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DIMENSIONS OF ANXIETY AND THEIR EFFECT ON AN
ASPECT OF THE PERFORMANCE PROCESS:
COMMISSION OF MENTAL ERRORS

by
Ralph Richard Schoenfeld

A dissertation submitted in partial fulfillment
of the requirements for the degree

Doctor of Education

University of San Diego

1993

Dissertation Committee

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ABSTRACT

The pressure and anxiety of performing well will increase as the importance of winning continues to be stressed in competitive sports. The purpose of this study was to investigate the anxiety-performance relationship in an applied, field-tested manner by examining the relationship between competitive state anxiety and the incidence of mental errors committed under various levels of competition. Male and female elite athletes of the men's and women's basketball teams from the University of Saskatchewan and the University of Regina (Saskatchewan, Canada) made up the subject population for this study.

The study utilized the Sport Competition Anxiety Test (SCAT, Martens, 1977) to measure trait anxiety (Trait-A), and the Competitive State Anxiety Inventory-2 (CSAI-2, Martens, Burton, Vealey, Bump & Smith, 1983) to assess the multidimensional nature of state anxiety (State-A). A Mental Error Questionnaire was developed by the researcher in collaboration with the participating teams' coaching staffs to evaluate the commission of mental errors.

Independent variables consisted of gender, and competition, while commission of mental errors and dimensions of state anxiety served as the dependent variables. Seven primary hypotheses were tested using one-way ANOVAs, correlation and multiple regression analyses, while two secondary hypotheses were tested using two-way ANOVAs to determine interaction effects.

Findings of the study included: (1) low to moderate correlations for SCAT's ability to predict state anxiety dimensions (as measured by the CSAI-2); (2) no significant differences between the dimensions of anxiety or gender and the commission of mental errors; (3) a significant difference between gender and anxiety for the cognitive anxiety dimension; (4) a significant difference between the commission of mental errors and cognitive and somatic anxiety dimensions; (5) a significant difference between the level of competition and somatic anxiety for the practice condition; (6) no significant difference between the level of competition and the commission of mental errors; (7) significant predictor variables (cognitive anxiety and self-confidence) for mental errors on competition; and (8) no significant interaction effects between levels of competition and gender with respect to dimensions of anxiety or the commission of mental errors. Therefore, it was concluded that neither gender nor the level of competition appear to have a significant impact on the dependent variables.

Dedication

Bonnie, Brad and Joelle—this work is dedicated to you. How can I ever thank you or repay you for the sacrifice and support which made a seemingly insurmountable undertaking, possible? You had the more difficult task and gave up much, so that I might fulfill a dream.

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CHAPTER I

THE PURPOSE

Statement of the Issue

The last twenty-five years could well be labeled the age of the athlete. Organized athletics has experienced a steady increase in media visibility, technological and scientific advance, and commercialism. As the importance of winning continues to be stressed in competitive sports, the pressure and anxiety of performing well will also continue to increase, and will parallel the level and intensity of anxiety that individuals experience in our fast-paced, highly competitive, and rapidly changing society. Research literature has recognized the significance of anxiety along with other emotional and personality factors in sports competition (Cooley, 1987; Martens, 1971; Silva, 1984; Singer, 1975; Ziegler, 1980). Martens (1977), a renowned sport psychologist, posed the following provocative questions concerning the influence of anxiety-related cognitive processes on performance in sports competition: "What causes athletes to become uptight? Why do some athletes 'rise to the occasion' in intense competition while others 'buckle under the pressure'?" He concluded that "'What's in the head' is just as important

in determining a winner, and in having competitive sports be an enjoyable experience" (p. 3).

Most athletes experience some anxiety before demonstrating outstanding performances, and while it is impossible to say that one cannot produce superlative performances when highly nervous, these extraordinary efforts are thought to occur in spite of anxiety, not because of it. An understanding of the determinants of competitive state anxiety will provide valuable information for both anxiety-reduction and performance enhancement intervention.

According to Bird and Horn (1990), a phenomenon that holds intrigue for athletes, coaches, and sport psychologists alike is the increase in mental errors committed during athletic contests as opposed to practice situations. The most commonly accepted explanation for those errors is the increase in anxiety that is purported to occur as a result of the highly evaluative nature of the competitive setting as compared to practice conditions (Landers, 1980).

This study examines the dimensions of precompetitive state anxiety and their impact on a performance process (decision-making) as indicated by the commission of mental errors during competition. As a result of establishing a relationship between anxiety and performance, athletes, coaches and sport psychologists will have the potential to determine individual optimum levels of anxiety that lead to peak performance conditions, and establish strategies that provide athletes with control over their anxiety level. Once athletes have demonstrated performance enhancing decision-making during competition, coaches

can focus their attention on providing the athletes with feedback on skill execution.

Background to the Problem

Early explorations of sport scientists into athletics consisted of testing basic theory and conceptual models with non-athletes—research topics were diverse and were channeled toward many populations. It was not until the early 1970's that North American sport psychologists began examining how athletes' thinking influences their performance.

Most of the early sport psychology research focused on attempts to link personality or character with participation in athletics, and consequently, the majority of those early investigations were designed to compare the personalities of athletes with those of non-athletes. When few definitive trends emerged the "personology" approach faded, and sport scientists pursued psychological aspects of individual sport behavior in the form of theory testing. Much of the theory testing, however, occurred in the laboratory, and when application of this testing was taken to field setting for reality testing, little was uncovered in terms of practical applications to sport behavior. Many of today's leading researchers are actively engaging in studies that may lead to the development of new theories which are unique to individual sport behavior. Research is being done in the laboratory, the gymnasium and the playing field; practical and theoretical questions are being posed and answered.

A major area of study that is capturing the imagination of athletes, coaches and sport psychologists is the cognitive construct known as arousal or anxiety (Gould et al., 1983; Martens et al., 1975, 1980, 1990; Sonstroem, 1984). This shift in research focus is based on the notion that the fluctuation in performance is generally caused by the fluctuation in the athlete's mental control. The athlete simply does not lose and gain stamina, skill, strategy, or conditioning during the ebb and flow of a competition. What the athlete does lose is control of cognitive factors such as the ability to concentrate, to process relevant cues, to focus on positive self-talk etc. (Harris, 1986). Consistent high-level performance begins with the discovery of those factors and conditions that accompany superior performance. Awareness and acceptance of the fact that each athlete has control over behavior and arousal/anxiety, allows that athlete to learn and develop skills and strategies necessary to consciously regulate responses in order to maintain an optimal performance level.

Ambiguities and inconsistencies in previous research on anxiety and performance may be partly due to the adoption of an oversimplified unidimensional conceptualization of anxiety. Recent research however, has addressed the issue of multidimensionality in competitive anxiety; first, the notion of traits and states which is widely accepted and is reflected in the extensive use of state-trait anxiety inventories (Spielberger, 1989), and second, the notion that competitive state anxiety is viewed as a multidimensional construct (Gould, Petlichkoff & Weinberg, 1984; Jones & Hardy, 1989; Martens et al., 1990). Studies

by Davidson (1978), Davidson and Schwartz (1976), and Schwartz, Davidson, and Goleman (1978), subdivided trait and state anxiety into cognitive anxiety, somatic anxiety, and attentional components. Most recently, Martens et. al., (1990) have provided the sport psychology field with three components of anxiety, supporting the dimensions of cognitive anxiety and somatic anxiety, but replacing the attentional dimension as argued by Schwartz et. al., (1978), with the dimension of self-confidence.

For the most part, studies investigating the anxiety-performance relationship have been laboratory in nature (Baddeley et al., 1968; Hammerton & Tickner, 1967, 1969; Idzikowski & Baddeley, 1983, 1987), with artificial manipulations of anxiety and performance variables (Morris & Liebert, 1973), utilizing between-individuals and between-groups comparisons (Burton, 1988) across a variety of unrelated activities (Gould et al., 1984, 1987; Burton, 1988), resulting in little practical application to competitive sport behavior. Consequently, some sport psychologists (Alderman, 1979; Martens, 1979), have emphasized the need for more relevant field research in order to better understand the complex social interaction inherent in sport competition. Martens (1979), has argued that the richness of field settings is important when one is interested in increasing the potency of an independent variable (e.g. competitive state anxiety).

The most promising avenue of research has assumed that anxiety is situation-specific rather than a global trait that pervades all situations (LeUnes & Nation, 1989). Therefore, it is more productive to

determine whether sport-relevant anxiety is consistent within sport contexts. Researchers, using general anxiety measures have failed to find precompetitive anxiety to be higher than preseason anxiety or that more difficult conditions (games) induce greater anxiety (Morgan, 1970). As a result, several sport-specific questionnaires have been developed for the purpose of measuring sport specific trait anxiety (Sport Competition Anxiety Test (SCAT); Martens, 1977), state anxiety (Competitive State Anxiety Inventory (CSAI); Martens et al., 1980) and, more recently, multidimensional competitive state anxiety (Competitive State Anxiety Inventory-2 (CSAI-2); Martens et al., 1990).

A review of the literature indicates that extensive research has focused on the relationship between anxiety and performance (Oxendine, 1970; Gould, Horn & Spreeman, 1983; Klavora, 1978; Sonstrom & Bernardo, 1982). Empiricists, however, have concentrated their investigations on objective results—success/failure as it relates to win/loss, score, or some other performance outcome criteria (Gould, Petlichkoff, & Weinberg, 1984; Klavora, 1978; Poteet & Weinberg, 1980; Weinberg & Hunt, 1976). Relatively little research has explored the effects anxiety has on the performance process (e.g., the quality of movement or the appropriateness of decision-making etc.)—research which would produce fewer statistics, yet perhaps a deeper understanding of performance in competitive sports.

Anxiety does not affect all individuals in the same way—some athletes perform very well when highly aroused or under intense pressure, whereas others tend to tighten up or "choke" under pressure.

According to Spielberger (1966), an athlete's anxiety before or during an event will be determined by an interaction of his or her general or usual level of anxiety (e.g., trait anxiety) and the specific situational constraints of the event (e.g., state anxiety). For example, both high and low trait-anxious individuals will probably exhibit higher levels of state anxiety when competing for the national championship than during a practice session, although the high trait-anxious person probably will feel more threatened by the championship game than the low trait-anxious person and will react with higher levels of state anxiety.

Each individual has different levels of tolerance for arousal as well as different levels of anxiety going into a task. Thus, the optimal level of anxiety for each individual is different. Oxendine (1970), postulated that the amount of state anxiety which would produce optimal performance was dependent on the nature of the task; complex tasks and tasks requiring fine motor coordination require a low level of anxiety to produce optimal performance, whereas simple tasks and gross motor skill tasks appear to require higher levels of anxiety.

Segal and Weinberg (1984), have argued that females exhibit higher levels of competitive trait anxiety than males, which suggests that females have a tendency to perceive competitive sport situations with greater feelings of fear and apprehension. Additionally, females are more concerned with evaluations of their performance, whereas males are more concerned with the outcome of a contest.

Most studies treating the anxiety-performance relationship have failed to consider the between-person differences in degree of anxiety

responsiveness (Oxendine, 1970); each subject often is not tested under all stress conditions. A score of 23 on the Competitive State Anxiety Inventory (Martens, 1977) for example, may represent a peak state anxiety experience for one subject and a low response condition for a second subject. Therefore, an intermediate or optimal level of arousal as used in a test of the inverted-U hypothesis (Yerkes & Dodson, 1908), will consist of a different value for different individuals. When subjects are assigned to a single stress condition, it creates an inter-subject or between-subject analysis of the dependent variable, performance. This study attempted to address the concerns posed by previous studies which have resulted in equivocal findings and attempted to answer questions concerning the relationship between pre-competitive anxiety and sport performance.

Delineation of the Research Problem

Although researchers have investigated the effects of many different types of personality factors on performance—motivation, commitment, extroversion-introversion, independence, aggressiveness, leadership—one often studied personality factor among athletes is anxiety. The relationship between anxiety and performance is a critical one for the athlete and the coach who want to maximize performance. While most researchers investigating the anxiety-performance relationship agree that a little arousal helps in preparing athletes for competition, many athletes have reported that their performance has been adversely affected by being too anxious or aroused for an athletic

competition (Gould, Horn & Spreeman, 1983; Klavara, 1978; Spielberger, 1989). The inverted-U hypothesis as postulated by Yerkes and Dodson (1908), states that performance improves with increasing levels of anxiety or arousal up to some optimal point, whereupon further increases will produce a decrement in performance. This optimal point is believed to be different for each individual and in accordance with each specific situation (Silva & Weinberg, 1984). Therefore, coaches and/or sport psychologists must try to help each athlete reach his or her optimal level of anxiety or arousal in order to maximize performance.

The interactionist model postulates that behavior can best be understood in terms of an interaction between the individual's own makeup (personality) and his or her specific situation (Cooley, 1987; Endler, 1978). Researchers have hypothesized that the type of task being performed is critical in determining the appropriate level of anxiety or arousal for achieving the best results. Tasks requiring a great deal of precision coordination and control, such as golf, would probably best be performed at low levels of arousal/anxiety (Weinberg & Genuchi, 1980), while tasks demanding strength and speed such as weight lifting, wrestling or tackling in football would best be performed under relatively high levels of arousal/anxiety (Gould, Horn & Spreeman, 1983; Highlen & Bennett, 1979).

Previous research which dealt with anxiety as a global construct (Spielberger, 1966), resulted in equivocal findings as to the relationship between anxiety and performance. More recent developments in the

state anxiety literature have focused on the multidimensional nature of the phenomenon (Bird & Horn, 1990; LeUnes & Nation, 1984; Martens et. al., 1983). Specifically it has been proposed that state anxiety actually consists of two components, cognitive state anxiety and somatic state anxiety, and that although these dimensions are independent, an effect on one will have a resulting effect on the other (Anshel, 1985, 1990; Bird & Cripe, 1986; Oxendine, 1970). Physiologically, anxiety is manifested in accelerated respiratory rate, heart rate, and palmer sweating, but the most debilitating symptom of somatic anxiety is muscle tension, a condition which interferes with the smooth functioning of needed muscle groups, and contributes to early fatigue. In addition, according to Nideffer (1981), anxiety takes its toll psychologically by narrowing the perceptual field and one's attentional focus, resulting in a diminished capacity to take in and process information. The intrusion of distracting and maladaptive thoughts and images results in focusing on all the things that may go wrong, how inadequate or incapable one is, how poorly one might do, and the consequences of possible substandard performances. Such thoughts destroy one's self-confidence, and become self-fulfilling prophecies. Covert psychological anxiety, if maintained over a long period of time, results in the athlete experiencing a significant decrease in concentration and performance, which only adds to the increased anxiety state, thus resulting in a negative anxiety/performance cycle (Martens et. al., 1990).

In order to control or eliminate this cycle, the athlete must begin to understand what is going on physiologically, and how he or she can regain control over the situation. Similarly, an athlete must understand what is going on psychologically, and what interventions will be effective to regain control of this situation. As stated previously, the physiological and psychological processes, although independent, influence each other. Of perhaps even greater significance than understanding and regaining control over the somatic and cognitive processes, is the ability of the coach, sport psychologist or athlete to assess the pre-competitive levels of each dimension, and to develop the appropriate intervention skills that will achieve levels required for optimum performance.

Purpose of the Study

Initial scientific explorations into the anxiety-performance relationship were conducted from the perspective that anxiety was a one dimensional construct, and resulted in equivocal findings. More recent investigations by Martens et. al. (1990) support the notion that anxiety is a multidimensional phenomenon, and instruments which are able to measure multidimensional pre-competitive state anxiety dimensions, and are sport-specific, have a greater chance to determine significant relationships between anxiety and performance.

The purpose of this research study was to investigate the anxiety-performance relationship in an applied, field-tested manner, by examining the relationship between competitive state anxiety and the

incidence of mental error commission under various levels of competition. Limited research can be found with respect to the effect of precompetitive "state anxiety" on an aspect of the performance process, since the majority of investigations have focused on the relationship between anxiety and various task or sport performance outcomes (Klavora, 1978; Martens, 1971; Martens et al., 1990; Sonstrom & Bernardo, 1982; Weinberg, 1978). This study utilized a performance process (decision-making) as the dependent variable. Previous research examined isolated factors such as information processing, perception and decision making, but in a context removed from the natural competition environment. Additionally, studies examining the anxiety-performance relationship (also known as arousal/anxiety-performance relationship) have used inter-subject or inter-group comparisons. The present study viewed the anxiety-performance relationship from an intra-subject perspective. By using intra-subject comparisons, the study accounted for optimum state anxiety levels which are believed to be different for each individual (Klavora, 1978).

This comparative study measured dimensions of anxiety as identified by Martens et al. (1990), for each individual, under three levels of competition. The following research questions were grouped under two main headings:

- A. What are the implications of anxiety on an individual?
  1. Is an athlete's trait anxiety a valid and reliable predictor of pre-competitive "state anxiety?"

2. Is an athlete's optimal level of precompetitive state anxiety reflected in his/her best performance as it relates to the commission of fewer mental errors?
3. Are there gender differences with respect to levels of precompetitive state anxiety?
4. Are the anticipated differences in levels of precompetitive "state anxiety" between males and females reflected in a discrepancy in mental error rate according to level of competition?
5. Does the increase in the level of competition increase the level of cognitive anxiety, somatic anxiety, and self-confidence anxiety?

B. How does the level of competition (practice, exhibition game, league game) affect anxiety and can this hypothesized difference be measured by an individual's performance process?

6. Is there a significant increase in the commission of mental errors during athletic contests as compared to practice sessions?
7. Is there a relationship between an increase in the commission of mental errors during competition and the highly evaluative nature of the league-game setting as compared to practice or exhibition game conditions?
8. Which aspect of precompetitive state anxiety (cognitive, somatic or self-confidence) has the greatest impact on the commission of mental errors?

Statement of Hypotheses

Based on a review of the literature and personal experience in working with high school and university athletes in the area of mental preparation for peak performance, the following null hypotheses were generated ($\alpha = .05$ was used in all tests of statistical significance):

Hypothesis 1: There is no correlation between an athlete's trait anxiety as measured by the SCAT and each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2.

Hypothesis 2: There is no significant difference between the levels of gender (male and female) with respect to each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2.

Hypothesis 3: There is no significant difference between the levels of gender (male and female) and the perceived commission of mental errors as measured by the MEQ.

Hypothesis 4: There is no significant difference between the dimensions of pre-competitive state anxiety (cognitive, somatic and self-confidence) as measured by the CSAI-2 and the commission of mental errors as measured by the MEQ.

Hypothesis 5: There is no significant difference between the levels of competition (practice, exhibition game, and league game) with respect to each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2.

Hypothesis 6: There is no significant difference between the levels of competition (practice, exhibition game and league game) with respect to the perceived commission of mental errors as measured by the MEQ.

