testing; (b) rated themselves, their abilities, and the task more negatively; (c) solved fewer anagrams; (d) experienced more interference from anxiety; and (e) reported greater distraction of attention to heightened autonomic arousal (emotionality), worrisome thoughts (worry), and task-produced competing responses (task-generated interference) than did low-anxiety individuals under evaluative stress.

In a review of the literature on paper-and-pencil anxiety scales, Sarason (1960) cited a number of studies that provide evidence that high test-anxious subjects are "more self-deprecatory, more self-preoccupied, and generally less content with themselves than subjects lower in the distribution of test anxiety scales" (p. 404). As well, Sarason himself has completed several studies which further indicate the self-deprecatory, self-ruminative tendencies of highly test-anxious subjects. In each of

these studies highly test-anxious and low-anxious college students were required to describe themselves for approximately one-half hour. Nonreinforcement, reinforcement of negative self-references, and reinforcement of positive self-references have been compared. Some of the conclusions from these experiments are:

a) Regardless of experimental conditions, highly test-anxious subjects generally describe themselves in more negative terms than do low test-anxious subjects.

b) High test-anxious subjects are extremely responsive to reinforcement when the response class being reinforced is negative self-references.

c) When the response class being reinforced is positive self-references, high-anxious subjects do not condition. That is, they do not produce more positive self-references as a result of being verbally reinforced for them.

Wine (1980) found that reassuring students improves their performance, which indicates that the cognitive capacity tied up by such rumination can be reduced when students are reassured regarding the threat posed by the task, or reassured about their abilities to succeed. Additionally, the findings that even relatively trivial manipulations, such as suggesting to students that they

concentrate more on a task, and less on extraneous matters improves performance (Sarason, 1984; Wine 1980), can be similarly interpreted. Such instructions enable students to devote a greater proportion of processing capacity to the task, and less to anxious self-ruminations. The enhancement of performance is, of course, attributable to having more cognitive capacity available for task solution.

A large-scale investigation by Many and Many (1975) found a significant negative relationship between self-reported self-esteem and test anxiety.

Several studies provide even more direct support for the contention that high test anxiety is associated with preoccupation and self-devaluing cognitions during task performance. Mandler and Watson (1966), Neale and Katahu (1968) and Marlett and Watson (1968) administered several tasks to high and low-test-anxious individuals. In each investigation post-task questionnaires asked subjects to indicate the incidence of self-devaluing cognitions during task performance. In all three studies, to the question, "How often during the testing did you find yourself thinking how well, or how badly you were doing?", the high-test-anxious subjects reported a significantly higher incidence of such thoughts than did the low-test-anxious persons.

The most direct evidence for the high incidence of interfering self-relevant thoughts during the test-anxious persons' task performance was reported by Ganzer (1968). He recorded the task-irrelevant comments of high and low-test-anxious individuals during a serial verbal-learning task. The high-test-anxious subjects made many more irrelevant comments than did the low, and the comments were mostly of an apologetic self-deprecatory nature.

It is clear that, not only is test anxiety associated with a general tendency to be self-deprecatory, but that negative self-devaluing cognitions are elicited in test-anxious individuals during evaluatively stressful cognitive task performance.

Anxiety and Performance on Simple and Complex Tasks

With some consistency, low-anxious subjects have been shown to perform at a higher level than their high-anxious counterparts, and it has been suggested that the inferior performance of the high anxious subjects is due to the large number of task irrelevant responses which they make (Child, 1954; Mandler & Sarason, 1952).

Research by Sarason and Palola (1960) showed that highly test anxious subjects performed at a lower level on

a difficult version of the Digit Symbol Test than did other subjects. Research by Sarason (1984) has recently revealed a significant negative correlation between "worry" and performance. This finding supports the notion that test anxiety, which is conceptualized in terms of worrisome, self-preoccupying thoughts, interferes with task performance.

In spite of the fact that the empirical underpinning for the hypothesis that anxiety impairs performance because it leads to task-irrelevant processing (i.e. worry) is less than overwhelming, it is nevertheless the case that most of the data are at least consistent with it.

However, empirical support also exists for situations in which highly anxious individuals display superior performance in comparison to less anxious individuals.

For example, Taylor and Chapman (1955) presented paired-associate lists of words in which each stimulus tended to evoke its own specific (correct) response. When the association between S and R in each S-R pair was initially strong, the performance of high-anxiety subjects was found to be superior to that of low-anxious subjects. However, for lists in which each stimulus word presumably elicited a large number of strong competing response tendencies, because of a high degree of synonymity among

stimuli, the performance of high-anxious subjects was observed to be inferior to that of low-anxious subjects (Spence, 1953).

Similarly, Montague (1953) investigated the effects of anxiety in simple serial verbal learning and found that the performance of high-anxious and low-anxious subjects differed for lists of nonsense syllables which presumably varied in degree of intralist interference. The performance of high-anxious subjects was superior to that of low-anxious subjects on a low-interference list in which similarity between syllables was low and association value was high. However, the performance curves for high-anxious and low-anxious groups were reversed on a high-interference list in which there was high similarity between syllables of relatively low association value. Results on a serial learning task with similar implications were reported by Lucas (1952). He manipulated intralist duplication in order to vary the degree of response competition and found that the amount recalled by high-anxious subjects decreased as a function of the number of duplicated consonants within a list. The performance of low-anxious subjects was not affected by intralist duplication.

While easy and difficult tasks almost certainly differ in terms of the demands which they make on processing

capacity, they differ in other ways as well. It seems intuitively reasonable that people are more likely to experience feelings of failure when attempting an extremely demanding task than when attempting a straightforward task, because progress is slower and the number of errors is greater on the more demanding task.