Hypothesis 7: There is no significant predictive value between the independent variables (pre-competitive state anxiety dimensions: cognitive, somatic and self-confidence) and the criterion variable (mental errors) with respect to the two levels of competition (two exhibition games and three league games).

The seven primary hypotheses described above were developed to test the main effects between the levels of the independent variables. In addition, specific combinations of the independent variables were of interest. The following null hypotheses were created to determine if any significant interaction effects existed.

Hypothesis 1: There is no significant interaction effect between the levels of competition (exhibition game, and league game) and the levels of gender (male and female) with respect to the perceived commission of mental errors.

Hypothesis 2: There is no significant interaction effect between the levels of competition (practice, exhibition game, and league game) and the levels of gender (male and female) with respect to the dimensions of pre-competitive state anxiety (cognitive, somatic and self-confidence).

Importance of the Study

This study informs athletes, coaches and sport scientists about the nature of precompetitive state anxiety of individuals, and its impact on the quality of performance. Just as enduring characteristics or traits interact with the environment, affect (someone's emotional response to a situation) also has a role in sport performance (Silva & Weinberg, 1984). Once a person experiences (overtly or covertly) a particular affect, this psychological state can influence subsequent performance. Traits predispose a person to respond a certain way in various situations, and the nature of the situation often influences the degree of manifestation. Moreover, when behavioral responses are exhibited, they often influence one's psychological state, which in turn can help or inhibit subsequent performance. Due to the complex nature of the anxiety-performance relationship, researchers have begun to employ multivariate models of assessment, and have combined variables to study how the interactions between them influence performance in sport settings. Consequently, sport scientists can approximate more closely the true nature of the competitive environment within which the athlete must perform.

Knowing how an individual responds in various competitive settings is often the foundation upon which intervention programs are built. By utilizing various techniques such as anxiety management training and attentional control training, an athlete can be taught to identify and modify undesirable psychological and physiological responses that may occur before and during competition. Through self-

regulation techniques, athletes can also be taught to achieve and maintain the desirable responses. Identification and intervention skills enable the athlete, coach or sport psychologist not only to modify a behavioral response but also to manipulate the underlying cognitions that have habitually supported the undesirable action. Intervention is often directed toward controlling prematch or precompetitive anxiety, the "choker syndrome" or the loss of confidence in addition to controlling many other pertinent habitual patterns of predisposition, affect or behavioral response. It is important to know how we can best measure and understand the impact of anxiety upon performance, and how we can best initiate change in order to assist athletes in realizing their full potential.

Definition of terms

The following definitions of terms are provided in order to avoid what in the sport psychology literature is often an ambiguous, and interchangeable use of anxiety and performance related terms to describe the same construct.

Arousal: The condition known as arousal refers to the physiological intensity dimension of the central nervous system, and is reflected by the state of an organism on a continuum from deep sleep to intense excitement. According to Sage (1984), arousal is viewed as an energizing function that is responsible for the harnessing of the body's resources for intense and vigorous activity.

Stress: Generally one of the most ambiguous psychological constructs, stress has been defined as an imbalance between the perceived environment demand and the perceived response capability of the organism. McGrath (1970), posited that "stress has to do with a (perceived) substantial imbalance between demand and response capability, under conditions where failure to meet demand has important [perceived] consequences" (p. 20, parentheses in original).

Worry: According to Martens (1987), "Worry occurs when there is a discrepancy between what you hope will happen and what you perceive is occurring or will occur" (p. 113). Negative thoughts resulting from a discrepancy between what one wishes for and what one perceives or imagines may occur (e.g., hoping to perform flawlessly during play, but worrying about being able to attain such perfection), lead to stress that typically takes the form of worry.

Threat: Martens et. al. (1990), has argued that threat is the perception of physical or psychological danger. It is the perception of an imbalance between environmental demand and response capability (e.g., when the perceived skill required to perform a task is greater than the perceived skill possessed by an individual). By contrast, Spielberger (1989), referred to stress as a "complex psychobiological process that consists of three major elements: stressors, perceptions or appraisals of danger (threats), and emotional reactions" (p.4).

Anxiety: Generally speaking, anxiety—as described in the psychological literature—is usually restricted to higher arousal states that produce feelings of discomfort or excessive concern and worry (Martens, 1990).

Trait anxiety: The predisposition to perceive certain situations as threatening and to respond to these situations with varying levels of state anxiety is defined as trait anxiety. As Spielberger (1966) has argued, trait anxiety is "a motive or acquired behavioral disposition that predisposes an individual to perceive a wide range of objectively nondangerous circumstances as threatening and to respond to these with anxiety reactions disproportionate in intensity to the magnitude of the objective danger" (p. 17).

State anxiety: According to Spielberger (1966), state anxiety refers to an existing or immediate emotional state characterized by apprehension and tension. Anxiety states are "characterized by subjective, consciously perceived feelings of apprehension and tension, accompanied by or associated with activation or arousal of the autonomic nervous system" (p. 17).

Cognitive anxiety: Morris, Davis, and Hutchings (1981) posited that cognitive anxiety is characterized by "conscious awareness of unpleasant feelings about oneself or external stimuli, worry, disturbing visual images" (p. 547). It is the mental component of anxiety usually

caused by negative expectations about success or by negative self-evaluation.

Somatic anxiety: Physiological and affective elements of the anxiety experience which develop directly from the autonomic system constitute the condition known as somatic anxiety. Evidence of this anxiety is reflected in such responses as rapid heart rate, shortness of breath, clammy hands, butterflies in the stomach, and tense muscles (Morris et. al., 1981).

Mental Errors: Inappropriate decisions made by the athlete during competition. These would include, but are not limited to decisions in areas such as: appropriate defensive position (e.g., individual and team concept); shot selection (e.g., based on game situation as well as possession situation); committing a foul (e.g., offensive or defensive); committing violations (e.g., bad passes, seconds in the key, travelling etc.); reading offensive and defensive opportunities.

Mental Error Questionnaire (MEQ): An instrument designed by the researcher in consultation with the coaching staffs of participating teams to measure the perceived mental errors committed by players during competition. The questionnaire asked coaches to rate each player's perceived commission of mental errors after each testing

(competitive) session, on a low (1-4 errors), medium (5-6 errors), and high (7-10 errors) range.

Levels of Competition: Refers to practice, exhibition game, and league game situations. Practice was utilized as a baseline for establishing a player's "normal" or average commission of errors. Practice is considered to be the least competitive situation, and coaches were not asked to fill out an MEQ after the practice testing session. During the statistical analysis of certain hypotheses, the testing sessions were aggregated into three levels (practice, exhibition game, and league game), while for the testing of other hypotheses, each practice, exhibition game and league game was treated as an independent level of competition.

Assumptions of the Study

Assumptions which are made during the research effort include the following:

1. The researcher assumed that the subjects used in this investigation, and the coaches who provide leadership for each organization (team), viewed the study as a meaningful effort to provide information that will improve the quality of their athletic endeavors, thus yielding 100 percent participation.
2. The researcher assumed that all participants responded to the questionnaires with integrity, without bias, and to the best of

their ability, yielding valid and reliable information which may be applied to test the hypotheses.

3. The researcher assumed that the Mental Error Questionnaire (MEQ) devised by the participating coaches was an accurate reflection of the mental errors committed by players during competition.
4. The researcher assumed that the underlying theory on anxiety as expressed by accepted authorities such as Fried and Spielberger, and the subsequent research conducted by renowned sport psychologists (Borkevic, 1978; Martens et al., 1990; and Oxendine, 1970) had validity with respect to individuals engaged in the competitive process.

Limitations of the Study

There are several limitations of the study that were identified.

1. The generalizability of the study would be limited to elite male and female basketball players at the university level in the province of Saskatchewan (Canada).
2. The study would be limited to the quantitative evaluation of the data provided by respondents with respect to the identification of the levels of anxiety and the commission of mental errors.
3. Triangulation of levels of anxiety and the commission of mental errors would be limited to the self-report data obtained through the use of the questionnaires.

4. The study would be limited to the extent to which participants create their own reality, and in doing so provide data to questions which may be perceived in a variety of ways. Each person filters information and stimuli based on their created reality, and although self-report has been used in many research efforts as an accurate means of determining how individuals perceive the world, this technique does limit the generalizability of the study. Athletes in areas outside the province of Saskatchewan may be subject to different environmental stimuli than those which have helped to create the Saskatchewan elite athlete's perception of reality.
5. The study would be limited to collecting information prior to each of the competitions (for all levels).
6. The study would be limited to elite men's and women's basketball teams representing the Universities in the province of Saskatchewan.

Outline of the Dissertation

Chapter I has presented an overview of the research problem and related background to the issues to be investigated in the study. The first chapter has stated the importance of research on anxiety relative to sport performance and the chapter has included the presentation of seven primary and two secondary null hypotheses, as well as the delineation of the assumptions under which the study was conducted and the limitations encountered in the research project.

Chapter II will present a review of the related literature and research findings that is pertinent to the understanding of the theoretical and historical development of the current study. The chapter will introduce key concepts involved in the understanding of the relationship between precompetitive state anxiety and sport performance. The importance of defining and achieving individual optimal anxiety/arousal levels in relation to performance enhancement will be developed. The literature review will include a discussion of the related arousal/anxiety-performance theories, and will conclude with a discussion of the need for research in the area of anxiety relative to performance, as well as the impact that the research may have in terms of achieving peak performance states.

Chapter III will outline the methodological framework of the study in terms of the research design, subject population, instrumentation, survey protocol, data collection and analyses, methodological assumptions, and limitations identified by the methodology. Chapter IV will present the data analysis and the findings of the research. The chapter will feature a discussion of the results as well as a presentation of representative tables, charts, and graphs to help illustrate the findings of the research.

Chapter V will present a summary of the research project. The implications for the various stakeholders will be identified and presented. Conclusions that can be drawn from the research will be discussed and the dissertation will conclude with recommendations for future research and study.

CHAPTER II

Review of the Literature

Introduction

Since the 1960's sport psychology has emerged as a recognizable subdiscipline within exercise and sport science. The research emphasis within sport psychology has changed over the decades. Most research areas started with tests of psychological theories and concepts in a sport setting (Morgan, 1980). Such topics as personality, social facilitation, achievement motivation, social reinforcement, and emotional arousal were popular (Landers, 1983). When researchers found that these general psychological theories were inadequate to explain sport behavior, some advocated abandoning the specific topic area, while others advocated modifying the theories for sport, and still others advocated focusing on more cognitively oriented theories that were being developed in general psychology (Wankel, 1975). A few stressed the need for sport psychology to develop its own theories in the real world of sport rather than applying psychological theories in artificial, laboratory-type settings (Martens, 1980).

Psychology has brought us a long way in increasing our body of knowledge, but as Alderman (1980) suggests, this knowledge outside or

apart from sport, can carry us only so far in understanding behavior in sport. Although sport scientists (Alderman, 1980; Martens, 1980) have begun to advocate the development of theories specific to sport psychology in order to gain a better understanding of behavior as it occurs in sport, researchers, for the most part, have not been developing the new conceptual frameworks or models within sport that Alderman (1980) suggests.

Recent empirical work in sport psychology has shown that sports performance is not simply the product of physiological (e.g., strength, fitness) and biomechanical (e.g., technique) factors, but that psychological factors also play a crucial role in determining performance. As Orlick and Partington (1988) concluded: "of the three major readiness factors rated by the athletes—mental, physical, technical—mental readiness provided the only statistically significant link with final Olympic ranking" (p. 129).

Much has been written about the effects of anxiety on performance. However, very little research literature can be found that integrates the various concepts into a single study related to the effects of pre-competitive anxiety on the quality of performance when studied under competitive conditions in field settings.

The purpose of this review is to delineate the various strands of research and discourse described above into an integrated summary of the factors that contribute to the creation of a peak performance state experienced by athletes, which will continue to influence the roles and

responsibilities of athletes, coaches and sport psychologists in preparing athletes for optimum performance achievements.

The first section will review the literature surrounding the ambiguity in terminology with respect to the arousal/anxiety-performance relationship—terms and concepts that have been used interchangeably and have created much confusion. The second section will examine the literature surrounding the dimensions of anxiety and will present research on anxiety as a multidimensional construct. The third section will develop the area of measurement with respect to trait and state anxiety, and will present research dealing with the issues of reliability and validity of the measurement instruments. The fourth section will examine arousal/anxiety-performance relationship literature. Specifically, this section will scrutinize the effects of: (1) anxiety on cognitive and motor behavior performance; and (2) anxiety on the individual. Additionally, research addressing the various theories and concepts relating to the anxiety-performance relationship will be explored. The fifth section will attempt to address and to elucidate critical relationships between pre-competitive state anxiety and athletic performance. Emphasis will be placed on the research literature surrounding the mediating factors and antecedents to the anxiety-performance relationship. The sixth section will present selected research on the cognitive/attentional disruptions and their impact with respect to athletic performance. The seventh section will focus on the scientific literature related to cognitive anxiety and its impact on a performance process—decision-making—as measured by

the commission of mental errors. The eighth section will review the process versus outcome research. The review of literature will conclude with a summary that integrates the various concepts discussed and reviewed in the previous sections of the literature review into a philosophical rationalization for the research project.

Addressing the Sport Performance Terminology Maze

One difficult problem in analyzing the arousal/anxiety-performance question is that of defining and categorizing human emotion (Spielberger, 1989). The terms motivation, excitement, or arousal, though often used interchangeably may imply different things to different individuals. When one speaks of emotional arousal, he or she may be referring to one or a combination of the following negative conditions: fear, anger, anxiety, jealousy, embarrassment, disgust, boredom, or rage. Positive states used to describe emotional arousal may include: joy, elation, ecstasy, interest, happiness, and love. Although the emotional states result from different situations, the physiological response of the individual is often similar (Oxendine (1970). For the purposes of this study, emotion will be described on the basis of level of arousal or activation and emotional arousal will refer to those conditions in which one's "normal" physiological functions have been intensified.

Another problem in the literature, as discussed by Spielberger (1966, 1972, 1989), concerns the ambiguity surrounding the construct of anxiety. Spielberger (1966, 1972, 1989) believes that this confusion

is based largely on a failure to distinguish between anxiety as a relatively enduring trait and anxiety as a transitory state. Because of the diverse nature of anxiety formation, both physiological and psychological causes must be considered. Each of these aspects of anxiety and arousal is important to the ultimate expression of the behavior—biological and mental events work together to produce changes in athletic performance.

Although biological processes are central to the experience of anxiety, clearly cognitive and behavioral aspects of reaction to stress must also be addressed (Borkovec, 1976). Occasionally, people become so preoccupied with their negative thoughts that they are unable to resolve even routine crises, with the end result that their confidence about handling stress decreases (Meichenbaum, 1972). Of course, this process evolves into a negative circular spiral in which one disastrous encounter precipitates yet another.

Weinberg, (1989) posited that before the relationship between arousal/anxiety and performance can be discussed, it is important to distinguish between several terms and concepts associated with the study of arousal and anxiety. Stress, worry, emotionality, arousal, and anxiety have all been used interchangeably in the sport psychology literature, and although there are similarities or common elements with respect to the above terminology, each is considered to be an independent construct.

Stress

Martens (1987) has argued that psychological stress has robbed more athletes of physical energy, victory, and enjoyment in sport than any other factor, and can destroy self-confidence by leading athletes to believe they are incompetent. Stress refers to a complex psychobiological process that consists of three major elements: stressors, perceptions or appraisals of danger (threats), and emotional reactions. According to Spielberger (1989), the stress process is generally initiated by situations or circumstances (stressors) that are perceived or interpreted as dangerous, potentially harmful, or frustrating. If a stressor—situations or circumstances that are characterized by some degree of objective physical or psychological danger—is perceived as dangerous or threatening, irrespective of the presence of an objective danger, an emotional reaction (anxiety) is evoked. Furthermore, thoughts or memories that are perceived as threatening can also evoke anxiety reactions as readily as real dangers in the external world.

Threat, or the experience of threat, is essentially a state of mind which is thought to consist of two main characteristics:

- (1) It is future oriented, generally involving the anticipation of a potentially harmful event that has not yet happened;
- (2) It is mediated by complex mental processes, (e.g., perception, thought, memory and judgement) which are involved in the appraisal process (Spielberger, 1989, p. 5).

Cherry (1978), proposed that stress is a combination of external factors or 'stressors' which are potentially, but not necessarily, disturbing to the individual. Some sports performers, will cope well with the 'stress' of competition, and what is important, therefore, is the interaction between the stressor and the individual—individuals experience negative stress or strain only if they perceive themselves as being unable to meet the demands imposed by a particular stressor (McGrath, 1970).

Another condition for the general notion of stress as an imbalance between demand and response capability, is that stress or threat only occurs when the consequences of failure to meet the demand are perceived to be important. The organism, however, can deliberately or otherwise alter the state of stress by: avoiding the consequences; fulfilling the demands; or altering perception of demands, of capabilities, and /or of consequences.

One of the major problems in examining the stress-performance relationship has been a lack of consensus over a precise definition of stress. Cox (1978) argues that stress has been treated as both a dependent and an independent variable. The independent variable approach treats stress mainly in terms of the stimulus characteristics of a disturbing environment. The second approach, which treats stress as a dependent or response-based variable, describes it in terms of the person's response to disturbing environments (Cox, 1978). Selye (1956) defined stress as the non-specific response of the body to any

demand, and since a person is always experiencing demands of some kind, then according to Selye (1956), a person is always under stress.

In recent years, sport psychologists have tended to interchange the terms state anxiety and distress (or more simply, stress). As defined by Martens (1982), stress refers to the process that is associated with the occurrence of state anxiety. This process is explained in terms of an objective demand, a perceived threat, and a state anxiety reaction. Worchel and Goethals (1989) cautioned that although stress and anxiety are closely related, they are separable phenomena. Stress exists when an environmental demand threatens an organism's well being and needs to be addressed, while anxiety is an emotion that is sometimes felt in dealing with stress. This important distinction will be developed further in subsequent sections.

Competitive Stress

Patmore (1986) has described sport at the highest levels as an 'experiment' in which the central factor determining the quality of performance is the individual's ability to cope with stress:

The technical skills of the contestants, if the experiment has been set up correctly, cancel each other out. The sport experiment is not concerned with the particular technical skills the subject has brought with him to the contest. His [technical] skill is not really at issue—although he fervently believes it is—since his fellow contestants also have it; they have been screened and selected very carefully indeed to ensure that their [technical] skill compares

with his. The deciding factor is not his [technical] skill, but his ability to perform it under stress (p. 13).

Sport by its very nature—according to Cratty (1984)—is highly visible and competitive, and the rewards for success are often great. The sport environment provides, therefore, many of the ingredients which invariably create stress in those who participate.