The emotional reactions to different tasks was investigated by Tennyson and Wooley (1971), who used concept acquisition self-instruction tasks with easy and difficult problems. The average state-anxiety score on the State Trait Anxiety Inventory was much higher immediately after performing the difficult task than after the easy task. Spielberger et al. (1972) also found that difficult learning tasks produced a much greater increase than easy tasks in the level of state anxiety, particularly during the early stages of learning.

These studies clearly indicate that anxiety has a greater detrimental effect on difficult than on easy learning tasks, both because difficult tasks make more substantial demands than easy tasks on processing capacity, and because difficult tasks are more likely to be associated with failure experiences leading to enhanced anxiety. It might be inferred from Cognitive-Attentional Theory that fear of failure is itself a function of the

relative difficulty of the task: anticipation of failure is likely to be greater when the task is complex than when it is simple. Hence, when the task is difficult, task-irrelevant responses are more likely to occur and thus, to interfere with performance. Because difficult tasks make more substantial demands than easy tasks on processing capacity, and because difficult tasks are more likely to be associated with failure experiences leading to enhanced anxiety, greater decrements in performance are likely to occur in anxious individuals. More simply stated, task-irrelevant responses are more likely to occur in complex situations, primarily because of the increased threat of failure.

Drive Theory provides an alternate explanation for the greater decrement in performance of anxious subjects on complex tasks. Drive Theory hypothesizes that emotional responses like anxiety raise the drive level of all relevant responses to a stimulus, thus increasing their probability of occurrence. On an easy task it is assumed that the correct response is dominant, and competing responses are much lower in habit strength. In complex learning situations, Drive Theory assumes that there is no one dominant response, hence anxiety may raise the drive level of both relevant and irrelevant responses above the

threshold. The occurrence of more incorrect responses leads to the interference of anxiety in performance.

In an examination of research findings dealing with anxiety and task difficulty, Heinrich and Spielberger (1981) note that "it is generally not possible to accurately determine the correct and incorrect (competing) response tendencies on complex learning tasks. Rather the difficulty of a given task is generally established to be relatively easier or more difficult than another task" (p. 149). The relative ordering of task difficulty is not satisfactory for relating Drive Theory to task performance.

O'Neil (1977) reviewed five different studies designed to clarify the relationship between task difficulty and anxiety and he, as well as Judd and Hedl (1977) concluded that Drive Theory predictions were not confirmed. Because of the inadequacy of Drive Theory to account for anxiety-task difficulty relationships, the limited capacity processing model (alias Cognitive-Attentional Theory) was advanced (Tobias, 1986).

Working Memory Capacity

With this knowledge, the next question to fall into place involves the issue of the exact mechanism by which anxiety-induced decrements in performance occur. M. W.

Eysenck (1979) assumed that the part of the processing system most heavily implicated in concurrent processing of task-relevant and task-irrelevant information is working memory. According to Eysenck, "Since task-irrelevant cognitive activities such as worry pre-empt some of the limited capacity of working memory, it is clear that they will produce decrements in the quality of performance" (p. 365). Eysenck believes that because working memory is crucially involved in the processing and temporary holding of information, reduction in its capacity would be expected to have broad repercussions on the performance of a great variety of cognitive tasks. However, only very limited experimental data are available in this area. For example, measures of short-term storage capacity have been limited to digit span indexes in providing information about the effects of anxiety upon working memory.

There is evidence, however, suggesting that the performance of highly anxious students is especially debilitated on tasks calling for short and intermediate term memory (Mueller, 1980). It is reasoned that for highly anxious students cognitive interference in processing reduces recall. Kreitzberg and Tobias (1979) provided evidence that anxiety interferes with the rehearsal required to maintain stimuli in short-term

memory. Sieber (1977) reported anxious students who had to rely on intermediate term memory performed less capably than their less anxious counterparts.

The theoretical assumption that anxiety (or more precisely, the worry component of anxiety) reduces the capacity of the working memory has also been explored in a different way. If, in fact, worry consumes a portion of the available capacity of working memory, and thus, places the anxious subject in a divided attention situation (where attention has to be shared between task stimuli and anxiety-related information such as worry), a comparable situation would be one in which a non-anxious subject is required to divide attention between a main task and a concurrent attention-demanding subsidiary task.

The expectation in both cases is that the additional task (i.e. attending to worry or to the subsidiary task) will worsen performance. Hitch and Baddeley (1976) found that the complexity of the reasoning task interacted with the presence or absence of a subsidiary task; the detrimental effects of concurrent performance of the subsidiary task on reasoning speed were greater on the more complex reasoning problems.

Anna Eliatamby (a student of Michael Eysenck) used the same reasoning task as Hitch and Baddeley (1976) and

observed a very similar interaction; however, she used anxiety as a factor rather than presence or absence of a subsidiary task and found that high anxiety had a much greater detrimental effect on the more difficult problems. The implication is that anxiety operates in a similar fashion to a subsidiary task, utilizing some of the available attentional resources. Hence, the anxious person turns his/her attention inward and the low-anxious person focuses more fully on the task; the implication being that the highly anxious person attends to fewer task cues than does the low-anxious person.