Stress in sport has developed into a popular and specialized area for academic inquiry. According to Spielberger (1989), a significant factor in this development is that the sport environment provides a natural laboratory in which to study behavior in general, and stress-related behavior in particular. Recent research in the area of competitive stress has been characterized by the adoption of a cognitive-based interactional model in which stress occurs as a result of cognitive appraisals that one's coping resources will be taxed or even inadequate to meet the demands imposed by a particular situation. This move away from the traditional behavioral-based analysis of stress in sport psychology, has meant that competition is no longer regarded as a uniformly stressful event (Selye, 1975); competitive stress may be interpreted negatively by one performer, but as an exciting challenge by another (McGrath, 1970).

The objective of the theory of competitive stress is to predict the level of state anxiety (A-state) among different people in varying competitive situations, and is based on Martens (1975) competitive process model, Spielberger's (1972) trait-state theory of anxiety, and McGrath's (1970) conceptual model of stress. The theory predicts that

persons higher in competitive trait anxiety (A-trait) perceive more competitive situations as threatening and are more threatened in a competitive situation than persons with lower levels of competitive A-trait. Competitive situations which are perceived as threatening will inevitably produce conditions of stress.

Worry

Negative thoughts that lead to stress typically take the form of worry (Martens, 1987). The cluster of responses associated with worry involves somewhat more complex cognitive processes, that is, learned patterns of thinking about oneself, one's performance, and anticipated outcomes of potentially threatening situations. Bandura (1977a) refers to these processes as self-evaluative and self-regulatory processes. Tendencies toward worry—self-preoccupation, negative self-evaluation, and negative expectations of both a general and specific nature—are learned through individual experiences of success and failure, through evaluation and feedback received from others, and through the observation of others' self-statements when facing similar stressful situations.

According to Morris, Davis and Hutchings (1981), worry is assumed to be the component of state anxiety that reflects "the cognitive elements of anxiety, such as negative expectations and cognitive concerns about oneself, the situation at hand, and potential consequences" (p. 541). As argued by Morris and Liebert (1970), Liebert and Morris (1967), and Spiegler et al. (1968), worry reflects

concerns about the possibility of failure in a given situation. Worry occurs when there is a discrepancy between what one hopes will happen and what one perceives is occurring or will occur. One hopes to be able to control one's anxiety prior to the game, but one worries about one's ability to do so. This is not an uncommon source of stress and the work of worrying can be mentally fatiguing. As Martens (1987) has argued, worry itself is not stressful, but if one does not have sufficient information to find the solution to a problem, worry becomes unproductive and frustrating and thus turns negative.

Scores on worry tend to be fairly constant across time, and are significantly and negatively correlated with subjects' pre-examination (pre-competition) ratings of performance expectancy (Morris & Liebert, 1969, 1970). For research studies in academic test anxiety, the worry component has been associated with poor expected or actual performance (Doctor & Altman, 1969; Liebert & Morris, 1967; Morris & Liebert, 1970).

Wine (1971, 1980) has suggested that the difference between high- and low-anxiety individuals in the utilization of task cues is in line with her division of attention hypothesis. She postulates that when people worry, they redirect the focus of attention toward negative thoughts and away from task-relevant aspects of performance. When athletes become preoccupied with their own self-evaluation and with the negative possibilities involved in the situation, performance suffers because of the misdirection of attention away from the task at hand (Morris & Engle, 1981). Worry is just such a cognitive process and is

the anxiety component most consistently and most strongly related (inversely) to cognitive performance (Morris & Liebert, 1970; Deffenbacher, 1980). Worry prior to and during competition may interfere with performance by distracting attention from preparation for the competition and from performing the tasks themselves (Deffenbacher, 1978).

Arousal

Motivation—why people do what they do—is defined by Murray (1964) as "an internal factor that arouses, directs and integrates a person's behavior" (p. 7), and is not only a key construct in psychology, but perhaps the most fundamental construct in psychology. Arousal—the intensity dimension of motivation—may be defined as the general state of activation or excitation that ranges on a continuum from deep sleep to extreme excitement (Sonstroem, 1984), and is considered to be a neutral term that reflects activation of the sympathetic nervous system. Arousal, as illuminated by Murray (1964), refers to the intensity of physiological activation, but does not indicate emotions.

Gill (1986), however, argued that increased arousal implies psychological or cognitive reactions as well as physiological responses. According to Gill (1986), arousal is a multidimensional state with both a physiological or somatic component and a psychological or cognitive component. In sport, the cognitive component of arousal typically involves worrying about performance evaluation or possible failure,

and individuals engaged in sport typically experience a combination of physiological arousal and cognitive worry, that is, state anxiety.

Although a moderate increase in physiological arousal may be useful, increased cognitive worry has no apparent value. In fact, increased worry is associated with lower self-confidence and poorer performance (Gill, 1986). To better understand that increased arousal beyond a certain point may be detrimental to performance, one needs to focus on the subtle but exceedingly important difference between arousal and anxiety. According to Sonstroem (1984), arousal as it is commonly used, refers to an all-inclusive, well-ranging continuum of psychological activation. Anxiety, in this study, refers to the heightened emotions of athletes prior to and during competition, self-assessed by athletes using a pencil-and-paper psychological inventory—Competitive State Anxiety Inventory-2 (CSAI-2)—developed by Martens et al. (1990).

Emotionality

Morris and Liebert (1973) postulate that emotionality is defined as "physiological and affective arousal elicited primarily by the stressful cues present in an anxiety-provoking situation" (p. 322). According to Jones and Hardy (1990) emotionality is an automatic reaction to the stress of the situation . Morris, Davis and Hutchings (1981) described emotionality as "one's perception of the physiological-affective elements of the anxiety experience, that is indications of autonomic arousal and unpleasant feeling states such as nervousness and tension" (p. 541).

Emotionality is the autonomic arousal aspect of anxiety, and reaches a peak immediately before a competition, falling off rapidly immediately after the event—emotionality scores, therefore, are not related to performance expectancy. Wine (1980) argues that emotional arousal appears to bear no consistent relationship to performance on intellectual or cognitive tasks. Husman (1969), on the other hand, contends that as emotion goes up, functioning intelligence goes down, and although the rising emotion and declining intellectual functioning is probably not a straight line relationship, there is little question about the distracting effects of extreme levels of emotion on any type of performance involving reasoning powers. Such interferences, Husman (1969) continues, may be particularly harmful when the performer is in an activity requiring quick thinking or fast decision-making. Extreme examples of this interference occur when the individual "freezes" or "goes blank."

Morris et al. (1981) argued that the "cluster of responses falling under the heading of emotionality are physiological responses and feeling states that occur as a combined function of the classical conditioning of emotional responses to environmental stimuli and of the presence of unconditioned stimuli that naturally elicit emotional arousal" (p. 552). Some years earlier, Morris and Liebert (1973) presented a similar viewpoint when they maintained that emotionality "may be largely a classically conditioned reaction to specific stimuli" but went on to say that it "may be effectively reduced through counter-conditioning methods" (p. 322).

Anxiety

"As it is in most aspects of life, anxiety is present in sport . Each time man 'takes to the field,' he not only lives with anxiety, he embraces it. It allows him and, in fact, motivates him, toward greater realization of his skill in the contest. Sport encourages man to live with anxieties as opposed to the psychiatric school advocating the 'cure' of anxiety" (Slusher, 1967, p. 192).

What is the nature of anxiety? Is anxiety innate or learned? How many different kinds of anxiety can be identified? What sorts of stimulus conditions elicit anxiety, and do these differ for different kinds of anxiety? Given the conceptual ambiguities in anxiety theory, it is perhaps not surprising that anxiety research is characterized by semantic confusion and equivocal findings.

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. Frued (1936) emphasized that anxiety is the "fundamental phenomenon and the central problem of neurosis" and understanding anxiety is considered "the most difficult task that has beset us" (p. 85). According to Frued (1936) anxiety is distinguishable from other unpleasant affective (emotional) states such as anger, grief, or sorrow by its unique combination of phenomenological and physiological qualities. These qualities have given anxiety a special "character of unpleasure" which, although difficult to describe, seems "to possess a particular note of its own" (p. 69). Often, though not

always, anxiety is accompanied by activation of the autonomic nervous system, which is why it is so often confused with arousal, and why the two constructs are used interchangeably.

For Sullivan (1953), a personality theorist, anxiety is an intensely unpleasant state of tension arising from experiencing disapproval in interpersonal relations. 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 disengaged. May (1950) argued that anxiety is "the apprehension cued off by a threat to some value which the individual holds essential to his existence as a personality" (p. 191). While the ability to experience anxiety is inborn, the particular circumstances or stimulus conditions which evoke it are largely determined by learning.

According to Borkovec (1976) measured anxiety is considered to be a function of external and/or internal cues. External cues include aspects of the environment which, because of past learning history, produce fear responses. Internal cues include verbal and nonverbal images, physiological activity, and perceptual feedback from skeletal behavior. While the external or internal cues may be separately capable of eliciting anxious behavior, observed anxiety reactions are most often a function of an interaction of both sets of cues: if a fear stimulus is presented, internal cues may be elicited; if diffuse arousal occurs, the organism may search its environment for external cues.

Cognitive behavior, motor behavior, and physiological reactions may be separately influenced by different environmental conditions at

different points in time and may even obey different learning principles. However, because of their potential interaction, changes in one response component may ultimately affect subsequent changes in the response of one or both of the remaining components. Most importantly, individuals differ in terms of the learning history associated with each response component, resulting in individual differences in the intensity and/or functional importance of the response from each component in reaction to a particular feared stimulus. Some individuals, for example, will report intense distress and display rapid avoidance when confronted with feared situations, but no evidence of increases in physiological arousal can be detected. Others, however, may show such autonomic increases but differ in the degree to which they are aware of the arousal, the degree to which they display avoidance behavior, or the level of reported discomfort.

The construct of anxiety is generally regarded as a negatively charged emotional state (Spielberger, 1966) that is characterized by internal discomfort and a feeling of nervousness. Kolb (1968) believed anxiety to be a penetrating feeling of dread and apprehension and of impending disaster. In support of this definition Worchel and Geothals (1989) proposed some components of anxiety that include: fear, anger, and feeling in danger; physiological arousal; increased heart and perspiration rate; trembling; and being mentally off balance.

Anxiety is not independent of arousal (Martens, 1975), but rather contributes to the overall arousal state, and must be dealt with as a special case of activation. According to Landers (1980), anxiety is that

aspect of arousal which is responsible for the organism's readiness to respond. It is at the cortical level that anxiety is interpreted as a relevant emotional phenomenon, that is, when athletes mull over their nervousness prior to competition, cortical activity determines the way in which the arousal state is interpreted into meaningful information.

A monumental problem in the sport psychology literature, as discussed by Spielberger (1966), concerns the ambiguity surrounding the construct of anxiety. He believes that this confusion is based largely on a failure to distinguish between anxiety as a relatively enduring trait and anxiety as a transitory state—a distinction which demands clarification.

Trait-Anxiety

Trait anxiety (T-anxiety) refers to relatively stable individual differences between people in the tendency to perceive stressful situations as dangerous or threatening and to respond to such situations with elevations in the intensity of their state anxiety (S-anxiety reactions), and anxiety may also reflect individual difference in frequency and intensity with which state anxiety states have been manifested in the past, and in the probability that S-anxiety will be experienced in the future. The stronger the anxiety trait, the more anxiety in a threatening situation (Spielberger, 1983, p. 1).

Trait anxiety, is a feature of personality. Athletes who value success highly may put pressure on themselves to perform, and may

experience greater anxiety during competition than athletes who do not value success as much. According to a number of empiricists (Klavora, 1978; Martens, 1990; Rainey & Cunningham, 1988) it is possible that competitive trait-anxiety (CTA) is related to athletes' perceptions of their success or failure in prior competitions—fear of failing again may cause those who believe they have failed in the past to be more anxious in competitive situations than those who believe they have been successful. Thus it appears that the trait anxiety personality variable may be one of the most important factors affecting the arousal levels of athletes prior to competition.

State-Anxiety

Spielberger (1989), conceptualized state-anxiety as a "transitory emotional state that varies in intensity and fluctuates over time" (p.96). State-anxiety is often treated as arousal with the added dimension of direction—generally a negative affect. It has been studied as an arousal criterion present in varying degrees within participants immediately prior to athletic contests by Flood and Endler (1980); Martens (1977); and Scanlan (1978). The findings in sports psychology research provide substantial evidence that state-anxiety level changes are produced by practice, physical activity, perceived or experienced success or failure, and level of competition (Spielberger, 1989).

State anxiety registered by a person in a competitive situation is determined by the person's perception of the likelihood of success. The prediction is that when sport outcomes are contingent on lower levels of

anxiety, athletes who are uncertain of their ability and thus more likely to feel anxious, are more likely to perform poorly. Relationships between pre-competitive anxiety and sport performance have been found, for example, in basketball (Klavora, 1978; Sonstroem & Bernardo, 1982), golf (Weinberg & Genuchi, 1980), riflery (Burton, 1971), and softball (Gershon & Deshaies, 1978).

Dimensions of Anxiety

Multidimensional Construct

Recent research into the relationship between anxiety and performance has been characterized by a move away from oversimplified unidimensional notions of anxiety towards a multidimensional approach in which the anxiety experience is viewed as being separable in two components (Jones & Hardy, 1989). Many theorists favour the notion of a two-component model of anxiety which was first introduced into the test anxiety literature by Liebert and Morris (1967), and which Davidson and Schwartz (1976) identified as 'cognitive' and 'somatic' anxiety. Morris et al. (1981) describe cognitive anxiety (or worry) as "the cognitive elements of anxiety, such as negative expectations and cognitive concerns about oneself, the situation at hand, and potential consequences", while somatic anxiety (or emotionality) is referred to as "one's perception of the physiological-affective elements of the anxiety experience, that is, indications of autonomic arousal and unpleasant feeling states such as nervousness and tension" (p. 541).

Martens et al. (1990) predicted that cognitive anxiety would be the principal influence upon performance, because somatic anxiety should dissipate once performance actually commenced, while the subjective probability of a successful outcome might fluctuate throughout the competitive event. There is however, a considerable amount of research (e.g., Baddeley & Idzikowski, 1985; Idzikowski & Baddeley, 1987) which suggests that the physiological response associated with anxiety continues to fluctuate during performance in many competitive situations .

It had been suggested by Borkovec (1976) and supported by Deffenbacher (1978), that the cognitive and somatic components of anxiety co-vary, because many stressful situations contain elements related to the onset of each component. Each component of anxiety may serve a conditional or discriminative function for the other component . If powerful somatic responses have been conditioned to a particular stimulus, these responses may indicate to the individual that there is reason to worry, and conversely, cognition in the form of images of failure may trigger a pattern of somatic responses.

Cognitive Anxiety

The cognitive dimension of anxiety is characterized by negative expectations, lack of concentration and disrupted attention (Davidson & Schwartz, 1976; Morris et al., 1981). As previously mentioned, cognitive anxiety is generally increased much earlier than somatic anxiety and tends to be a more enduring response. Spiegler (1968)

found that cognitive anxiety among students facing a very important examination was elevated to pre-examination levels up to 5 days before the examination and remained stable during that period. Gould et al. (1984) reported similar findings for a prestigious national wrestling competition.

Martens et al., (1989) provided evidence from a sample of golfers to indicate that cognitive anxiety remains unchanged during the competition itself (and possibly even increases), while Morris et al. (1981) concluded that cognitive anxiety is more consistently and strongly related to performance than somatic anxiety. Wine (1971) proposed that cognitive anxiety exerts its influence in the form of inhibiting performance by disrupting attentional processes so that individuals become too concerned with possible failure and do not direct sufficient attention to the task at hand. Gould et al. (1984) found that cognitive anxiety predicted wrestling performance better than somatic anxiety.

Somatic Anxiety

The contention of researchers (Borkovec, 1976; Davidson & Schwartz, 1976; Gould et al., 1984; Liebert & Morris, 1967; Morris et al., 1981) is that somatic anxiety is the awareness of physiological responses such as nervousness and tension, and tends to peak rapidly and close to the start of the event. While cognitive anxiety and self-confidence are affected up to several days prior to competition, somatic anxiety experiences elevation within 24 hours of the event. According

to Martens et al. (1990), somatic anxiety decreases once performance has been initiated.

Cox (1986) maintained that somatic state anxiety and performance reflect a quadratic relationship that takes the form of an inverted-U. Increases in somatic state anxiety are accompanied by an increase in performance up to an optimal level, after which any further increases in somatic state anxiety will lead to a decrease in the level of performance.

Self-Confidence

While extensive preliminary evidence conducted by Martens et al. (1983) revealed that the Competitive State Anxiety Inventory- 2 (CSAI-2) did measure separate somatic and cognitive state anxiety components, factor analyses revealed the emergence of a third component—self-confidence. Factor analysis of the questionnaire split the hypothesized cognitive anxiety factor into two separate components, one consisting of negatively worded items (cognitive anxiety) and the other consisting of positively worded items (self-confidence). Specifically, self-confidence was found to be negatively correlated with both the cognitive and somatic subcomponents (Martens et al., 1990).

Equivocal and inconsistent findings reported in the sport science literature raise some concern as to the validity of self-confidence as a dimension of anxiety. Empirical studies by Jones and Cale (1989) and Martens et al. (1990) recorded no changes in self-confidence across the time-to-event (the period preceding competition) paradigm, whereas Ussher and Hardy (1986) recorded an elevation in self-confidence after

the competition. Jones, Cale and Kerwin (1988) recorded a decrease in self-confidence immediately before their cricket subjects batted, whereas Jones and Cale (1989) recorded no change for men, but a decrease in self-confidence on the day of the competition for females. Parfitt and Hardy (1987) found either no change or a decrease in self-confidence on the day of the competition in the various experiments. A possible explanation for this variance of findings may be that self-confidence is more vulnerable to situational changes than cognitive anxiety.

Independence of Anxiety Constructs

Cognitive changes are not experienced in isolation; every change in the mental-emotional state is consciously or unconsciously accompanied by an appropriate change in the bodily (somatic) state (Green & Green, 1977). This lends support to the notion that we think with our entire body. Once athletes become sensitized to the varying levels of cognitive and somatic states and have learned to identify which mental-emotional and somatic states and feelings accompany superior performance, they can learn to "program" these responses voluntarily to set the stage for another superior performance.