This attention interpretation of the effects of anxiety on performance is consistent with an empirical generalization advanced by Easterbrook (1959) concerning the relationship between arousal level and task variables. He reviewed a large body of research which indicated that emotional arousal consistently narrowed the range of cue utilization in task performance. More specifically, it was found that anxiety interfered with the use of incidental cues, perhaps by diminishing their value and delaying reaction to them. Meanwhile, however, it also tends to sharpen or concentrate attention to central cues. This finding is easily explained within the present framework: when an individual is anxious, attention is diverted inward

to perceptions of his/her anxiety and therefore less attention is available for external stimuli. However, among the criticisms lodged against Easterbrook's hypothesis is the query as to whether the poor incidental learning under high arousal occurred because anxious subjects "chose" not to process the irrelevant stimuli or because they could not process them due to limited attentional capacity.

This discussion surfaces another factor which may interact with the performance of anxious individuals, and thus requires further investigation: motivation.

A Brief Discussion of Anxiety and Motivation

Theorists such as Sarason (1975) and Wine (1971) have argued that the major way in which anxiety affects performance is by leading to task-irrelevant processing activities. If the further assumption is made that these task-irrelevant activities utilize some of the processing resources of working memory, it follows that anxiety will produce a decrement on all tasks dependent on working memory.

In actual fact, however, anxiety has sometimes been found to facilitate performance on easy learning tasks, as

was previously discussed, thus suggesting that anxiety must also affect the processing system in ways not yet discussed. Theorists such as Miller (1948) and Spence and Spence (1966) contend that anxiety produces an increase in "drive" or motivation. Initial reaction deems it strange that anxiety should be associated with increased effort and motivation, as it most frequently reduces the quality of performance.

Kahneman (1973) provides a theoretical analysis explaining why anxiety might lead to enhanced use of resources. One of his basic contentions is that the most significant determinant of the amount of effort expended by an individual is the evaluation of task demands. Because anxious individuals engage in much task-irrelevant processing at the expense of the processing demanded by the task itself, they are faced with greater overall processing demands than are non-anxious individuals. In essence, the anxious individual attempts to "compensate" for the performance decrements produced by task-irrelevant processing (i.e. worry) by means of an increase in attentional resources.

A second important finding presented by Kahneman (1973) is his discovery that effort increases fairly steadily as the processing demands of the main or primary

task increase due to greater task difficulty or complexity; however, as the task demands increase, the discrepancy between the effort or capacity required and effort that is actually supplied becomes greater. There is an inverse relationship between the effort supplied to the main task and the spare capacity or effort that is available for processing subsidiary tasks. It is possible to measure this spare processing capacity by looking at performance on a secondary or subsidiary task that is carried out concurrently with the primary task. The general expectation is that performance on the subsidiary task will be inversely related to effort expenditure on the primary task (together with any task-irrelevant processing associated with worry). The implication is that anxious subjects invest more effort and resources than non-anxious subjects in the main task. However, in 20 experimental dual-task situations (Kahneman, 1973), extra effort had little or no impact on the performance of the main task (there was a non-significant effect of anxiety on the main task in 16 experiments and a beneficial effect in only one experiment).

A likely explanation for the poor subsidiary task performance shown in high-anxiety conditions is that the high anxiety reduced the spare processing capacity

available for handling the subsidiary task information. Research obtained by Hamilton (1978) supports his notion. In this study the main task was to retain up to seven digits in the correct order for a few seonds, and a subsidiary reaction time task was interpolated between presentation of the digit string and its subsequent recall. Performance on the reaction time task was considered only on those trials on which the digit string was recalled correctly. When the digit string was maximally demanding (i.e. seven digits), high-anxiety subjects had significantly longer reaction times than low-anxiety subjects. Since all the subjects had been instructed to devote all of their spare processing capacity to the subsidiary tasks, the implication is that more effort and processing resources are expended on the main task under anxiety.

Thus, the empirical data presented indicates that high-anxiety subjects that are motivated exert more effort than low-anxiety subjects. Since this extra effort usually fails to translate itself into a performance superiority for anxious subjects, a disparity exists between effort investment and performance level. A plausible explanation is that much of the extra effort exerted by anxious subjects is devoted to task-irrelevant processing

activities such as worry and cognitive self-concern.

Alternatively, anxiety does not necessarily lead to an increase in motivation. For example, if an anxious person believes that the probability of reducing anxiety through successful task performance is very low, then anxiety will lead to a low investment of effort in the task. As argued by Eysenck (1982), anxiety should lead to increased effort if the source of the anxiety is intrinsic to the task, i.e. caused by fear of the consequences of inadequate task performance. In contrast, there is no particular reason to expect that anxiety will be associated with increased effort if the cause of the anxiety is extrinsic to the task, i.e. originating in events unrelated to the task.

A study by Capretta and Berkun (1962) provides a clear example of task-extrinsic anxiety. Their subjects performed a digit-span task while walking across a swaying rope bridge over a deep ravine. Since performance on the digit-span task could not be instrumental in reducing the anxiety caused by being in a dangerous environment, there is no good reason to suppose that the anxious subjects were highly motivated to repeat the digits in the correct order.

The phenomenon of learned helplessness provides a good example of the drastic drop in motivation that can occur when the chances of success are perceived to be minimal.

If, as seems likely high-anxiety people tend to be more pessimistic than low-anxiety people about the probability of performing a task successfully, there could well be circumstances in which motivational level is actually inversely related to anxiety level.

In sum, empirical data suggest that high-anxiety subjects are more motivated and exert more effort than low-anxiety subjects. However, this extra effort seldom results in improved performance. It is plausible that task-irrelevant processing activities such as worry and self-criticism consume much of the extra effort exerted by anxious subjects. Also, it appears that on complex tasks, in which maximum demands are placed upon processing capacity, and fear of failure is amplified, subjects' task-irrelevant cognitions function as distractions, resulting in performance decrements. The present study sought not only to establish whether performance efficiency differs between high and low-anxious subjects, but explored the precise nature of performance decrements. In this way, the effect of anxiety, or more specifically worry, on cognitive functioning may be more clearly determined.