While the cognitive, somatic and self-confidence components of anxiety have been shown to covary in some studies (Smith & Morris, 1977), they have also been shown to vary independently in others (e.g., Morris & Liebert, 1973; Schwartz, Davidson & Goleman, 1978). With respect to the covariation of cognitive and somatic responses, Borkovec

(1976) suggested that each component might serve a conditional or discriminative function for the other. Borkovec (1976) argued that "changes in one response component due to direct manipulation of its conditions may ultimately affect subsequent changes in the response of one or both of the remaining components" (p. 267). For example, a sudden increase in physiological arousal (somatic anxiety) can be a source of worry, while conversely, worrying about a threatening event may cause an increase in physiological arousal. Morris and Liebert (1973) provided support for the independence of worry (cognitive anxiety) and emotionality (somatic anxiety) by independently manipulating worry and emotionality (as measured by the Test Anxiety Questionnaire), using two different treatment conditions: threat of electric shock and threat of failure. The threat of electric shock resulted in an increase in emotionality only, while the threat of failure (negative) feedback resulted in an increase in worry only.

Temporal patterning is an alternative method for establishing independence of the components of anxiety, and as early as 1968 the two components identified in the test anxiety literature were shown to follow different temporal patterns prior to and immediately following an examination (Spiegler, Morris & Liebert, 1968). Emotionality was shown to peak late and fast immediately prior to the start of the examination, while worry remained stable throughout the pre- and post-examination periods. This paradigm was adopted by Martens et al. (1990) to dissociate the components of anxiety in their Competitive State Anxiety Inventory-2 (CSAI-2). The temporal patterning obtained by

Martens et al. (1990) in his testing of wrestlers and gymnasts which recorded consistent results with previous test anxiety research in the way components varied, has been replicated on a number of occasions (e.g., Jones & Cale, 1989; Parfitt & Hardy, 1987; Ussher & Hardy, 1986).

The cognitive and somatic components have also been demonstrated to be potentially independent so that the two anxiety components are hypothesized to be induced and maintained by different situations. Cognitive anxiety, but not somatic anxiety, has been demonstrated to increase as a result of failure threat (Morris & Liebert, 1973), taking intelligence tests (Morris & Liebert, 1969), ego threat (Deffenbacher, 1978) and writing important examinations (Spiegler et al., 1968). Those events which are thought to be relevant to the experience of somatic anxiety are usually of shorter duration and seem to consist primarily of initial non-evaluative cues which are thought to lose their salience rapidly as the testing session progresses (Morris et al., 1981). Jones and Cale (1989) proposed that increased somatic anxiety can enhance performance involving predominantly gross motor activity but has a distracting effect on cognitive performance due to attention being directed more towards the physical symptoms of the anxiety response rather than to the cognition required for effective performance.

Research initiated by Gould et al. (1987) on the effect of the dimensions of anxiety on performance confirmed the independence of cognitive and somatic anxiety and self-confidence, and indicated a

significant negative linear trend for performance and self-confidence, a significant inverted-U shaped quadratic trend for performance and somatic anxiety, but no significant trend for performance and cognitive anxiety. The general consensus of the earlier test anxiety literature was that:

Worry, the cognitive component of anxiety involving conscious concern about one's performance and its consequences, emerges consistently as the most important element of the anxiety experience when considering effects on performance (Morris, Brown & Halbert, 1977 p. 155).

It was therefore surprising that Gould and others (1987) found no significant relationship between cognitive anxiety and performance. This result may have been due, however, to the type of analysis (linear) employed as well as to the type of task and performance measure used (e.g., pistol shooting accuracy); a measure which may be particularly sensitive to changes in physiological as opposed to psychological arousal. Gould et al. (1987) concluded that:

In essence, there is a need to move towards considering the types of processes which underlie performance and reiterates Straub and Williams' (1984) argument for a more cognitive approach to research in sport psychology (p. 40).

Measurement

Previous Measurement of the Effect of Anxiety on Performance.

The examination of state anxiety, including factors associated with state anxiety (Martens & Gill, 1976; Scanlan & Passer, 1979) and the state anxiety-motor performance relationship (Martens & Landers, 1970) has been one of the most extensively studied areas in sport psychology. A primary factor limiting the development of anxiety theory and research has been the lack of uniformly acceptable state anxiety assessment instruments (Martens, 1977; Martens & Landers, 1970). Specifically, previous measures of state anxiety have been criticized for their failure to assess independent anxiety components and for their lack of situational specific content.

Krause (1961) concluded that transitory anxiety is conventionally inferred from six different types of evidence: introspective reports, physiological signs, body language, task performance, clinical intuition, and the response to stress. Of these, introspective reports (self-reports) provide the most widely accepted basis for inferring transitory (state) anxiety. Basowitz et al. (1955) defined anxiety as "the conscious and reportable experience of intense dread and forboding, conceptualized as internally derived and unrelated to external threat" (p. 3), and concluded that to report feeling "anxious" is to be anxious, with the provision of course that the subject is capable of distinguishing between different feeling states and is motivated to report these states accurately and honestly.

The extensive research literature on the relation between anxiety and performance has especially important implications for sports psychology. In psychological research on learning and performance, the Taylor (1953) Manifest Anxiety Scale (MAS), one of the earliest measures of chronic (trait) anxiety, has been used in numerous studies, and has concluded that generally persons with high MAS scores perform more poorly on difficult learning tasks than persons with low anxiety. However, it does not adequately predict differences between high- and low-anxious persons with respect to learning and performing sports skills (Martens, 1971).

A more precise measure of A-trait and A-state is the State-Trait Anxiety Inventory (STAI), developed by Spielberger et al. (1970) to provide reliable, relatively brief self-report measures of state and trait anxiety. Scores established from the 20-item instrument define a continuum of increasing intensity. Low S-Anxiety scores indicate calmness and serenity; intermediate scores indicate moderate levels of tension and nervousness; high scores reflect intense apprehensions and fearfulness, approaching panic. Although still commonly used in sport literature, the STAI's major limitation is that it does not address the thoughts and feelings of athletes in sport situations.

Self-report measures such as Spielberger's A-state scale and Martens's (1977) Competitive Short Form of the Competitive State Anxiety Inventory (CSAI) have been the most popular means of assessing arousal (or anxiety states), but have been criticized by Landers (1980) for failing to differentiate between relevant physiological,

behavioral, and cognitive components of anxiety. Landers (1980) has argued for the need for researchers in sport to redirect their unidimensional conceptualizations of sport-anxiety toward a model that emphasizes the reciprocal relationships among cognition, physiological responses, and behavior and which utilizes a multidimensional-multimethod approach.

Anxiety has been measured using both self-report inventories and physiological measures. All of these can have shortcomings: considerable discrepancy has almost always been observed between physiological and self-report measures (Thayer, 1970), while the suitability of the self-report items used has been questioned by Magnusson (1974). Still other researchers (Mellstrom, Cicala & Zuckerman, 1976) have suggested that anxiety is a learned response to a situation, so that in order to predict behavior, knowledge is required about how the individual reacts in a given situation. This line of reasoning has led to the development of a number of situationally-specific anxiety inventories: for example, a fear of negative evaluation scale and a social avoidance and distress scale (Watson & Friend, 1969), a scale for measuring fear of snakes, heights and darkness (Mellstrom, Cicala & Zuckerman, 1976) and the Sport Competition Anxiety Test (SCAT) (Martens, 1977), a scale for measuring anxiety about competition.

During the development of SCAT, Martens (1977) also illustrated that situation-specific questionnaires were better predictors of state anxiety than were general inventories. When compared with the trait

version of Spielberger's (1966) State-Trait Anxiety Inventory (STAI), the trait sport-specific questionnaire (SCAT) was a better predictor of state anxiety in sport situations than the STAI (Martens et al., 1990).

While research studying pre-competition levels of anxiety and self-confidence and the relationships with subsequent sports performance (e.g., Gould et al., 1984, 1987; McAuley, 1985) provides valuable data, a limitation is that the performance measure (e.g., wrestling, swimming or gymnastic performance) has tended to be rather imprecise in nature (Gould et al., 1987; Jones et al., 1988). An alternative approach is to examine relationships between anxiety and subcomponents of performance—this allows for a more detailed analysis of how pre-competition affect relates to the perceptual-motor process underlying performance (Jones, 1988).

Generalizability of the Research.

Little field evidence in support of the cognitive/attentional disruption explanation and its effects on performance has been generated. Studies in golf performance and cognitive anxiety sometimes found no significant relationships (McAuley, 1985) and sometimes predicted relationships appeared in one situation but not in another (Martens et al., 1983). Similarly, in an investigation of intercollegiate wrestlers by Gould, Petlichkoff, and Weinberg (1984), a very marginal relationship between cognitive anxiety and performance was evidenced in only one of two matches. Furthermore, in a more recent investigation of pistol shooting performance (Gould, Petlichkoff,

Simons, & Vevera, 1987), there was no indication of the proposed relationship between cognitive anxiety and sport performance. However, Gould et al. (1987) did identify several potential methodological problems that could account for the current status of the field-based literature.

One possible methodological problem is that the most favored assessment instrument, the Competitive State Anxiety Inventory-2 (CSAI-2) (Martens et al., 1983), may lack either sufficient construct or predictive validity relative to athletic performance (Landers, 1983). However, the CSAI-2 has been shown to validly measure three constructs thought to be associated with competitive state anxiety: cognitive anxiety, somatic anxiety, and self-confidence (Gould et al., 1984)). Therefore, perhaps if construct validity is present, problems in predictive validity may be due to methodological weaknesses (e.g., research design, subject population, and task/activity measured) rather than psychometric properties inherent in the CSAI-2.

If such is the case, then a major issue of concern is the manner in which sport performance has usually been measured in field settings. In some circumstances the opponents varied (e.g., wrestling); in others the terrain and situation demand characteristics varied (e.g., golf). However, even when task demands were manipulated so as to remain constant (e.g., pistol shooting), the predicted relationship between cognitive anxiety and athletic performance was not demonstrated. Should the only conclusion be that the relationship is nonexistent, or at the very best dismal, or is there still room for some optimism?

Burton's (1988) recent findings on swimmers' anxiety, using intra-individual rather than an inter-individual approach indicates a sound basis for such optimism.

Development of the CSAI-2.

Martens et al.'s (1990) multidimensional anxiety theory attempts to explain the relationship between cognitive anxiety, somatic anxiety and performance in terms of a series of two-dimensional effects; it makes predictions about the separate effects of cognitive anxiety and somatic anxiety upon performance. What is really needed however, is an explanation of how cognitive and somatic anxiety interact to influence performance. This seems to imply that any satisfactory model of anxiety and performance must be at least three-dimensional.

Bearing in mind the argument that state questionnaires should offer more worthwhile information regarding the anxiety-performance relationship than other forms of anxiety measurement (Spielberger, 1966), it is not surprising that Martens and his colleagues subsequently developed a state version of the SCAT; the Competitive State Anxiety Inventory (Martens, et al., 1980). However, this questionnaire did not incorporate the multidimensional nature of anxiety. As a result, Martens et al. (1990) developed the CSAI-2 as a sport-specific questionnaire which separately measured the cognitive and somatic components of state anxiety. As mentioned previously, preliminary factor analysis of this scale unexpectedly revealed three instead of two factors—the third factor to emerge was identified as self-confidence and

comprised the positively worded items which were presumed to form part of the cognitive anxiety scale. Consequently, negatively worded items formed the cognitive anxiety subscale and positively worded items comprised the self-confidence subscale.

Research using the CSAI-2 (Jones & Cale, 1989; Jones , Cale & Kerwin, 1988) has obtained similar inter-correlations between the CSAI-2 subscales to those originally obtained by Martens et al. (1990), all of which indicates that the CSAI-2 is an appropriate tool for the study of multidimensional competitive state anxiety. In addition, the CSAI-2 should be a valuable tool for examining individual differences in anxiety patterns in sport settings and for investigating the relationship between such patterns and sport behavior (Gill, 1986).

Anxiety-Performance Relationship

The success or failure of an individual athlete is dependent on the blending of physical ability, conditioning, training, mental preparation, and the ability to perform well under pressure. Sport competition can generate much anxiety and worry, which in turn can affect physiological and thought processes so dramatically that performance often deteriorates—at worst, the effects of anxiety gets one so tied up in knots that one becomes frozen in fear; at best, anxiety subtly impairs performance by distracting one's attention. Understanding anxiety and it's effect on athletic performance, finding ways to estimate the anxiety demands of a particular sport, and assessing anxiety levels of individual

athletes has become a major interest for athletes, coaches and sport psychologists.

Therefore, anxiety and performance have been studied by researchers mostly in a laboratory settings. Field studies using a variety of global anxiety measures have now been conducted, but the results are mixed. Relationships between pre-competitive anxiety and sport performance have been found, for example, in basketball (Klavora, 1978; Sonstroem & Bernardo, 1982), golf (Weinberg & Genuchi, 1980), parachuting (Powell & Verner, 1982), riflery (Burton, 1971), and softball (Gerson & Deshaies, 1978). However, other researchers have failed to find relationships between the two factors when studying male distance runners (Sanderson & Reilly, 1983), bowling (Burton, 1971), or when controlling for ability in golf (Cooke et al., 1983).

Effects of the Anxiety Components upon Global Performance Measures

Early correlational studies by Doctor and Altman (1969) and Morris and Liebert (1970) showed worry, but not emotionality, to be negatively related to academic test performance. Later Morris et al. (1975) hypothesized that while worry might be the dominant influence upon cognitive performance in test situations, physiological arousal and the attendant emotionality might well interfere with motor performance. This was based on Morris and Liebert's (1969) speculation that while the cognitive component of anxiety (worry) interferes with cognitive performance, emotionality may be the

component which interferes with motor performance (due to hands shaking, decreased muscular coordination etc.).

More recently, Deffenbacher (1980) carried out an extensive re-analysis of test anxiety data and refuted Morris et al.'s (1975) findings, concluding that:

Partial correlations demonstrated that when the effects of emotionality were partialled out, worry continued to form a significant negative correlation with performance. However, when worry was partialled out, emotionality was not significantly correlated with performance (p. 115).

Gould, Petlichkoff and Weinberg (1984) were among the first to conduct work in the cognitive and somatic effects on performance area specifically related to sports performance. Gould et al. (1984) used the CSAI-2 to collect data on levels of cognitive anxiety, somatic anxiety and self-confidence in wrestlers, and compared these levels of anxiety with match outcomes (win, lose), and points scored in the first period of two separate matches. It was found that there were no significant relationships in the first matches, but a marginally significant relationship in the second match. Follow-up analysis indicated that the match outcome, but not the points scored was significant. Statistical analysis showed that only cognitive anxiety was a significant predictor of match outcome, with somatic anxiety and self-confidence contributing little to the relationship.

Past research has found that absolute levels of state anxiety measured across subjects have little relationship to performance

(Sonstroem and Bernardo, 1982) but that variable levels of state anxiety around an individual's optimal level produce more consistent relationships: the lack of consistent results by Gould et al. (1984) could be explained by the manner in which the scores of the CSAI-2 were used and the way performance was assessed. The research by Sonstroem and Bernardo (1982) implies that intra-individual relationships between CSAI-2 levels and performance might be more appropriate in yielding more consistent results with regard to the way in which performance is assessed in other studies (e.g., Gould et al., 1987 etc.).

Not standardizing performance means that performance could have changed because of an opponent rather than because of the level of anxiety (Gould et al., 1987). Research by Barnes et al. (1986) using elite swimmers, attempted to overcome this criticism by standardizing their performers' accomplishments against their own previous performance rather than against some other competitor's performance. They hypothesized that cognitive anxiety and self-confidence would both be related to competitive performance, but that somatic anxiety would not, interpreting Fenz and Epstein's (1967) findings on expert parachutists to mean that expert performers would be able to control pre-competitive levels of physiological anxiety.

Their findings suggested that while cognitive anxiety was indeed a significant predictor of performance, self-confidence and somatic anxiety were not, thus supporting Gould et al.'s (1984) conclusions. The results were surprising in that Martens et al. (1990) had argued that

cognitive anxiety and self-confidence were on opposite ends of the cognitive evaluation continuum. Barnes et al.'s. (1986) results may in fact simply be a reflection of the relatively unpredictable nature of self-confidence as posited by other researchers (Jones & Cale, 1989; Jones, Cale & Kerwin, 1988).

Burton (1988) conducted a study on swimmers using Martens et al.'s, (1990) CSAI-2 and Landers and Boutcher's (1986) classification system. The results suggested that cognitive anxiety was more strongly related to performance than somatic anxiety. An inverted-U shaped relationship was recorded between performance time and somatic anxiety, while positive linear and negative linear relationships were recorded between performance time and cognitive anxiety. Positive linear and negative linear relationships were recorded between performance time and self-confidence, and performance time and cognitive anxiety, respectively.

While the above research findings have incorporated a research design which may be potentially very appropriate for studying how the different processes of performance may be affected by stressors, they have not considered the multidimensional nature of anxiety. Ussher and Hardy (1986) were among the first to conduct research which considered the effects of different components of anxiety upon different subcomponents of performance. They obtained a dissociation of cognitive and somatic anxiety under the time-to-event paradigm; more precisely, their results suggested that increases in somatic anxiety impaired learned hand grip, while increases in cognitive anxiety were

not directly associated with the performance effects. According to Morris and Liebert's (1969) arguments and Davidson and Schwartz' (1976) matching hypothesis, one would conclude that cognitive anxiety should impair performance on the cognitively based tasks and physiological arousal/somatic anxiety should impair performance on the physiological and motor-based tasks. Parfitt and Hardy (1987) conducted several similar experiments to the one performed by Ussher and Hardy (1986) to investigate the effect that different anxiety components had upon subcomponents of hockey and basketball performance. However, Parfitt and Hardy (1987) deliberately emphasized the situational relevance to their subjects of each of the tasks which they asked them to perform. If one assumes that the effects of cognitive and somatic anxiety depend upon the availability of processing resources (allocation and capacity), then it is not unreasonable to suggest that subjects who are aware of the situational relevance of a task will invest some of their resources in the task even when they are anxious.

It is clear that different components of anxiety are associated with differential effects upon certain subcomponents of performance. Contrary to previous findings (e.g., Morris, Harris & Rovins, 1981), cognitive anxiety is not the only component of anxiety to influence performance. Neither is this influence always the negative one that is predicted by Wine (1971) or Davidson and Schwartz (1976). Still, it could be argued that cognitive anxiety is the primary influence upon performance (Morris, Harris & Rovins, 1981) even though it is not the only influence, since it is possible that cognitive anxiety determines the

effect which 'on-the-day' physiological arousal/somatic anxiety has upon performance.

In order to determine whether or not different aspects of a performer's 'game' were being disrupted by anxiety, it would clearly be necessary to perform some sort of 'match' analysis, which is a technique that provides players, coaches and sport psychologists with objective data about different aspects of a player's performance during a competition. For example, a match analysis of a basketball game could include how many times a particular player committed a mental error (e.g., travelling, seconds in the key, inappropriate pass, running the wrong offensive pattern, failing to block out etc.). Research (Jones & Hardy, 1990) would imply that it might be more meaningful to first of all identify the cognitive and motor subcomponents which underlie performance and then examine them in a competitive (game) situation.

In summary, when the time-to-event paradigm has been used to investigate the effects of cognitive and somatic anxiety upon situationally relevant criterion tasks, positive effects have been associated with cognitive anxiety, while both positive and negative effects have been associated with somatic anxiety. It has also been argued by Jones and Hardy (1990), that these results are best explained via resource allocation and attentional capacity effects.

Trait and State Anxiety as Predictors of Sport Performance

Empirical evidence supporting the state-trait distinction in anxiety research was first demonstrated in the factor analytic studies of Cattell

and Scheier (1961). It is now generally accepted that a comprehensive theory of stress and anxiety must distinguish between anxiety as a transitory emotional state, and individual differences in anxiety as a relatively stable personality trait (Spielberger, 1989). Studies using both state and trait measures have indicated that the state measures are consistently better predictors of performance (Gerson & Deshaies, 1978; Sonstroem & Bernardo, 1982).

An analysis of the relationship between state and trait competition anxiety may be based on the stress and coping theories which postulate that state anxiety is a result of a primary appraisal which involves the assessment of the threat or danger involved in a situation and a secondary appraisal which involves the self-perception of the individual's resources and abilities to overcome the threat (Gerson & Deshaies, 1978). Within this theoretical framework, state anxiety is the reaction to a particular set of circumstances; however, individuals' general tendencies to feel threatened by competition and their general self-efficacious beliefs about how well they can handle competition and competition anxiety will be reflected in their trait anxiety. Changes in specific competitive situations will affect both the primary and secondary appraisals; however, such an effect may be minor relative to the individual's generalized beliefs about competition.

Anxiety-Cognitive Behavior Relationship

When confronted with a stressful situation in sport the body begins to undergo varying emotional shifts, most notably, an increase in

anxiety levels (Selye, 1975). Many athletes begin to feel rushed and out of control. In addition, there is a stage of psychological reactivity when the athlete experiences covert cognitive anxiety. If the anxiety state is maintained over a long period of time, the athlete experiences a decrease in concentration and performance which only adds to the increased anxiety state. Thus the athlete is caught in a vicious anxiety cycle (initial increase in anxiety which results in a decrease in performance which leads to heightened anxiety which leads to a further decrease in performance etc.). When coaches or athletes become overly stressed, they cannot perform efficiently. Valuable energy is wasted and the ability to calmly consider alternative courses of action is lessened. Replacing the negative effects of anxiety with the positive benefits of relaxation enhances the probability of having the mind work with an individual (calm decision making) and not against one (panic reaction).

Husman (1969) states that as emotion goes up, functioning intelligence goes down. However, rising emotion and declining intellectual functioning is probably not a linear relationship. Nevertheless, there is little question about the distracting effects of extreme levels of emotion on any type of performance involving reasoning powers (decision-making). Such interference may be particularly harmful when the performer is in an activity requiring quick thinking or fast decision making (e.g., basketball game). Initial increases in either physiological arousal or cognitive worry may quickly create a negative thought-anxiety cycle (Ziegler, 1978). Making an

error increases one's cognitive worry and further heightens physiological arousal, thereby decreasing one's concentration and increasing the probability of more errors. Extreme examples of this interference occur when the individual "freezes" or "goes blank".

Anxiety-Motor Behavior Relationship

Physiological arousal has limited potential benefits for sport performance and there appears to be no research showing that arousal-increasing techniques enhance performance. In fact, autonomic responses of increased heart rate, respiration rate, blood pressure, and perspiration on the palms could make handling equipment difficult, and stressing the cardiorespiratory system more than necessary could induce early fatigue and reduce endurance. Increased muscular tension also can create special problems for sport performers (Weinberg, 1977). Gill (1986) found that high-anxious performers exhibited more unnecessary muscular activity and wasted energy before, during, and after the actual movement. Furthermore, high-anxious individuals exhibited simultaneous contraction of the agonist and antagonist muscles, which interfered with smooth, coordinated muscle action, thus creating the feeling of paralysis.

As nearly every coach and athlete knows, when an athlete is totally tension free, concentration may wane and thoughts may wander from the task at hand. Consequently, a superior athlete may be outperformed by a less competent athlete, due simply to motivational and attentional deficiencies. According to LeUnes and Nation (1989), what

is required for optimal performance may be a moderate level of anxiety, sufficiently high to sharpen the athlete's focus but not so intense that it encumbers his or her execution.

Oxendine (1970) has argued that optimum level of arousal varies with the particular motor task (e.g., different tasks require different levels of arousal for most effective performance). In addition, the optimum arousal state varies from person to person. Furthermore, Oxendine (1970) contends that even for the same person, the optimum level would be expected to vary somewhat from day to day—individuals respond to situations according to both internal and external stimuli. Research evidence, scientific literature, and empirical observation (Anshell, 1990; Martens, 1974; Oxendine, 1970; Sonstroem & Bernardo, 1982; Weinberg, 1989) offer the following generalizations on the anxiety-motor performance topic:

1. Optimal performance in gross motor activities which involve strength, endurance, and speed require a high level of arousal.
2. Performance of complex skills, involving fine muscle movements, coordination, steadiness, and general concentration is adversely affected by a high level of arousal.
3. For all motor tasks, a slightly-above-average level of arousal is preferable to a normal or sub-normal arousal state.

There are two basic theories relating to the arousal/anxiety-performance relationship—drive theory and inverted-U theory. Inverted-U theory includes many subtheories that explain why the relationship between anxiety and performance take the form of the

quadratic curve while drive theory is a multidimensional theory of performance and learning. Despite the inverted-U appearing earliest in the scientific literature on the relationship between performance and arousal/anxiety, empirical findings on drive theory will be examined first.

Drive Theory

Many coaches are still of the opinion that their teams' performances improve in direct relationship with increased arousal of their players; the more the players are "psyched up" or "high," the better will be the expected performance. This belief is the very reason why coaches consider their pre-game or mid-game motivational talks (also known as pep talks), as the ultimate extension of their coaching ability. Supporters of this view agree with the notion that the level of arousal is open-ended and that there is no limit to how high a competitor can become; the higher his or her pre-game emotions, the better he or she will play.

In applying drive theory to social facilitation research, Zajonc (1965) specified that increased arousal caused by the presence of an audience would elicit the dominant response among several possible responses. In the early stages of learning a motor task, the incorrect response is considered to be the dominant response. Conversely, during the later stages of learning a motor task, the correct response is considered to be the dominant response.

Habit was viewed as associative as opposed to a motivational variable. This means that habit is determined by learning principles, which include the process of reinforcement. Because different habits are likely to vary in strength due to different learning experiences, they are predictably going to interact with a given amount of drive. Habits that are strong, and thus high in the habit hierarchy, will contribute to substantially greater tendency to make the response. Spence and Spence (1966) reasoned that in an easy task, in which the habit differences between correct and incorrect responses are likely to be sizable, higher drive levels should result in a better performance. Conversely, in a difficult task, in which the respective habit strengths for correct and incorrect behaviors are not likely to be great, high drive should produce poorer performance because of behavioral interference.

In summary, according to Cox (1985), drive theory proposes that:

1. Increased arousal (drive) will elicit the dominant response.
2. The response associated with the strongest reaction potential is the dominant response.
3. Early in learning or for complex tasks, the dominant response is the incorrect response.
4. Late in learning or for simple tasks, the dominant response is the correct response (pp. 108-109).

However attractive and plausible drive theory might be in explaining the anxiety-performance relationship, it has received mixed support (Martens, 1971, 1974; Spence, 1971). The theory is difficult to test,

and for this reason, interest in drive theory has waned in recent years in favor of the inverted-U theories.

Inverted-U Theory

The relationship between unidimensional anxiety/arousal and performance has been most popularly conceptualized as taking the form of an inverted-U; a hypothesis credited to the work of Yerkes and Dodson (1908). The major assumptions of optimal arousal theorists are that for every type of behavior there exists an optimum level of arousal, usually of moderate intensity, that produces maximum performance and that this optimum level decreases as performance complexity increases (Bunker & Rotella, 1980). Levels of arousal above or below this optimum amount are seen to produce inferior performance. Simply stated, increases in arousal are accompanied by increases in performance up to a certain point but further increases cause a deterioration in performance.

Such assumptions seemed too simplistic for Weinberg (1989), who argued that this view of optimal arousal level takes little account of factors such as perceptual requirements of the task, decision-making components and skill level. This notion was supported by Landers and Boutcher (1986) who proposed a system for estimating the complexity of sports performance which centers on the analysis of three major dimensions of skilled performance; decision characteristics, perceptual characteristics, and motor act characteristics. Decision characteristics of the skill include the number of decisions necessary, the number of

alternatives for each decision and the speed and sequence of decisions. Perceptual characteristics of the skill take into consideration such factors as the number of stimuli needed, the number of stimuli present, the duration and intensity of stimuli and the clarity of the correct stimulus among competing stimuli. In addition, motor act characteristics of the skill include the number of muscle actions necessary to execute the skill, the amount of coordination of actions needed, and the precision steadiness and fine motor skill required.

The Yerkes-Dodson Law (1908) can be used as a point of reference—complex tasks are performed better when one's drive is low while simple tasks are performed better when drive is high. Therefore, drive which is either too great or too low for a particular task may result in impaired performance. It is assumed that "drive" is somewhat related to motivation or arousal. However, reflective explanations which offer a rationale on the results of performance based on the task being either complex or simple or the level of drive being either high or low are of little value in predicting performance.

Because the basic tenet of the inverted-U hypothesis proposes that the optimum point of arousal varies as a function of task characteristics, different sports are likely to demand different levels of arousal for the best results. Even for the same sport, the nature of the essential behaviors may dictate different levels of psychological activation for the best result—different positions may require different levels of arousal/anxiety to be effective. Behavioral features of positions within

multi-positional activities therefore, must be considered when defining optimal arousal levels in sport.

Similarly, skill level is likely to dictate disparate points of optimal arousal. Beginning athletes require a lower level of arousal for the best performance results, while highly skilled individuals require higher levels of arousal/anxiety for optimal performance results.

Pre-competitive hype is a familiar tool used by sport practitioners, apparently to "get athletes ready to play." But implicit in the message of the inverted-U hypothesis is the notion that such a strategy can be excessively used and may actually backfire. As it relates to sport, the inverted-U hypothesis predicts that athletes may become so "psychologically charged" that they are unable to perform efficiently—arousal is translated as anxiety and it becomes counterproductive (Bunker & Rotella, 1980).

According to some empiricists (Jones & Hardy, 1990; Weinberg, 1989) however, the inverted-U relationship is too simplistic and is incapable of reflecting the extremely complex relationship which actually exists between anxiety and performance (it gives you the big picture, but doesn't fill in the spaces). While it seems relatively clear that the nature of the relationship between athletic performance and arousal takes the form of the inverted-U, it is not clear why this occurs. Therefore, three sub-theories that predict a quadratic relationship between performance and arousal/anxiety and offer a "why" rationale are identified and include: (1) cue utilization theory (Easterbrook, 1959), which is based on the principle of relevant and irrelevant cues

and attentional narrowing; (2) signal detection theory which is based on the notion of errors of commission and omission and on a subject's response criterion; and (3) information processing theory which is based on channel capacity and neural activity. All three theories will be expanded in the following sections.

Drive Theory Versus Inverted-U Theory

The common assertion is that drive theory predicts that well-learned tasks involving established habits should always reflect performance facilitations as arousal/anxiety increases. On the other hand, the inverted-U hypothesis argues that behaviors, however well they are learned, will be impaired at some point, given a sufficiently high level of anxiety and arousal.

Investigations by Martens and Landers (1970) and Klavara (1977) lend support to the inverted-U hypothesis, in that moderate stress condition was associated with better motor performance than either low- or high-stress conditions. Intra-subject results found by Sonstroem and Bernardo (1982) also appeared to be remarkably consistent with the inverted-U hypothesis.

Cue Utilization

Closely related to the notion of audience distraction is the notion of attentional narrowing and cue utilization (Easterbrook, 1959). The basic premise of the cue utilization theory or attentional narrowing theory is that as arousal increases, attention narrows. The narrowing of

attention results in some cues being gated out, first irrelevant cues and later relevant cues. Attentional narrowing predicts an inverted-U relationship between arousal and performance. When arousal is low, the attentional band is wide and both irrelevant and relevant cues are available. The presence of these cues is distracting and causes a decrement in performance. At a moderate or optimal level of arousal, only the irrelevant cues are eliminated, and therefore performance is high. Finally, when arousal is high, attentional focus is narrow and both relevant and irrelevant cues are gated out. This results in a decrement in performance as predicted by the inverted-U.

Easterbrook's (1959) cue utilization theory handles the problem of task difficulty by positing that the attentional band is much narrower for simple tasks than for complex tasks. Consequently, high arousal would gate out relevant cues much more quickly for a complex task than for a single or well-learned task.

At the higher levels of arousal, it is also important to recognize the phenomenon of distractibility (Kahneman, 1970, 1973; Schmidt, 1987). When arousal levels become very high, cue utilization theory predicts that attention narrows. However, there is a point at which a person's attention begins to jump randomly from one cue to another. This process of sporadically directing attention to many different sources is referred to as distractibility. The athlete who experiences this phenomenon of distractibility will be confused by having to momentarily attend to many relevant and irrelevant cues.

In the low-arousal situation, the errors tend to be a failure to detect a signal or relevant cue (error of omission), while in the high-arousal situation, the errors tend to be false identification of signals or cues (error of commission). In the optimal arousal situation, the errors are ideally balanced between false alarms and misses. This model is very appealing, because one would expect errors to increase with high and low levels of arousal. Sports that require instant decisions require a moderated level of arousal to avoid errors of commission or omission.

Weinberg (1989) argued that perhaps the best explanation of the inverted-U hypothesis lies in Easterbrook's (1959) hypothesis—that the observed effects on performance are due to the effects of arousal upon attentional selectivity. The hypothesis simply states that an individual's breadth of perceptual attention narrows as his or her level of arousal increases and therefore, increases in arousal from a low to a moderate level are accompanied by an increase in perceptual selectivity whereby irrelevant task cues are eliminated and performance improves. As the arousal level continues to increase beyond the optimum, breadth of attention continues to decrease, causing a "tunnelling" effect, so that relevant cues are also eliminated, resulting in a deterioration in performance. Eysenck (1984) contended that when the information processing demands are too great for the available processing capacity, then individuals may adopt a coping response by restricting attention to only a small amount of the information available.

When being evaluated, the high-test-anxious person turns his or her attention inward while the low-test-anxious person focuses more

fully on the task. The implication is that the high-test-anxious person attends to fewer task cues than does the low-test-anxious person. This attentional interpretation is similar to that advanced by Easterbrook (1959) which indicated that emotional arousal consistently narrows the range of cue utilization in task performance.

Signal Detection Theory

Since signal detection theory has not been field-tested for the inverted-U concept, a theoretical point of view only is presented. In its simplest form, signal detection theory holds that the intensity of noise in the nervous system falls along a continuum ranging from low to high. The addition of a signal to the noise naturally increases the neural activity, and the individual's task is to discriminate between noise alone and signal plus noise.

In the low-arousal/anxiety situation, the errors tend to be a failure to detect a signal (error of omission), while in the high-arousal/anxiety situation, the errors tend to be false identification of signals (errors of commission). In the optimal arousal situation the errors are ideally balanced between false alarms and misses. Therefore, the signal detection model is very appealing, because one would expect errors to increase with high and low levels of arousal, but the nature of the error is different due to the activation or deactivation of brain cells (Welford, 1973). The theory's salience to athletics lies in the belief that sports that require instant decisions require a moderate level of arousal/anxiety to avoid errors of commission or omission.

Information Processing Theory

The basic prognostications of information processing theory for the arousal/anxiety-performance relationship are identical to those of signal detection theory in that both predict the inverted-U relationship. According to Welford (1962), brain cells become active with increased levels of arousal/anxiety and they begin to fire causing noise in the information processing system and a reduction in the channel capacity. Low levels of arousal/anxiety result in a relatively inert system with low performance levels, while high levels of arousal/anxiety effect a performance decrement because of the reduced information processing capacity of the channels. At some optimal level of arousal/anxiety, the information processing capacity of the system is at its maximum, and performance is at its best.

Social Facilitation

Hunt and Hillary (1973) concluded that the presence of coactors had a facilitative effect on the dominant response, hindering performance when the dominant response was incorrect and facilitating performance when the dominant response was correct. MacCracken and Stadulis (1985) reported a developmental study in which the presence of an audience facilitated the motor performance of highly-skilled children while causing a performance decrement in lower-skilled children.

Cottrell's (1972) notion of evaluation apprehension does not challenge Zajonc's (1972) basic model in its application of drive theory

to social facilitation, but it does challenge his position that the mere presence of others is enough to cause a social facilitation effect. The mere presence of an audience is not enough to increase drive; in order for an audience to increase arousal/anxiety, it must be capable of critically evaluating the subject's performance. Cottrell (1972) believed that this evaluation factor is a learned source of drive—subjects react to evaluative audiences with increased levels of arousal/anxiety because of previous experience with evaluation apprehension. Zajonc (1972) however, argued that the presence of an audience causes an increase in arousal/anxiety by creating an atmosphere of uncertainty, not evaluation apprehension. This raises the possibility that it is the athlete's perception of an audience's ability to appraise performance that is the cause of arousal/anxiety when performance occurs in front of an audience. The essence of Zajonc's (1972) contention that the "uncertainty" caused by the presence of an audience and Cottrell's (1972) "evaluative apprehension" arising from similar conditions is captured by Chapman's (1974) concept of psychological presence—the degree to which a performer feels the presence of an audience.

Evidence supporting Cottrell's evaluation apprehension notion has also been documented by Martens and Landers (1972). Landers and McCullagh (1976), however, explained the social facilitation phenomenon by arguing that audiences are distracting and lead to increased arousal/anxiety on the part of the performer. There appears to be mixed support for both the drive theory and the inverted-U theory—performance on a simple motor task was facilitated by the

passive audience, while performance on a complex task was inhibited. While studies by Landers and McCullagh (1976) have shown that motor performance tasks are largely unaffected by the numbers of observers, it was demonstrated that arousal/anxiety levels increased as the number of onlookers increased. Most athletic situations involve interactions among athletes and between athlete and spectator. Therefore, an interactive audience is one in which the audience has verbal, visual and emotional contact with the athletic participants. Factors to be considered with respect to interactive audiences would include, but not be limited to: home court advantage, visiting team disadvantage, audience size and intimacy, the hostile crowd, audience sophistication, the home court disadvantage, gender, and competition among coactors.