CHAPTER III

DESIGN OF THE STUDY

Subjects

The subjects were 214 students enrolled in an introductory psychology or sociology course at Grant MacEwan Community College. Three separate College campuses were involved in this study, sampling students from south, central, and west Edmonton. Grant MacEwan Community College offers one and two-year-programs in areas such as social work, law enforcement, and general arts for adults involved in post-secondary education. 21 (9 males and 12 females) and 18 (9 males and 9 females) volunteers were operationally defined as high and low-test-anxious respectively on the basis of the Test Anxiety Scale. The subjects ranged in age from 18 to 46 years with the mean age being 27 years.

Test Instruments

Test Anxiety Scale

In contrast to general anxiety scales such as the Taylor Manifest Anxiety Scale (MAS; Taylor, 1953), the Test

Anxiety Questionnaire (TAQ; Mandler & Sarason, 1952) was constructed as a measure of anxiety proneness in a specific kind of stressful situation--the testing situation. It was expected that items which related specifically to the subject's reactions to testing situations would be more predictive than general anxiety scales of one's behavior in these situations.

Mandler and Sarason (1952) assumed that two kinds of thoughts may be evoked in testing situations: (1) those directed toward task completion, and (2) those that interfere with task completion. It is the latter interfering response class, consisting of cognitive self-criticisms readily elicited in testing situations that the TAQ was intended to measure. The TAQ, a 37-item questionnaire in a rating-scale format contains items that refer to the kinds of internal responses typically experienced by the subject immediately before and during examinations and tests.

I. Sarason (1958) constructed a 21-item measure of test anxiety, which he labeled the Test Anxiety Scale (TAS). It is based largely on items taken from Mandler and S. Sarason's TAQ rewritten for a true-false format. The TAQ and the TAS are highly correlated, product-moment correlation = .93.

I. Sarason noted that the attentional fouses of high and low-anxious subjects differ when under threat. The low-anxious subjects turn their attention to the task, while high anxious subjects attend to their internal self-oriented responses.

As a result of factor analyses and item analyses, the TAS has since undergone a number of revisions. The first of the revisions involved "pruning"; items with marginal part-whole correlations were dropped. The version that was chosen for this study is the 37-item TAS (Sarason, 1972), which was developed because it was felt that a longer scale would increase reliability.

Regarding construct validity, the TAS is moderately correlated with the Manifest Anxiety Scale (Mandler & Cohen, 1958) which was developed by Taylor in 1953 in order to test predictions regarding relationships between drive level and task variables in their effects on task performance. It is notable that the TAS, a situation-specific anxiety-trait measure, was a better predictor of the effects of stress on performance in a test-like situation than the MAS, a measure of general trait anxiety (Heinrich & Spielberger, 1981). Scores on Alpert and Haber's Achievement Anxiety Test (1960), a test anxiety questionnaire, correlated .64 with TAS scores. The

Test Anxiety Inventory, the most recent development in the measurement of test anxiety correlated .80 with TAS scores (Spielberger et al., 1978) establishing the validity of the TAS as a measure of test anxiety.

Behavioral observations support of the justification of the TAS as a valid measure of test anxiety in that those scoring higher on the TAS were more fidgety, and sought reassurance, became distressed, verbalized self-criticisms, and expressed displeasure for the testing situation more frequently than those achieving low scores on the TAS.

Test-retest reliabilities over .80 have been obtained for intervals of several weeks. Wagaman, Cormier and Cormier (1975) have reported a test-retest reliability coefficient of .87. The Test Anxiety Scale is found in Appendix A.

Cognitive Interference Questionnaire

The Cognitive Interference Questionnaire (CIQ) was developed by Sarason and Stoops (1978) to assess retrospectively the degree to which people, after working on tasks, report having had thoughts that interfere with concentration on the task.

The CIQ consists of 22 items, the first 21 of which are rated for the frequency of occurrence of particular

types of intrusive thoughts. Each type of thought is rated on a scale of 1 to 5: Never (1), Once (2), A few times (3), often (4), and Very often (5). Factor analysis showed that the CIQ items fall into relatively homogeneous groups. The first ten items pertain to the task on which the subject has just performed, and the remaining items refer to a diversity of thoughts unrelated to the task. The final item provides a global rating on a 7-point scale of the degree of mind-wandering experienced while working on a task.

These task-irrelevant thoughts have been negatively correlated with performance, especially among highly test-anxious students (Sarason & Stoops, 1978). There was also a significant interaction between test anxiety and the instructional conditions, largely as a function of the very high incidence of interfering thoughts reported by high-test-anxious subjects in the most evaluatively stressful achievement-oriented situations (Sarason, 1984).

According to the literature, the reliability and validity of measures used in this area of study have not been fully explored. However, Sarason (1978) and Stoops (1978) have suggested this to be the most suitable instrument for measuring anxiety-related, task-irelevant thinking. The Cognitive Interference Questionnaire is

found in Appendix B.

Wisconsin Card Sorting Test

A weakness of the test anxiety literature is that with a few exceptions, there has been no careful analysis of the nature of the performance decrements that have repeatedly occurred in studies involving test-anxious individuals. When decrements in performance have occurred, it has not been possible to determine specific processes that are either activated or inhibited by test anxiety. Focus has been placed merely upon overall success or failure, ignoring particular sources of task difficulty.

The Wisconsin Card Sorting Test (Grant & Berg, 1981) was preferred over other measures of cognitive functioning as it provides objective measures not only of overall success, but also of particular sources of difficulty on a cognitive task i.e. inefficient initial conceptualization, perseveration, failure to maintain set, and inefficient learning across several stages of the test. Analysis of the effect of anxiety on these specific cognitive processes may allow a more indepth understanding of how anxiety inhibits optimal cognitive functioning.

The WCST was originally developed to measure abstraction ability in normal individuals. Abstract

thinking, as operationally defined by this test, is the ability to sort cards according to a principle of class membership. Additionally, the WCST has been used to identify neurological impairment particularly focal frontal lobe lesions. The WCST uses stimulus cards and response cards that display figures of varying forms (crosses, circles, squares or triangles), colors (red, green, blue or yellow), and numbers (one, two, three or four). As the test is usually given, four stimulus cards with the following characteristics are placed before the subject: one red triangle, two green stars, three yellow crosses, and four blue circles. The subject is then handed a deck of response cards and instructed to place each consecutive card from that deck in front of one of the four stimulus cards, wherever he or she thinks it should go. The subject is informed only whether each response is right or wrong, and is not told the correct sorting principle. Once the subject has made a specified number of consecutive sorts according to the initial "correct" principle (color), without warning, the criterion principle is changed to form or number. The test is completed when the subject has reached criterion on three concepts once repeated (color, form, number, color, form, number) or has sorted 128 test cards.

When a correct response matches the stimulus card according to more than one dimension (i.e. both color and number), an irrelevant dimension is reinforced as well as the relevant one. This kind of ambiguity occurs fairly often in the WCST, and presumably can make concept attainment more difficult. The subject must use a strategy of elimination in this case, to determine which dimension is correct and which is irrelevant. The task, as such is complex, relying upon short-term memory storage and retrieval. Due to the task complexity, the effects of task-irrelevant processing emerge, as complete attention is necessitated to obtain successful performance. The WCST was selected as a measure of cognitive functioning because of the complexity inherent to the task. Unlike performance on a simple task, no spare attention is available for worry and cognitive self-concern. Any such preoccupation will clearly result in performance decrements.

Analyses performed (Heaton, 1981) failed to find significant sex differences on any of the WCST measures. Also, no significant age x education interaction effects were obtained for any of the WCST measures. Subjects grouped according to age, showed that group main effects for IQ were not significant (Heaton, 1981).

The authors of the WCST used the Halstead-Reitan

Battery for validity studies. The Average Impairment Rating (AIR) from the Halstead-Reitan Battery was used as a measure of general neuropsychological impairment, and was significantly correlated with WCST perseverative response scores for both the brain damaged (r=.55) and the control (r=.36) groups. The perseverative response score achieved the best diagnostic accuracy, correctly classifying 74% of the total impaired group and 72% of the normals (Robinson, et al., 1980). Construct validity was further established by reports of statistical differences between brain damaged versus controls, alcoholics versus controls, and psychiatric patients versus controls.

No reliability data are provided for the WCST, likely, because it is unclear as to how one would go about obtaining such a measure for this kind of task (Markley, 1985). Perhaps parallel forms with different concepts would work. However, with sufficient practice, intact subjects should discover the "meta-rule" governing the card sorts and thereafter be untestable.

Procedure

The Test Anxiety Scale (Sarason, 1972) was administered to 214 students enrolled at any one of three

College campuses in Edmonton, Alberta (Southside, Innercity, or Westend). The upper (scores > 26) and lower (scores < 9) 30% of the scale distribution operationally defined high and low-test-anxiety groups, respectively. The selection of score ranges for grouping subjects was influenced by several factors. First, the score criteria and "cut-off" points that were used to define groups accounted for the anticipated attrition of subjects. Secondly, the mean (x) anxieties of these groups are comparable to those of other studies by Sarason (1978, 1980) and Deffenbacher (1978). Finally, homogeneity in amount of test anxiety experienced was established within low and high-test-anxious groups (standard deviations of 2.3 and 3.1 respectively).

The 39 high and low-test-anxious students were individually administered the Wisconsin Card Sorting Test, one-two weeks later. It was initially explained to each participant that the author was conducting a research study designed to investigate individual reactions to tests. The Wisconsin Card Sorting Test was described as a measure of one's ability to do college-level work, and participants were instructed to perform to the best of their ability, as they would be compared with others. The WCST was presented in this way in an attempt to simulate an

achievement-oriented testing situation.

Immediately after the completion of the WCST, the Cognitive Interference Questionnaire was administered. Testing time varied from twenty to forty minutes per participant.

Treatment of the Data

The following statistical procedures were utilized in order to analyze the data collected from the study:

(a) Hotelling T^2 to investigate whether differences exist between the performance of low and high-test-anxious subjects on six variables of the WCST.

(b) t-test between high and low-test-anxious subjects with respect to the CIQ, to determine if anxiety induced cognitive self-concern and worry.

(c) Pearson Product-Moment Correlation to determine the degree of relation between level of anxiety (TAS) and level of cognitive interference (CIQ).

Null rather than directional hypotheses were used because no clear indication was found of what to expect in the findings of this study.

The Null Hypotheses being tested in this study were:

Hypothesis I: No significant difference exists

between high and low-test-anxious subjects' performance.

Hypothesis II: No significant difference exists regarding the amount of cognitive worry and task-irrelevant processing experienced by high and low-test-anxious subjects.

Hypothesis III: No significant relationship exists between the level of anxiety and the amount of cognitive interference experienced.