Although negative factors contributing to the home court advantage would be related to such things as travel, jet lag, unfamiliar surroundings, sleeping arrangements, and changed eating habits, most authors agree that the significant factor is related to whether the audience is supportive or hostile—Schwartz and Barsky's, (1977) findings on college basketball games, the home team won 64 percent of the games. Varca (1980) argued that more effective rebounding, steals and blocked shots by the home team contributed to the success of the home team winning a greater percentage of the games. It could be argued however, that the home court advantage is due to a decrement in performance by the visiting team rather than an increment in performance on the part of the home team.

A hostile crowd can have a devastating effect on a visiting team, making it impossible to communicate verbally with players, coaches or officials. Deafening noise can be distracting and disorienting, which would affect the ability of athletes to concentrate on task relevant cues. Attention may therefore be directed inward (Cox, 1985). Prior experience with hostile crowds would therefore be assumed to have an affect on the level of pre-competitive arousal/anxiety levels.

Audience sophistication is related to the degree of knowledge and understanding that an audience possesses. Research evidence presented by Cox (1985), suggests that when performers are aware that observers are highly skilled and knowledgeable, the psychological presence or evaluative potential of the situation is very high.

Performing alone or in front of an audience does not affect men and women differently (Murray, 1983). However, according to Chapman (1984), during coaction women are more susceptible to the social facilitation effect than are men.

The leveling effect simply means that when coactors of unequal ability compete with each other, there is a tendency for the performance level of the coactors to become more alike—the performance of the less skilled athletes improves, while the performance of the more skilled performers declines. The less skilled athlete will be motivated to try hard, but the highly skilled athlete may be content to play just well enough to win—arousal/anxiety may be too low in the first instance and at optimum level in the second instance. This results in both athletes playing near the same level.

Attention

According to Nideffer (1980), attention is the ability to direct our senses and thought process to particular objects, thoughts, or feelings. Orlick and Partington (1988) also suggested that a large proportion of the athletes fail to perform to potential because they are unable to maintain their concentration in the face of distractions. Concentration and attention are substantial cognitive components which determine cognitive and motor performance. Terms such as mental concentration, vigilance, selective attention, activation and task preparation are related to intensive and selective processes in which environmental information is perceived and assessed.

Mental concentration requires effort, sensitivity, and the ability to choose among alternate actions in executing a task while the subject is exposed to (external) environmental distractions (noise) and inner disturbances. Humans are commonly perceived as a limited information processing system which is unable to process all the data available in the environment. Consequently, of this functional limitation, primary importance is placed on the attentional mechanisms which enable the perception of relevant data for processing. A second limitation of humans is the amount of time they can sustain concentration while exposed to external and internal noise. The ability of athletes to comprehend relevant information while avoiding irrelevant cues as well as to concentrate during competition are of primary importance for a successful performance (Tenenbaum et al, 1988).

A key element in Nideffer's theory of attention, involves the relationship between attention and competitive arousal/anxiety (Nideffer, 1980, 1981). Three major changes in attention are proposed to occur as the level of arousal/anxiety increases:

1. As arousal/anxiety increases the athletes becomes locked into their preferred attentional style. As a result they are unable to rapidly shift attentional focus from one type to another (e.g., from broad-external to narrow-internal) even when, a more flexible attentional focus may be appropriate at the time.
2. One's attentional focus begins to narrow involuntarily, resulting in the amount of information from both internal and external sources that may be processed and evaluated to become greatly reduced. Clearly, performance will suffer to the extent that this excluded information contains cues relevant to the task.
3. One's tendency becomes more internally focused—this is perhaps the most significant change in an individual's attentional focus under high levels of anxiety/arousal.

In reference to the third major arousal/anxiety change described above, Nideffer (1980) concludes that:

The person becomes distracted by his own bodily feelings (beating heart, muscle tension, and so on) and his thoughts (why did the runners leave base, what's the matter with me, I might choke, and so on). As attention is directed internally, the ability to concentrate on the game deteriorates (p. 103).

Literature from diverse areas (Easterbrook, 1959; Liebert & Morris, 1967; Morris et al., 1981; Nideffer, 1989) suggest that: a) highly anxious persons are generally more self-preoccupied than are people low in anxiety; b) the self-focusing tendencies of highly competition-anxious persons are activated in competitive situations; c) those situational conditions in which the greatest performance differences occur are ones which evoke the self-focusing tendencies of highly competition-anxious subjects, and the task-focusing tendencies of low-anxious subjects; d) anxiety reduced the range of task cues utilized in performance; e) "worry," an attentionally demanding cognitive activity, is more debilitating of task performance than is autonomic (spontaneous) arousal.

High competition-anxious persons spend a part of their task time doing things which are not task oriented. These persons worry about their performance, and about how well others might do. They ruminate over choices open to them, and are often repetitive in their attempts to solve the task.

These responses. . . may be manifested as feelings of inadequacy, helplessness, heightened somatic reaction, anticipations of punishment or loss of status and esteem, and implicit attempts at leaving the test situation. It might be said that these responses are self rather than task centered (Mandler and Sarason, 1952, p.166).

In a review of literature on paper-and-pencil anxiety scales, Sarason (1960) cited a number of studies that provide evidence that

high-anxious subjects are "more self-deprecatory, more self-preoccupied, and generally less content with themselves than subjects lower in the distribution of anxiety scales" (p. 404). Such thoughts would have debilitating effects on self-confidence.

In sport, unlike many other achievement situations, there are numerous potential external distractors such as opponents, spectators, environmental conditions, and even the coach's behavior. As well, there are internal distractors in the form of self-doubt, self-evaluation, awareness of fatigue and/or pain, and anxiety. One's ability to avoid allowing potential distractors to impair performance is a key to achievement.

Pre-competitive State Anxiety and Performance Relationship

Since the early 1960s, the influence of anxiety in contemporary society has been increasingly recognized. This is especially true in competitive sports. Sport scientists (psychologists and physiologists) are accumulating important information which contends that when confronted with a stressful situation in sport the body begins to undergo varying emotional shifts, most notably, an increase in anxiety levels (Martens et al., 1990; Ziegler, 1980). On a cognitive level, some athletes begin to feel rushed and out of control, while physiologically many changes are experienced—the sympathetic nervous system becomes activated, and the athlete begins to exhibit overt signs such as sweating, cold hands, nausea, and tight muscles etc. (Martens et al., 1990).

Effect of Pre-Competitive State Anxiety on Individuals

The thoughts of David Hemery, one of Britain's greatest ever athletes, waiting for the start of his Olympic gold medal winning 400 meter hurdles race in 1968, depict the powerful impact that anxiety can have on athletes:

I was practically paralytic with fear—John too—although somehow we were able to crack bad jokes in our attempt to relieve the tension, wishing we were anywhere but there at the time. John Cooper and Dennis sat at the end of the beds smoking furiously, and looking, perhaps, even more overwrought than Sherwood and myself. My fingers and feet were damp and freezing cold. I felt weak, my breath was short and I felt a slight constriction in my throat. The back of my neck ached a bit and my prevailing thoughts were of impending unpleasantness. Sherwood and I just wanted to get the whole thing over and done with. The waiting was agony but my mind, conditioned through long training and experience, warned 'wait to warm up! Wait! Wait! . . . (Hemery, 1976, pp. 1-2)

Klavora (1978) argues that the ability to adjust the athlete's pre-competitive arousal/anxiety level—to elevate it or to reduce it—is but one side of the matter. The other side the athlete must deal with is the problem of "to what level of arousal/anxiety should I adjust myself?" This question is related to the athletes' customary competitive level of arousal/anxiety which produces their best performance. Other related questions important to the athlete and the coach are: How do I go about

measuring my arousal/anxiety levels? How does the coach know that the athlete or the team is "up" for the game or at their customary competitive level or arousal/anxiety? Are there any differences among players in their arousal/anxiety levels prior to competition? Is the athlete's pre-game behavior related to his or her pre-game arousal/anxiety?

The combination of positive group effects for cognitive arousal/anxiety, coupled with a negative linear relationship across subjects, seems to suggest that small amounts of cognitive arousal/anxiety on the day of an important event exert a beneficial effect upon performance, while large amounts of cognitive arousal/anxiety have a detrimental effect upon performance (Jones & Cale, 1989). Mild concern about the outcome of a competitive event might well motivate performers to greater effort and higher levels of performance (Kahneman, 1973; Eysenck, 1982), while uncontrollable fear about the consequences of failure would almost certainly constitute a very powerful source of distraction (Wine, 1971). Negative effects of increased arousal/anxiety have consistently been demonstrated over a wide range of cognitive and motor processes. Performance decrements have been found in the case of: manual dexterity (Baddeley et al., 1968), tracking (Hammerton & Tickner, 1967), working memory (Idzikowski & Baddeley, 1987), and memory load, spatial ability and logical reasoning (Idzikowski & Baddeley, 1987). However equivocal findings are evident in the case of effects of arousal/anxiety on reaction time. Arousal/anxiety has been found to have no effect to produce

longer reactions (Wachtel, 1968) and even to result in faster simple reaction times (Wenar, 1954).

In the athletic setting, as in the school setting, awareness of the differential effects of cognitive and somatic arousal/anxiety on performance—both very high and very low cognitive arousal/anxiety are associated with poor performance, while somatic arousal/anxiety interferes with performance only at extremely high levels—should be helpful in assisting athletes to attain maximum performance levels. An instrument with validity in predicting cognitive and somatic reactions would be useful in both application and research (Morris & Liebert, 1969, 1970).

Previous research hypothesized that state anxiety decreases with success and increases with failure (Martens et al., 1990). In addition, high trait anxiety individuals evidence higher levels of state anxiety than low trait anxiety individuals after failure, and conversely demonstrate lower levels of state anxiety after success. Martens et al. (1975) found that success-failure was a strong situational factor affecting state anxiety with failure experiences significantly increasing state anxiety (A-state) and success experiences significantly reducing A-state.

With respect to the optimal pre-competition emotional arousal/anxiety-motor behavior relationship in athletics, Klavora (1975) argued that a "wide range of individuals, in terms of their emotional arousal level, may perform well in tasks that require rather delicate responses of fine muscle groups" (p. 284). It has been widely held that only individuals who exhibit low levels of emotional arousal would

perform well in such tasks (Oxendine, 1970). Conversely, a wide range of individuals, in terms of their emotional arousal level, may exhibit adequate performance in tasks that require only brute strength and speed—traditionally, it has been believed that in these tasks only highly emotionally aroused individuals would perform their tasks effectively.

The majority of research into the competitive stress response (almost universally referred to as 'anxiety') has focused on the period preceding competition. Silva and Hardy (1984) identified four main reasons for this:

1. The assumption that the athlete's mental set prior to competition can affect subsequent performance;
2. The assumption that the athlete has some control over his or her mental preparation during the pre-competition period;
3. This period is much more accessible to researchers than the period of competition itself;
4. If pre-competition arousal/anxiety is a (negative) source of performance variance for a particular individual, then the coach or clinician can assist in developing an appropriate pre-competition state for that individual.

At present, we can conclude that sport performance is optimal at a moderate arousal/anxiety level, and we can qualify that relationship by noting that optimal arousal/anxiety levels vary across tasks and among individuals. Because we cannot predict precise optimal arousal/anxiety levels for each performer and each task, we might direct our efforts at helping performers recognize and control their own individual optimal

states in varying situations. Indeed, some research suggests that the ability to control arousal/anxiety is the key to successful sport performance, and Fenz' (1975) work suggests that the difference between elite and non-elite performers is not a difference in absolute level of arousal/anxiety but rather the difference appears to be in their ability to control arousal/anxiety. Elite performers seem to bring arousal/anxiety under control so that they are experiencing moderate levels of arousal/anxiety at the time of performance. Mahoney (1979) noted that differences in cognitive patterns, and specifically differences in pre-competition thoughts, may accompany the differences in arousal/anxiety patterns. Qualifiers (elite athletes) seemed to approach competition with a task orientation and to focus their energy and attention on the task, whereas the non-qualifiers (non-elite athletes) worried about being anxious.

Mediating Factors

Our basic conceptualization of personality processes such as anxiety phenomena follows the doctrine of interactionism, as described by Morris (1977), which argues that the occurrence of arousal/anxiety is a joint function of person variables and of situation variables. Person variables consist of cognitive and behavioral tendencies acquired by persons through individual and social learning experiences. Situational factors may also affect anxiety. The perceived importance or difficulty of the contest is one situational factor identified as being related to state anxiety with "crucial" or important contests being preceded by higher

anxiety. The behavioral tendencies interact with situational cues to evoke arousal/anxiety responses.

Other situational factors identified as influential in eliciting an arousal/anxiety response have included: experiences of success and failure (Martens & Gill, 1976); outcome of contests (Gruber & Beauchamp, 1979); and expectancies for team and individual performance (Scanlan & Passer, 1978). The presence of an audience, knowledge about the opponent and perceived ability of the opponent, skill level of the competition and the relative time to competition are other potential situational factors that may determine state anxiety (Cooley, 1987).

Scanlan and Passer (1979) have shown that, contrary to the extensive literature in support of competitive trait anxiety as the factor most responsible for negatively affecting athletic performance, competitive performance expectancies bear an even greater relationship to performance. Winning players held higher expectancies for themselves and their team than did losing players or players who had tied. Similarly, players with greater ability were higher in self-esteem than their less proficient counterparts. This would indicate that performance expectancies and general self-attitude would appear to be more directly related to how well an athlete performs than the anxiety events they are purported to mediate (Martens, 1974).

Antecedents

To date, relatively little systematic and structured research has been carried out which examines the antecedents of competitive state anxiety. Of this scant amount, the majority has focused on identification of the antecedents of the different anxiety components (e.g., Gould Petlichkoff & Weinberg, 1984; McAuley, 1985).

Multidimensional anxiety theory (Martens et al., 1990; Burton, 1988), argues that at least two different components can be distinguished in the anxiety response: a cognitive component associated with fear about the consequences of failure and a somatic component reflecting perceptions of the physiological response. The theory goes on to argue that these different components have disparate antecedents and can be independently manipulated. Morris, Davis and Hutchings (1981) and Martens et al. (1990) have posited that somatic anxiety is a conditioned response to entering the performing environment, which should therefore dissipate once performance commences, and that cognitive anxiety reflects concerns about the consequences of failure; it should only change when the subjective probability of success changes. Based on these suppositions, Martens et al. (1990) predicted that cognitive anxiety should remain stable and high throughout the period preceding an important event, while somatic anxiety should peak late and rapidly upon arrival at the site of the competition. Spiegler, Morris and Liebert (1968) had previously obtained similar findings with respect to test anxiety.

The antecedents of both cognitive anxiety and self-confidence are those factors in the environment which are related to the athlete's expectations of success, and include perception of one's own and of the opponent's ability (Gould, Petlichkoff & Weinberg, 1984; Martens et al., 1990). Conversely, cues which elicit elevated somatic anxiety are thought to be non-evaluative, of shorter duration, and consist mainly of conditioned responses to environmental stimuli (Morris, Harris & Rovins, 1981). Changing room preparation and pre-competition warm-up routines are events which would evoke somatic arousal/anxiety (Gould, Petlichkoff & Weinberg, 1984; Martens et al., 1990).

Although Gould et al. (1984) reported that the CSAI-2 subscales—cognitive anxiety, somatic anxiety and self-confidence—were found to have different antecedents, the results showed that no single antecedent (e.g., competitive trait anxiety, perceived ability, success and past experience) was related to all three of the CSAI-2 components. The strongest predictor of cognitive anxiety however, was found to be years of experience based on the competitors' experience at a particular level and the age at which they began competing, and showed a negative relationship, that is, performers with more experience reported less cognitive anxiety. Perceived ability was found to be strongly related to the CSAI-2 self-confidence component, but demonstrated little relationship to the cognitive and somatic anxiety components.

More recently, Cale and Jones (1989) reported findings which suggest that while goal difficulty is an important determinant of both cognitive anxiety and self-confidence, the major predictor of self-

confidence appears to be perceived readiness. However, the external environment also contributes significantly to this prediction . That would explain equivocal results which have been recorded showing self-confidence to dissociate from cognitive anxiety some parts of the time but not others (Barnes et al., 1986; Jones, Cale & Kerwin, 1988). Such findings would support Martens' and colleagues' (1990) proposal that performance expectations are antecedents of both cognitive anxiety and self-confidence. These results indicate the important role that the coach and/or sport psychologist play in the performers' competition preparation and, in particular, the performers' perceived readiness—helping performers perceive that they are 'ready' will reduce cognitive anxiety and increase self-confidence, while contributing to the performer's belief that he/she is not 'ready' will increase anxiety and reduce self-confidence.

Jones, Swain and Cale (1990), examined predictors of the CSAI-2 components in males and females in a variety of sports utilizing the time-to-event paradigm, and found that females focus more on personal goals and standards, whereas males focus more on interpersonal comparison and winning. Males cognitive anxiety and self-confidence were mainly predicted by the extent to which subjects thought they would win, together with their perception of their opponents' ability in relation to their own. In contrast, the importance of doing well personally in the competition and perceived physical and mental readiness were the major predictors of cognitive anxiety and self-confidence for females.

According to Passer (1983), when male youth soccer players were evaluated with respect to competitive trait anxiety, it was discovered that players' performance expectancies, anticipated affective reactions to success-failure, and expectancies for criticism, were all influential in determining how well the participant played. The greater the anxiety (e.g., the more dismal the expectations for being successful), the less effective—as rated by their coaches—were the young athletes. Moreover, failure seems to be potentially more devastating, psychologically speaking, for participants who demonstrate high competitive trait anxiety—such athletes worried more about their performance and were more apprehensive about evaluations by peers than young males who demonstrated low anxiety. The concern of course is that a vicious cycle may form; the child who is anxious and expects to perform poorly does so, and consequently experiences greater perceived ridicule, which leads to increased apprehensiveness about competitive situations. Such experiences and expectations will leave a lasting impression (conditioned response) on individuals.

Task characteristics

As postulated by Yerkes and Dodson (1908) and subsequently related to sport by Oxendine (1970), high arousal/anxiety levels are optimal for performance at simple tasks and interfere with performance at complex tasks. Optimal arousal/anxiety levels, therefore, vary with the degree of task complexity. Ussher and Hardy (1986) reported evidence from a sample of experienced rowers to suggest condition-

specific effect of cognitive and somatic anxiety on cognitive and motor subsystems. More specifically, performance on a predominantly motor task, was detrimentally affected by increased somatic anxiety, while a cognitive task, was negatively affected by increased cognitive anxiety.

In sport situations involving speed, strength, or endurance, the athlete must be able to focus attention on the important factors relevant to the task. Shelton and Mahoney (1978) have found that athletes' focus of attention is an extremely important "psyching-up" strategy for strength activities. High arousal/anxiety causes attention to shift, often causing increases in error rate. Attention can be directed to a variety of environmental cues, particularly cues detected by the auditory and visual senses (Bacon, 1974).