CHAPTER IV

RESULTS

Overview

Three hyotheses were constructed for the purpose of this study: to determine if differences exist between the cognitive performance of high and low-test anxious subjects; to identify whether high-test-anxious individuals experience a greater amount of distractive self-concern and; to establish whether a relationship exists between anxiety level and amount of cognitive interference experienced.

Anxiety and Cognitive Peformance

(a) Findings

The results of this study reject the first Null Hypothesis. The WCST provided six scores related to cognitive processing. The T^2 statistic was calculated to be 25.464 and tested in terms of the F distribution to be significant ($p < .007$). Overall, the test of vector of means of the latent variable, cognitive processing, reveals

significant differences between low-test-anxious and high-test-anxious groups.

However, in examining individual variables, the probabilities fail to highlight any single variable as significant. Thus, the six variables of the WCST as a group generate significant differences between high and low-test-anxious groups, but no one variable is strong enough to explain the differences.

(b) Conclusions

The cognitive performance of the high-test-anxious subjects is less adequate than is that of less anxious subjects. However, no one variable is responsible for the performance decrements of test-anxious subjects. Perhaps an analysis of linear combinations of variables would account for inter-group differences.

Level of Anxiety and Cognitive Interference

(a) Findings

The Test Anxiety Scale and the Cognitive Interference Questionnaire were utilized respectively, to measure level of test-anxiety and amount of cognitive interference. The calculated t-value of 5.66 and critical t-value of 2.12 means that high-anxious individuals experienced a greater amount of cognitive interference than their low-anxious

counterparts (df=37, $p < .0001$). The results of the t-test between the high versus low test-anxious subjects with respect to cognitive interference indicate that a significant difference exists between groups on this variable, thus rejecting the second Null Hypothesis. These results are presented in Table I.

The third Null Hypothesis is also rejected by the results of this study. The Pearson correlation results indicate that a relationship exists between the level of anxiety and amount of cognitive interference experienced. The r statistic was calculated to be .69 at the .00001 level of significance. These results are presented in Figure 1.

(b) Conclusions

TABLE I

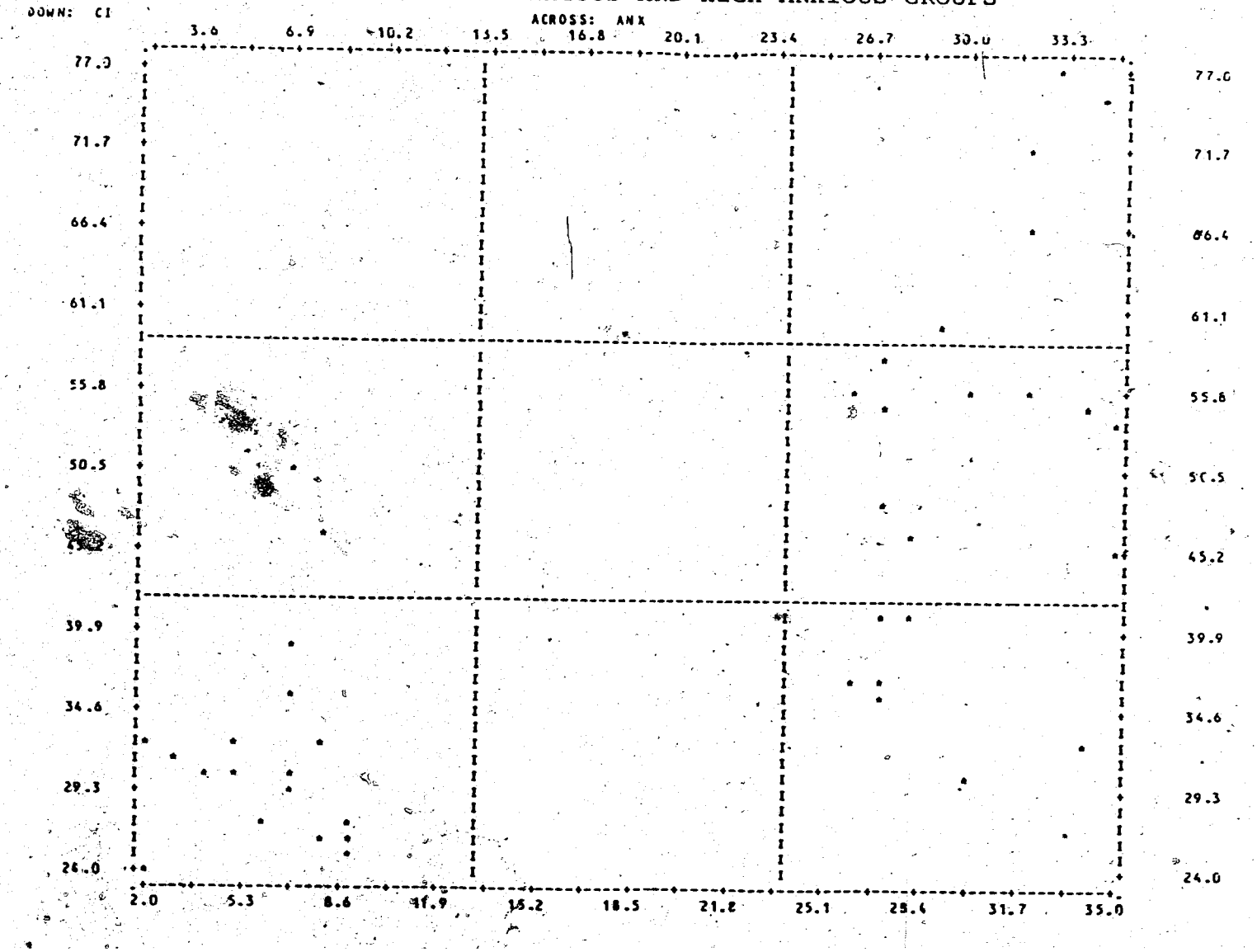
COGNITIVE INTERFERENCE, MEANS AND STANDARD DEVIATIONS FOR LOW-ANXIOUS AND HIGH-ANXIOUS GROUPS

ANXIETY LEVEL	M	SD	t
High-Anxious	50.381	12.785	5.66*
Low-Anxious	31.889	7.194	

*p<.0001

FIGURE 1

SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN LEVEL OF ANXIETY AND COGNITIVE INTERFERENCE FOR LOW-ANXIOUS AND HIGH-ANXIOUS GROUPS



There is a significant positive relationship between level of test-anxiety and amount of cognitive interference experienced.

CHAPTER V

CONCLUSION AND IMPLICATIONS

Summary of the Study

The major purpose of this study was to investigate whether highly test-anxious subjects, in situations that pose testlike challenges, perform at relatively low levels and experience relatively high levels of task-irrelevant thoughts.

Following administration of the Test Anxiety Scale to students enrolled in an introductory psychology or sociology course, groups of high and low-test-anxiety were distinguished. 21 high-test-anxious and 18 low-test-anxious subjects were individually administered the Wisconsin Card Sorting Test involving concept formation. Scores for six performance variables were obtained for each subject.

The hypotheses of the study were:

I. No significant difference ex[illegible]etween high

and low-test-anxious subjects' performance.

II. No significant difference exists regarding the amount of cognitive worry and task-irrelevant processing experienced by high and low-test-anxious subjects.

III. No significant relationship exists between the level of anxiety and the amount of cognitive interference experienced.

A Hotelling T^2 was conducted on the data to test the significance of differences between high and low-test-anxious subjects' performance on six variables. Although no significant difference between groups was established for any one of the six variables, significant differences were established at the .007 level of significance when the six variables were grouped together to provide an overall score of success.

A t-test was conducted to determine the significance of differences between levels of cognitive interference experienced by high and low-test-anxious subjects. Significant differences were established between groups on this variable at the .0001 level of significance. A Pearson Product-Moment Correlation was obtained to determine the degree of relation between level of test-anxiety and cognitive interference. A significant

positive relationship was established (.69) at the .00001 level of significance. The hypothesis that groups would not differ in specific aspects of their performance on a test of concept formation received empirical support in this study, although overall differences in performance were evident. The hypotheses that no significant difference exists regarding the amount of cognitive interference experienced by high and low-test-anxious subjects; and that no significant relationship exists between level of anxiety and amount of cognitive interference experienced are rejected by the results of this study.

Discussion

The results of this study supported the predictions derived from attentional theories of test anxiety. While no significant difference was found between high and low-test-anxious subjects' performance on six specific variables, differences were found in the overall efficiency of cognitive processing between the two groups. As predicted, the high-test-anxious group experienced greater interference from anxiety than did the low-test-anxious group. Thus, for the highly test-anxious, an evaluative

situation appeared to elicit interfering anxiety in the form of attention to worrisome thoughts and ruminations, and focus upon elements of the task irrelevant to efficient problem solution. The low-test-anxious group, however, did not experience this dysfunctional pattern of attention.

Implications for Further Research and Treatment

Because of the sample group size and non-representativeness of the sample, it is not possible to generalize the results of this study to the entire population. For the group sampled, however, test-anxiety did reduce the quality of performance, while increasing the level of task-irrelevant thinking.

It is readily apparent that various types of further research are warranted to clarify the performance, motivational, and attentional patterns of high-test-anxious subjects. Before moving into specific research and treatment applications, a few implications of the attentional analysis of test anxiety are presented below:

1. An attentional approach is explicitly concerned with how the subject uses his/her task time--his/her cognitive activity, what he/she is thinking about and attending to.

2. This approach implies little interest in autonomic arousal per se. In this context, degree of arousal is irrelevant unless the subject is attending to his/her arousal. Of course, when arousal becomes quite extreme, it is attentionally demanding.

3. Finally, this analysis implies that the test-anxious person's performance may be improved by directing his attention to task relevant variables, and away from self-evaluative rumination.

The experimental studies in this area have typically been concerned with manipulations of the evaluative situational conditions which evoke test anxiety. Generally, studies have not investigated conditions designed to alter the interfering responses elicited by the anxiety. It seems reasonable to suggest that an appropriate next stage for research in this area is one in which the evaluative dimension is held constant, and in which a search is begun for variables that will alter the test-anxious subjects' interfering responses. An attentional analysis of test anxiety can provide some direction to such a search.

The results of this study suggest a particular approach to the treatment of test-anxious persons. First

of all, the specific concern with how highly test-anxious subjects use their task time suggests treatment in which subjects are given intensive practice in dealing with tests. Second, this task practice should be accompanied by instructions to focus fully on the task and to inhibit self-relevant thinking. There is a large body of literature in selective attention, the basic premise of which is that subjects' attention can be differentially directed to specific stimuli or away from others. With repeated training under attention-directing instructions, subjects become more and more skilled in attending to the "relevant" stimuli and ignoring the "irrelevant" stimuli (Wine, 1971). Further research is required to determine the degree to which attentional training not only improves task performance but lowers reported test anxiety level as well.