Individual differences

An area which has stimulated research interest, is the role of individual differences in the arousal/anxiety response. The most popular individual difference variables which have so far been investigated include competitive trait anxiety (e.g., Martens, 1977; Martens & Gill, 1976), sex (e.g., Jones & Cale, 1989; Martens et al., 1990), gender role (e.g., Wottog, 1984), skill level (e.g., Martens et al., 1990) and type of sport (e.g., Martens et al., 1990).

The general tendency athletes carry with them to react with anxiety to competitive situations (competitive trait anxiety) is a very powerful predictor of the level of state anxiety they will experience in a specific competitive situation (Martens, 1976). Whether or not the

athlete perceives a situation as threatening will often depend on the athlete's competitive trait anxiety—the predisposition to view competitive situations as threatening. This ultimately will be determined by the objective competitive situation, and will result in heightened state anxiety if the situation is perceived as threatening to the athlete.

One individual difference variable which has received considerable attention, particularly within the context of competitive anxiety, is that of gender. It has consistently been demonstrated that females report higher levels of sport-specific trait anxiety (Martens, 1977) than males. Females have also been shown to report higher levels of competitive state anxiety than males (Jones & Cale, 1989), perhaps because of traditional socialization of the sexes favoring males in the preparation for athletic competition, that is, with respect to exposure to a competitive orientation to life. According to Gill et al. (1984), gender differences in expectations of success may also be an important factor in determining competitive state anxiety; competitive situations actually exaggerate gender differences in achievement cognitions, with females generally reporting less confidence and lower expectations of success than males. These differences vary according to the task and the situation, with gender differences being particularly evident in tasks which are perceived to be masculine.

Jones and Cale (1989) noted from their study that females do not conform to temporal patterning established for males. Using a sample of university athletes during the week leading up to a prestigious

competition, Jones and Cale (1989) reported that the patterning of cognitive and somatic anxiety did conform to the predictions for the males. However, for the females, cognitive anxiety increased as the competition drew near and was higher than in the males immediately before the competition. Females also demonstrated an earlier increase in somatic anxiety than did the males. These findings imply that caution needs to be exercised when using the time-to-event paradigm with female subjects.

Vision in the peripheral field is quite variable among different people and can even vary over time within the same individual. Females appear to have better peripheral vision than males, but are also more susceptible to stress and evidence greater visual narrowing in sport involving high risk (this condition would definitely impair decision-making during basketball competition).

Rainey and Cunningham (1988) investigated issues related to competitive trait anxiety among male and female athletes. It appeared from the study that because women's sports was given less attention than men's sports, expectations or criticism had less relation to competitive trait anxiety. However, the more female athletes placed importance on sports, the higher was their competitive trait anxiety. Segal and Weinberg (1984) concluded that it is a consistent finding that females exhibit higher levels of competitive trait anxiety (CTA) than males, with CTA being defined as "the tendency to perceive competitive sports situation as threatening and to respond to these with feelings of apprehension and tension" (p. 153). Males who registered high in

competitive trait anxiety reported lower levels of self-esteem and more frequent worries than women (Brustad & Weiss, 1987). No significant relationships however, were found between levels of competitive trait anxiety and cognitive variables. This would indicate that competition in sport takes on different meanings for females than for males—especially at a younger age.

Skill level

According to the drive theory (Hull, 1943), increases in drive (arousal/anxiety) enhances the probability of eliciting the dominant response. If the dominant response is correct (as in later stages of skill acquisition), then increases in arousal/anxiety will increase performance. Similarly, when the dominant response is incorrect (as in early skill acquisition), then increases in arousal/anxiety will be detrimental. The drive theory can also be applied to task complexity: higher arousal/anxiety levels experienced during the performance of simple tasks will increase performance, while elevated levels of arousal/anxiety during the performance of complex tasks will decrease performance (Hull, 1943).

Yerkes and Dodson (1908), argued that "an easily acquired habit, that is, one which does not demand difficult sense discrimination or complex associations, may readily be formed under strong stimulation, whereas a difficult habit may be acquired readily only under relatively weak stimulation" (pp. 481-482).

Type of sport

The principles put forward by the Yerkes and Dodson Law (Yerkes & Dodson, 1908) were utilized by Oxendine (1970) in developing a hierarchical classification of sports based on complexity and the degree of fine muscle control and judgment involved. Gross motor activities such as weight lifting, sprinting, and football tackling and blocking were found to require the highest levels of arousal/anxiety for optimal functioning. At the other end of the continuum of five sport classes identified by Oxendine (1980), were activities requiring fine muscle control and judgment for best execution (e.g., bowling, field goal kicking, and figure skating). This type of activity is best performed with low levels of arousal/anxiety. Weinberg and Genuchi's (1980) results supported this hypothesis in that low levels of both competitive A-Trait and A-State were related to better scores across 3 days of tournament golf, which is considered a task requiring precision and fine muscle movements.

Cognitive/Attentional Disruptions

Individual differences play an important part in determining which aspects of performance are most likely to be disrupted. Some aspects of performance which previous research (Baddeley & Idzikowski, 1985; Hammerton & Tickner, 1968; Humphreys & Revelle, 1984) has shown to be affected—and likely to be disrupted—by competitive anxiety in basketball performance are:

1. Perception: affects attentional narrowing (Hammerton & Tickner, 1968), and selectivity leading to hyper-distractability (Deffenbacher, 1978) (e.g., tunnel vision and ball watching leading to a failure to see free players—own and opposition—and distraction by refereeing decisions and self-distracting thoughts).
2. Working memory or short-term memory: impaired working memory with large memory loads (Humphreys & Revelle, 1984; Jones & Cale, 1989) (e.g., time penalties in attacking key, untimely release of the ball when there is a choice of passes, and failure to drive at the basket when there is a choice, that is, when the opening presents itself).
3. Long-term recall: impaired for difficult tasks and enhanced for simple tasks (Parfitt & Hardy, 1987) (e.g., failed critical free throw, accurate rebound shooting).
4. Manual dexterity: impaired (Baddeley & Idzikowski, 1985) (e.g., poor ball handling under pressure, lack of touch on a failed lay-up).
5. Dynamic balance: impaired (e.g., clumsy and flat-footed defending).

Selection Errors

Landers (1980) and Schmidt, (1982) theorized that increases in state anxiety cause attentional disruptions or biases in the information the performer receives from the environment. Thus they attempted to

explain performance decrements that occur under conditions of elevated anxiety on the basis of selection errors that occur prior to information processing, and focused their investigations on the process through which information is taken into the human system. Such explanations are based on cognitive or attentional disruptions that occur as a consequence of elevated state anxiety and then serve to prejudice or distort environmentally based information. Although support for the cognitive/attentional disruption explanation can be found in Easterbrook's (1959) and Kahneman's (1973) theoretical treatise, and in Landers' (1982) and Reis and Bird's (1982) laboratory investigations, there appears to be little field evidence.

Based on current thinking and some empirical evidence (Landers, 1980; Schmidt, 1982), the reasoning underlying the present study is that if the mental errors that occur during competition are representative of cognitive/attentional disruptions, then, both theoretically and intuitively, individuals who exhibit more mental errors should have higher cognitive anxiety than those who demonstrate fewer mental errors.

Cue Utilization

Discussions of the effects of emotional arousal on the breadth of attention are taking on an increasingly prominent role in accounts of the experiential and behavioral consequences of anxiety (Easterbrook, 1959; Wachtel, 1967; Wine, 1971). Easterbrook's (1959) basic theoretical formulation suggests that the effect of emotional arousal on attention, is to narrow and focus the attentional field by systematically reducing the

range of cue utilization. More specifically, it is proposed that responsiveness to peripheral or less relevant stimuli is diminished, while the responsiveness to central, immediately relevant or dominant cues is maintained, if not in fact enhanced.

Bacon's (1974) investigation supported Easterbrook's hypothesis that the effect of arousal/anxiety is to reduce the range of cue utilization, and in addition supported Wachtel's (1968) contention that emotional arousal decreases responsiveness to peripheral stimuli by overly narrowing the focus of attention and omitting task relevant cues that may lead to a decision-making error. Moreover, arousal/anxiety seems to have differential effects depending upon the degree of attention the stimuli attract; sensitivity loss systematically occurs to those cues which initially attract less attention. Further, Bacon (1974) found support for the notion that arousal/anxiety reduces: (1) the number of cues that a subject can handle at one time; (2) the capacity for dual activity; and (3) the capacity limitations within the short-term memory system.

Studies investigating the effects of arousal/anxiety on memory process (Bacon, 1974), did show reduced sensitivity to the auditory cue which suggests that arousal narrows the range of stimuli that are processed by impairing the memory traces of those signals which initially attract less attention. Arousal may exert its effect in this condition by both overloading the system—thereby exceeding the capacity limitations of short-term storage—and by interfering with the

attentional control processes (e.g., rehearsal), that aid in maintaining information in short-term memory.

Attentional Focus

Wine (1971), suggested that cognitive arousal/anxiety inhibits performance by disrupting attentional processes. Individuals become too concerned with possible failure and therefore, do not direct sufficient attention to the task at hand. A key element in Nideffer's (1980,1981) theory on attention, involves the relationship between attention and competitive arousal/anxiety. Three major changes in attention are proposed to occur as the level of arousal/anxiety increases. First, as arousal/anxiety increases, athletes becomes locked into their preferred attentional style. As a result athletes are unable to rapidly shift attentional focus from one type to another (e.g., from narrow-internal to broad-external or vice-versa) even when, as is the case in most sport situations, a more flexible attentional focus may be appropriate at the time.

The second modification in attention that occurs with an increase in the level of competitive arousal/anxiety, according to Nideffer (1980, 1981), is that one's attentional focus begins to narrow involuntarily. As a result, the amount of information from both internal and external sources that may be processed and evaluated is greatly reduced. Clearly, performance will suffer to the extent that this excluded information contains cues relevant to the task.

Nideffer (1980,1981) suggested the third, and perhaps most significant change in an individual's attentional focus under high levels of arousal/anxiety, is one's tendency to become more internally focused. Individuals attend to thoughts about their own and others' actions, as well as their somatic responses. Consequently, task relevant information from internal and external sources is missed.

One of the commonly reported effects of arousal/anxiety is its effect on the narrowing of the visual field. Studies have shown that the subject maintaining performance on a visually central or primarily important task is less able to respond to peripheral or secondary stimuli when under stress (Wachtel, 1968). Arousal/anxiety effects depend upon the degree of attention the stimuli attract with sensitivity loss systematically occurring to those cues which initially attract less attention (Bacon, 1974). For sport performance, the loss of peripheral sensitivity greatly handicaps performance of most sport skills by interfering with the ability of the visual system to process information. An athlete having low arousal/anxiety has a broad perceptual range and therefore accepts irrelevant cues uncritically which may lead to lower performance by committing errors of over-inclusion.

Nideffer (1980) suggests that a broad focus is useful in "open skills" that require the "individual to be aware of and able to respond to a complex, rapidly changing environment" (p. 232). By contrast, a narrower focus is useful in intricate, complex "closed skills," where only one stimulus (e.g., a ball or pins) is relevant. A relatively narrow focus is also needed in all-out endurance, strength, or speed activities

when accuracy is not of prime concern. The sports demanding narrower attentional focus can tolerate higher levels of arousal/anxiety since there are fewer task cues and therefore less chance of task-relevant cues being eliminated through the perceptual narrowing process.

It appears as if arousal/anxiety is associated with a narrowing of attention leading to the types of problems and mistakes that characterize athletes who make errors of under-inclusion (of task-relevant cues). The relationship between arousal/anxiety, attention and performance has rather far-reaching consequences for athletics. Psychologists have been emphasizing that increases in arousal/anxiety act to narrow attentional processes. If this narrowing is appropriate (e.g., few cues are needed), then arousal/anxiety can act to enhance performance. If, on the other hand, a broad focus is required, or if attention is directed to internal stimuli (thoughts and feelings) when it should be directed externally, performance will be impaired (Nideffer, 1989).

An individual's ability to shift attention and to meet the attentional demands of performance situations is affected by the level of arousal/anxiety (Nideffer, 1980). According to the Hullian Drive Theory (1943), the individual will rely more heavily on those skills or habits that are most highly developed. This suggests that individuals will become more dependent upon their preferred attentional style, whether this is the best (most appropriate) way to respond or not. Thus, the analytical athlete will become more analytical as pressure increases and errors will begin to occur if the performance situation requires a different type of attentional focus.

Furthermore, Nideffer (1980) argues that panic may set in if arousal/anxiety continues to rise and the noise in the system gets very high (e.g., heart rate and respiration rate are elevated), resulting in the individual to lose all control over attention. No longer able to rely on their attentional strength, individuals will be unable to filter out any irrelevant stimuli, or to stay focused. Their attention will be captured by the most demanding stimuli at the moment—their own heart rate, a negative thought, or a scream from the sidelines. At this point, the individual's body and/or the environment is controlling their mind, rather than their mind controlling their body or the environment.

Individuals who feel the pressure, yet continue to perform effectively, perhaps have more of the attentional abilities that a given performance situation requires, than individuals who feel the pressure and fail to perform. Although most of us have fairly well balanced attentional skills, there will be relative strengths and weaknesses, or attentional preferences. An individual's analytical skills (broad-internal), for example, may be a little closer to the trait end of the continuum than one's assessment skills (broad-external). It is this slight imbalance in skills that can make an individual's behavior under pressure (when arousal/anxiety increases) more predictable. The closer an attentional ability is to the trait end of the continuum, the greater the "habit strength" in Hull's (1959) terms. Under optimal conditions of arousal/anxiety, attentional skills are affected by situational factors (especially for the well balanced individual). Under increasing

arousal/anxiety, preferred attentional styles begin to dominate and take on trait characteristic (Nideffer, 1980).

Concentration is affected by arousal/anxiety, and conversely, arousal/anxiety is affected by concentration. We all develop conditioned emotional responses to a wide variety of stimuli and certain events act as triggers to activate somatic responses (e.g., increase the flow of adrenaline, increase muscle tension), and/or cognitive responses (e.g., generate a variety of negative thoughts or self-doubts). Similarly, there are other events and/or thoughts that act as triggers to calm us down, to get our attention back on the task at hand. Insight as to which conditions or factors lead to peak performance, is the challenge of sport psychology.

Cognitive Anxiety and Mental Errors in Sport

A phenomenon that holds intrigue for sport psychologists and athletes alike is the increase in mental errors during athletic contests as opposed to practice. The most commonly accepted explanation for those errors is the increase in arousal/anxiety that occurs as a result of the highly evaluative nature of the competitive setting as compared to practice conditions.

Mental concentration requires effort, sensitivity, and the ability to choose among alternate actions in executing a task while the subject is exposed to (external) environmental noise and inner disturbances (thoughts) (Posner, 1975). The mental processes during concentration activation rely on a selection mechanism which contributes to the

amount of energy invested in one or more sources of information. The ongoing process of concentration is also characterized by an alerting and sustaining mechanism. The first is related to expectations for the beginning of an activity, while the latter operates to maintain the activity at an appropriate arousal/anxiety state and attentional level (Davies, 1982).

The psychological function of human beings is commonly perceived as a limited information processing system which is unable to process all the data available in the environment. As a consequence of this limitation, primary importance is given to the attentional mechanisms which enable the awareness of relevant data for processing. A second limitation is the amount of time one can remain focused while exposed to external and internal noise. The ability of athletes to comprehend relevant information while avoiding irrelevant cues, as well as to concentrate during competition, are of primary importance for a successful performance. Mental preparation, so common nowadays, is aimed at enhancing these traits under high anxiety/arousal states with disturbing internal and external environments.

Mental concentration of a subject is task-dependent. Boring tasks which involve routine and repetitious activity negatively affect motivation and have a less than desirable effect on performance concentration. The number of errors performed in tasks like these may therefore be used as estimators for sustaining concentration. Most (1982) has maintained that high-ability subjects whose thinking diverges during a boring activity perform with more errors than others.

Process versus Outcome Research

The first problem encountered in the literature on process and outcome research stems from the use of a restricted conception of the term performance. In Martens' (1971) review, performance is defined as "goal centered, purposeful, observable behavior of a relatively short duration" (p. 153). When so viewed, performance is task oriented with little carry over from task to task. Such performance measures are specific to the situation and do not reflect individual behavioral differences. The major criterion for measuring motor behavior is an assessment of the end product rather than the quality of the process (e.g. decision-making) behind the movement. However, it is the process leading to the movement that must be investigated, rather than merely the end product.

The majority of recent research (DeMoja & DeMoja, 1986; Gould et al., 1981; Highlen & Bennett, 1979) has focused on global sports performance (e.g., distinguish between win or loss) as the performance measure. While this form of performance measurement has yielded ecologically valid data, it appears too imprecise to facilitate a more comprehensive understanding of the relationship between stress and sports performance. The research strategy proposed by Jones and Hardy (1988) advocates investigating the effect of a single stressor (e.g., competitive state anxiety) upon a subcomponent of performance (e.g., commission of mental errors).

Landers and Boutcher (1986) also proposed identifying important perceptual, decision and response components involved in specific sports

skills, particularly in the context of maximizing the ecological validity of findings. Such an approach would have important implications for intervention strategies in sport, specifically with respect to information processing strategies. In addition, according to Bird and Horn (1990), investigations should attempt to explore the cognitive arousal/anxiety-sport performance relationship by studying a cognitively based variable—decision-making as measured by mental error commission—and its association with the level of cognitive arousal/anxiety, rather than focus the investigation on an objective sport outcome.

Summary of the Literature Review

The understanding of anxiety may be attributed to sport psychologists using terms such as stress, arousal, worry, emotionality and anxiety interchangeably and without clear definition between the words and the concepts. Although similarities exist between the terms used to describe anxiety, there are subtle distinctions worth noting.

While stress is the non-specific response of the body to any demand made upon it, distress is considered to be the negative dimension of this condition—a condition more commonly known as anxiety. Arousal and anxiety have also been used synonymously, but anxiety differs from arousal in that it encompasses both some degree of activation and an unpleasant emotional state. Worry has often been substituted to describe the cognitive dimension of anxiety and may in fact lie at the root of anxiety. Emotionality is often substituted for the physiological or somatic dimension of anxiety and is manifested in

accelerated respiratory rate, heart rate, and palmar sweating. The most debilitating symptom of somatic anxiety is muscle tension—a condition which interferes with the smooth functioning of needed muscle groups, and contributes to early fatigue.

Cognitively, anxiety narrows the perceptual field and attentional focus, resulting in a diminished capacity to take in and process information. The intrusion of distracting and maladaptive thoughts and images results in focusing on all the things that may go wrong; how inadequate or incapable one is, how poorly one might do, and the consequences of possible substandard performances. Such thoughts destroy one's self-confidence, and become self-fulfilling prophecies.