As mentioned earlier, a weakness in the area of test-anxiety research is that there has been no careful analysis of the nature of performance decrements experienced by test-anxious subjects. Focus has been placed merely upon overall success or failure, ignoring particular sources of task difficulty. The Wisconsin Card Sorting Test, which provides performance scores for six variables was used in this study in the attempt to overcome this weakness. Grant and Patel (1957) used the WCST with

high and low-anxious groups and made an interesting discovery involving one of the six variables entitled "learning to learn". The high and low-anxious groups showed different patterns of results across the six WCST stages: the low-anxiety group did worse on stage two and then improved more on the later stages of the test, whereas the high-anxiety group did worse on the later stages. These results reveal an inability of the anxious group to learn the underlying principle required for success in the card sort, and at the same time highlights the ability of the low-anxious group to learn and incorporate the underlying principle into improved performance. In this instance, the reason for the differential performance between groups involved the concept of learning, whereby the "meta-rule" is sought at the onset of the task, resulting in improved performance by the completion of the task. Future researchers need to recognize and define the properties of specific tasks and the attentional demands they make on subjects.

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APPENDICES

APPENDIX A

TEST ANXIETY SCALE

INSTRUCTIONS: This questionnaire concerns reactions that individuals have to testing situations. The following is a list of reactions, some of which you might have had before, during, or after a testing situation. If you feel that the statement describes you, answer TRUE. If you feel that it is not descriptive of you, answer FALSE. Answer every statement either true or false by placing an X over the T or F.

T F 1. While taking an important exam I find myself thinking of how much brighter the other students are than I am.

T F 2. If I were to take an intelligence test, I would worry a great deal before taking it.

T F 3. While taking an important examination I perspire a great deal.

T F 4. During course examinations I find myself thinking of things unrelated to the actual course material.

T F 5. I get to feel very panicky when I have to take a surprise exam.

T F 6. During test I find myself thinking of the consequences of failing.

T F 7. If I knew I was going to take an intelligence test, I would feel confident and relaxed beforehand.

T F 8. After important tests I am frequently so tense that my stomach gets upset.

T F 9. I freeze up on things like intelligence tests and final exams.

T F 10. Getting a good grade on one test doesn't seem to increase my confidence on the second.

T F 11. I sometimes feel my heart beating very fast during important tests.

T F 12. After taking a test I always feel I could have done better than I actually did.

T F 13. I usually get depressed after taking a test.

T F 14. I have an uneasy, upset feeling before taking a final examination.

T F 15. When taking a test my emotional feelings do not interfere with my performance.

T F 16. During a course examination I frequently get so nervous that I forget facts I really know.

T F 17. I seem to defeat myself while working on important tests.

T F 18. The harder I work at taking a test or studying for one, the more confused I get.

T F 19. As soon as an exam is over I try to stop worrying about it, but I just can't.

T F 20. During exams I sometimes wonder if I'll ever get through college.

T F 21. I would rather write a paper than take an examination for my grade in a course.

T F 22. I wish examinations did not bother me so much.

T F 23. I think I could do much better on tests if I could take them alone and not feel pressured by a time limit.

T F 24. Thinking about the grade I may get in a course interferes with my studying and my performance on tests.

T F 25. If examinations could be done away with I think I would actually learn more.

T F 26. On exams I take the attitude, "If I don't know it now there's no point worrying about it."

T F 27. I really don't see why some people get so upset about tests.

T F 28. Thoughts of doing poorly interfere with my performance on tests.

T F 29. I don't study any harder for final exams than for the rest of my course work.

T F 30. Even when I'm well prepared for a test, I feel very anxious about it.

T F 31. I don't enjoy eating before an important test.

T F 32. Before an important examination I find my hands or arms trembling.

T F 33. I seldom feel the need for cramming before an exam.

T F 34. The College ought to recognize that some students are more nervous than others about tests and that this affects their performance.

T F 35. It seems to me that examination periods ought not to be made the tense situations which they are.

T F 36. I start feeling very uneasy just before getting a test paper back.

T F 37. I dread courses where the professor has the habit of giving quizzes.

APPENDIX B

COGNITIVE INTERFERENCE QUESTIONNAIRE

INSTRUCTIONS: This questionnaire concerns the kinds of thoughts that go through people's heads at particular times, for example, while they are working on a task. The following is a list of thoughts, some of which you might have had while doing the task on which you have just worked. Please indicate approximately how often each thought occurred to you while working on it by placing the appropriate number in the blank provided to the left of each question.

1=Never
2=Once
3=A few times
4=Often
5=Very Often

____1. I thought about how poorly I was doing.

____2. I thought about what the experimenter would think of me.

____3. I thought about how I should work more carefully.

____4. I thought about how much time I was using.

____5. I thought about how others have done on this task.

____6. I thought about the difficulty of the problems.

____7. I thought about my level of ability.

____8. I thought about the purpose of the experiment.

____9. I thought about how I would feel if I were told how I performed.

___10. I thought about how often I got confused.

___11. I thought about other activities (for example, assignments, work).

___12. I thought about members of my family.

___13. I thought about friends.

___14. I thought about something that made me feel guilty.

___15. I thought about personal worries.

___16. I thought about something that made me feel tense.

___17. I thought about something that made me feel angry.

___18. I thought about something that happened earlier today.

___19. I thought about something that happened in the recent past (last few days, but not today).

___20. I thought about something that happened in the distant past.

___21. I thought about something that might happen in the future.

Please circle the number on the following scale which best represents the degree to which you felt your mind wandered <u>during the task you have just completed</u>.

Not at all 1 2 3 4 5 6 7 Very much