Trait anxiety or A-trait is the predisposition to perceive most situations as being threatening and responding to these situations with elevated physiological intensity. When anxiety varies over time and reflects the degree of anxiety that a person experiences at a given moment, it is referred to as state anxiety or A-state. In a competitive setting, these conditions are known as competitive A-trait and A-state.

Competitive state anxiety is a reaction which is triggered by a particular stimulus that is sport situated, such as walking into a dressing room. High trait anxious individuals are more likely to experience higher levels of state anxiety.

The competitive process, which is generally accepted as being responsible for elevations in anxiety dimension, is comprised of an objective competitive situation, a subjective competitive situation, a response, and consequences of the response. For a situation to be

classified as competitive, a standard of evaluation, presence of an evaluator (audience) who is aware of the standard and a comparison of performance outcome against the standard must be present. However, regardless of the objective competitive situation, it is the particular person's unique cognitive appraisal of that situation which determines whether or not a pre-competitive anxiety response will occur. If the outcome of the cognitive appraisal is negative (e.g. perception of probable failure), a fight or flight response will result. In the event that avoidance may not be possible, a response will have to be executed, and this response is followed by an evaluation—generally measured and evaluated in light of a success or failure performance outcome. Evaluations of performance will impinge on future similar competitive situations and will be manifested in elevated or diminished levels of pre-competitive state anxiety. It is not difficult to understand then, why the empirical research has targeted anxiety as the phenomenon most responsible for performance success or failure, especially at the elite athlete level.

Understanding the optimal level of arousal/anxiety for each activity is only part of the information needed to make effective use of emotions in the execution of motor skills. Also needed is a means of determining the arousal/anxiety level of an individual or group at a particular time, and further, the ability to alter it. Changing arousal/anxiety state in the desired direction requires an understanding of some basic principles of psychology and skill in using certain techniques.

Ambiguities and inconsistencies concerning anxiety and performance may be partly due to the adoption of an oversimplified unidimensional conceptualization of anxiety. Recent research however, has addressed the issue of multidimensionality in competitive anxiety—first, the notion of traits and states which is widely accepted and is reflected in the extensive use of state-trait anxiety inventories, and second, the notion that competitive state anxiety is viewed as a multidimensional construct.

Investigations of the anxiety-performance relationship have been laboratory in nature, with artificial manipulations of anxiety and performance variables, and utilization of between-individuals and between-groups comparisons across a variety of unrelated activities. When results of this testing have been taken to field settings, little has been uncovered in terms of practical significance to sport behavior. Consequently, sport psychologists have emphasized the need for more relevant field research in order to better understand the complex social interaction inherent in sport competition, arguing that the richness of field settings is important when one is interested in increasing the potency of an independent variable (e.g. competitive state anxiety).

The most promising avenue of research has assumed that anxiety is situation-specific rather than a global trait that pervades all situations. Therefore, it is more productive to determine whether sport-relevant anxiety is consistent within sport contexts. The use of general anxiety measures has failed to find pre-competitive anxiety to be higher than pre-season anxiety or that more difficult conditions (games) induce

more anxiety. As a result, several sport-specific questionnaires have been developed for the purpose of measuring sport-specific trait anxiety (Sport Competition Anxiety Test (SCAT); Martens, 1977), state anxiety (Competitive State Anxiety Inventory (CSAI); Martens et al., 1980) and , more recently, multidimensional competitive state anxiety (Competitive State Anxiety Inventory-2 (CSAI-2); Martens et al., 1990).

A review of the literature indicates that while extensive research has focused on the relationship between anxiety and performance, relatively little has centered on the effects of anxiety on the performance process. Investigations of anxiety and its relationship to performance, have focused on objective outcome—success/failure as it relates to win/loss, score, or some other performance outcome criteria. Such information does not address the quality of movement or the effectiveness of the decision-making process, leaving a void which begs investigation.

Anxiety does not affect all individuals in the same way, and performance is not affected in the same way for every task. Each individual has different levels of tolerance for arousal as well as different levels of anxiety going into a task. Therefore, the optimal level of anxiety for each individual is different, and the amount of state anxiety which would produce optimal performance is dependent on the nature of the task. Complex tasks and tasks requiring fine motor coordination require a low level of anxiety to produce optimal performance, whereas simple tasks and gross motor skill tasks appear to require a higher level of anxiety.

Females are believed to generally exhibit higher levels of competitive trait anxiety than males, which suggests that females have a tendency to perceive competitive sport situations with greater feelings of fear and apprehension. Additionally, females are more concerned with evaluations of their performance, whereas males are more concerned with the outcome of a contest.

The anxiety-performance relationship has primarily failed to consider the between-person differences in degree of anxiety responsiveness, and often, each subject is not tested under all stress conditions. A score of 23 on the Competitive State Anxiety Inventory for example, may represent a peak state anxiety experience for one subject and a low response condition for a second subject. Therefore, an intermediate or optimal level of arousal as used in a test of the inverted-U hypothesis will consist of a different value for different people. When subjects are assigned to a single stress condition, it creates an inter-subject or between-subject analysis of the dependent variable, performance. This study has attempted to address the concerns posed by previous studies which have resulted in equivocal findings and has attempted to answer questions concerning the relationship between pre-competitive anxiety and sport performance as it relates to the quality of performance for each individual.

Whatever theory of arousal/anxiety-performance interactions ultimately prevails, it will have to incorporate elements that can explain why a little excitement in sport is not enough and a lot is too much. Perhaps the greatest difficulty in the entire area associated with motor

behavior and athletic participation is matching ideal arousal/anxiety and the onset of the competition.

CHAPTER III

Research Design and Methodology

Introduction

This chapter describes the methodology utilized in the study as well as the research design employed. Operational definitions of the dependent variables, independent variables, and categorical variables are presented, and the seven primary null hypotheses are stated. A description of the subject population is discussed. After the statistical treatment of the data is outlined, the chapter concludes with a delineation of methodological assumptions and limitations identified in the research project.

The Research Design

The research design used in the study are two: an applied behavior analysis design dealing with a within-subject study or intrasubject comparison and a between-group or comparative group study. This study compared group means by applying inferential statistics to the data of the dependent variables (level of anxiety, and commission of mental errors). Concurrently, the study also explored an

individual's behavior under three different conditions and six time periods.

The applied behavior analysis design is based on reinforcement theory which posits that "specific environmental events maintain or change (reinforce) the behavior of an individual" (Huck et. al., 1974, p. 330), and allow a researcher to study a behavior of an individual subject or small group of subjects over successive observations. The applied behavior analysis research design has been used to solve many applied problems in a variety of natural settings (Kerlinger, 1973), and researchers using this design believe that: (1) the behavior of two individuals often differs in the way they respond to the same environmental event, and (2) this type of research benefits subjects of study in their natural setting.

The design sometimes referred to as a between-group or intersubject comparison or comparative group study makes comparisons of the dependent variable between two or more groups of subjects. Between-group designs always compare group means or medians by applying inferential statistics to the data of the dependent variable—a statistical technique not always applied to the data of applied behavior analysis designs.

Subject Population

The population of university basketball players in the province of Saskatchewan (Canada) were the subjects of the research. The subject population consisted of male and female elite athletes making up the

men's and women's basketball teams at the University of Saskatchewan (Saskatoon, Saskatchewan), and the University of Regina (Regina, Saskatchewan). Athletes in the subject population included first year, sophomores, juniors, fourth-year seniors, and fifth-year seniors, ranging in age from 18 to 24 years. The ethnic composition of subjects consisted of 55 "Anglo" or caucasian players and one black male player who was born in Saskatoon.

The entire population of university basketball players ($N = 56$) in the province of Saskatchewan were included in the study, but due to league regulations, visiting teams are only allowed to dress 10 players, while home teams can dress 12 players. This restriction in limiting roster size for competition resulted in 46 players being tested and evaluated on a consistent basis.

Athletes who make up the elite university men's and women's basketball teams have primarily come from similar programs, as 90% of the teams' composition come from the two major cities within the province. Elementary school, junior high school, and senior high school basketball programs are coached by individuals who are hired as teachers and coach on a voluntary extra-curricular basis. As such, each individual who coaches is required to have national coaching certification credentials which include levels based on theoretical and practical components. Leagues are governed by a committee of representatives from each of the schools who are ultimately responsible to the administration of the schools and the educational system within each city. Consequently, teams are coached by individuals who possess

similar professional development for coaching, operate within strict guidelines and adhere to similar professional conduct if not similar philosophical orientation. Players who come to the university program from sound educational coaching approaches, have a consistent orientation with respect to their approach to competition.

Dependent Variables, Independent Variables, and Categorical Variables

Two dependent and two independent variables were identified for study in the research project. Further, eleven categorical variables were identified to separate the various levels of dependent and independent variables.

Dependent variables.

The commission of mental errors and the dimensions of pre-competitive state anxiety served as the dependent variables for the research project. Mental errors for each participating player on the team were determined by the respective coaching staffs and were recorded on a Mental Error Questionnaire (MEQ) instrument. Pre-competitive state anxiety levels for each athlete were determined by utilizing the Competitive State Anxiety Inventory-2 (CSAI-2) (Martens et al., 1983).

Independent variables.

In accordance with the purpose of the investigation, a classifying variable as well as a manipulated variable was utilized to gather data.

Sex or gender acted as the independent classifying variable, while the level of competition served as the manipulated variable.

Categorical variables.

1. Level of Competition: Three levels of competition were identified: practice, exhibition game, and league game. Practice level was determined to be sometime after the first week of practices—when the team had been selected and the starting roster had been established—in order to reduce the anxiety surrounding the competition for a position on the team or for a position on the starting unit. In addition, practice session testing avoided the week in which a game was to be played, as it was felt that the pending game would produce anxiety conditions not normally related to the practice environment.

Exhibition game data was collected after the initial "official" exhibition game had been played. It was felt that the novelty of a "first game" would produce anxiety responses not characteristic of "typical" exhibition games.

League games comprised the third level of competition. An attempt was made to include successive game testing between the same opponents, as well as testing on "home-and-away" successive games.

2. Gender: Testing occurred prior to practice sessions, exhibition games and league games for the men's and women's teams.

3. Mental Errors: Respective team coaching staffs were asked to rate each participating player on the level of mental error commission

after each testing session. The levels identified were: low, medium and high.

4. State Anxiety: Athletes (team members) were asked to complete a self-report inventory prior to each competition. Three dimensions of state anxiety were measured: cognitive (psychological-negative), somatic (physiological), and self-confidence (psychological-positive).

5. Teams: The men's and the women's teams from both of the universities in the Province of Saskatchewan—the University of Saskatchewan and the University of Regina—took part in the study, thus yielding data on a population, not a sample. In total, four teams took part in the study.

The Null Hypotheses

The following null hypotheses were introduced in Chapter 1. A confidence level of $\alpha = .05$ was used in all tests for statistical significance:

Hypothesis 1: There is no correlation between an athlete's trait anxiety as measured by the SCAT and each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2.

Hypothesis 2: There is no significant difference between the levels of gender (male and female) with respect to each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2.

Hypothesis 3: There is no significant difference between the levels of gender (male and female) and the perceived commission of mental errors as measured by the MEQ.

Hypothesis 4: There is no significant difference between the dimensions of pre-competitive state anxiety (cognitive, somatic and self-confidence) as measured by the CSAI-2 and the commission of mental errors as measured by the MEQ.

Hypothesis 5: There is no significant difference between the levels of competition (practice, exhibition game, and league game) with respect to each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2.

Hypothesis 6: There is no significant difference between the levels of competition (practice, exhibition game and league game) with respect to the perceived commission of mental errors as measured by the MEQ.

Hypothesis 7: There is no significant predictive value between the independent variables (pre-competitive state anxiety dimensions: cognitive, somatic and self-confidence) and the criterion variable (mental errors) with respect to the two levels of competition (two exhibition games and three league games).

In addition to the seven primary null hypotheses to be tested via one-way ANOVAs, two secondary null hypotheses were written to test

for the existence of statistically significant interaction effects via two-way ANOVAs between combinations of the categorical variables:

Hypothesis 1: There is no significant interaction effect between the levels of competition (exhibition game, and league game) and the levels of gender (male and female) with respect to the perceived commission of mental errors.

Hypothesis 2: There is no significant interaction effect between the levels of competition (practice, exhibition game, and league game) and the levels of gender (male and female) with respect to the dimensions of pre-competitive state anxiety (cognitive, somatic and self-confidence).

Instrumentation

Assessment instruments used in this study consisted of the Sport Competition Anxiety Test (SCAT), the Competitive State Anxiety Inventory-2 (CSAI-2), and a Mental Error Questionnaire (MEQ). The SCAT was used to determine the level of trait anxiety, while the CSAI-2 was used to assess the different levels of competitive state anxiety. Due to the multidimensionality of the state anxiety inventory (CSAI-2), cognitive and somatic anxiety as well as precompetitive levels of self-confidence were assessed. Based on the data obtained by its developers, the SCAT was found to have a mean test-retest reliability of .77, while the CSAI-2 was reputed to have acceptable internal reliability (.79 to .90). Both instruments were also reported to have sufficient construct validity.

The Mental Error Questionnaire (MEQ) was developed by the experimenter in consultation with the coaching staffs whose teams participated in the study. The MEQ, which consisted of a 10-point bipolar scale ranging from very much affected (e.g., 7-10—many mental errors) to very little affected (e.g., 1-4—few mental errors), enabled the coaches to quantify the relative number of mental errors (e.g., violations, inappropriate passes, offensive and defensive position breakdowns etc.) committed by each of their team's players during competition. Coaches were informed that mental errors could be defined as the degree to which players' performances were adversely affected during a particular game as compared with their usual performance during practice.

Methodology

The researcher conducted preliminary information sessions, and administered paper-and-pencil questionnaires for each of the testing sessions at an appropriate site determined by each team. Exit interviews were conducted at the counselling office of the researcher, and/or at an appropriate site determined by each team.

Initial permission to conduct this study was obtained from the respective head coaches of the teams involved. Informed consent forms, the Sport Competition Anxiety Test, (SCAT; Martens, 1977) and the Competitive State Anxiety Inventory-2 (CSAI-2; Martens et. al., 1983) were completed by participants prior to a December, 1992 practice session under the administration of the researcher. Subsequent

administrations of CSAI-2 were conducted by the researcher prior to: two exhibition games in December, 1992; and three league games in January, 1993. The Mental Error Questionnaire was completed by the respective coaching staffs of the teams involved in the study after each exhibition game and league game in which the participants completed the CSAI-2 questionnaires. In total, each subject's pre-competitive state anxiety was measured six times during the course of the study using the CSAI-2 questionnaire. In addition, each subject was evaluated five times during the course of the study on mental error commission during competition.

The SCAT (Martens, 1977) was completed by all members of the respective teams prior to the initial administration of the CSAI-2. According to Martens (1990), recent research with the CSAI-2 revealed that anti-social desirability instructions are very beneficial in reducing response bias to that scale. Consequently, the anti-social desirability instructions devised for the CSAI-2 and modified for the SCAT were read to the subjects prior to administration of the SCAT. The instructions are found in appendix C.

The CSAI-2 was administered between 30 and 45 minutes prior to the practice session, and each of the exhibition games and league games. At the beginning of each CSAI-2 administration, the following anti-social desirability instructions were read to the entire group. The instructions for the CSAI-2 may be found in appendix E.

Immediately after the practice sessions, exhibition games and league games the respective team coaches completed the Mental Error

Questionnaire. The data were entered into the Statview SE + Graphics microcomputer statistics program and numerical values were generated.

Statistical Analysis of Data

This study explored the questions previously presented (see Chapter I pp. 11-12), and tested the hypotheses (see Chapter I pp. 11-14). Analysis consisted of four parts. Part A explored: (1) the main effects between gender and anxiety, and (2) the main effects between the level of competition and anxiety. In addition, part A attempted to determine if there is an interaction effect between the level of competition and gender with respect to the level of anxiety (questions 3 and 5).

Part B explored: (1) the main effects between gender and the commission of mental errors, and (2) the main effects between the level of competition and the commission of mental errors. In addition, part B attempted to determine if there is an interaction effect between the level of competition and gender with respect to the commission of mental errors (questions 4, 6 and 7).

Part C explored the relationship between pre-competition anxiety and mental errors, and attempted to determine if there is a relationship between the different forms of anxiety and the commission of mental errors (question 2).

Part D attempted to find out which of the anxiety dimensions (cognitive, somatic, and self-confidence) contributes most to the commission of mental errors (question 8).

The data was entered into the Statview SE + Graphics 1.04 computer software program for analyses to determine descriptive statistical summaries for the areas of interest in this study. A confidence level of .05 was used in all tests of significance. Alpha levels or confidence levels of .05 and .01 are commonly used in social science research. As the present research attempted to determine whether certain factors such as gender or level of competition have an impact on the dimensions of pre-competitive anxiety and the commission of mental errors during basketball performance, an alpha level of .05 is liberal enough to permit consideration of results that may be important. Simultaneously, a .05 level of significance is conservative enough to eliminate factors that have little impact on the questions investigated. Parts A and B of this study were analyzed by two-way analysis of variance (ANOVA) to examine the two main effects of level of competition and gender and the nature of any interaction effects between the levels of competition and gender on anxiety and the commission of mental errors respectively. A Scheffé post hoc analysis was used following a significant main effect to determine which of the levels of competition are significantly different. Following a significant interaction, a graph was produced to determine the nature of the interaction. A correlation matrix was computed to determine the strength of the relationship between the different components of anxiety and the commission of mental errors. Finally, a multiple regression analysis was used to determine: (1) whether the different components of anxiety contributed to the commission of mental errors; and (2) which

of the anxiety dimensions (cognitive, somatic, and self-confidence) had the greatest impact on the commission of mental errors.

Methodological Assumptions of the Study

Assumptions which were made during the research effort included the following:

1. The researcher assumed that the subjects used in this investigation, and the coaches who provide leadership for each team, would view the study as a meaningful effort to provide information that would improve the quality of their athletic endeavors, and thus commit total concentration to the task of identifying their cognitive, somatic and self-confidence states at the time of each testing.
2. The researcher assumed that all participants would respond to the questionnaires with integrity, without bias, and to the best of their ability, thus yielding valid and reliable information which could be applied to test the hypotheses.
3. The researcher assumed the validity and reliability of the survey instruments (SCAT, and CSAI-2) as posited by the originators (Martens, 1977; Martens et. al., 1990). Further, the researcher assumed that the MEQ developed by the researcher (in collaboration with the participating coaches) would accurately reflect the mental errors committed by players during competition. The researcher further assumed that the coaches would be able to accurately perceive the

mental errors committed by each of their players during competition.

4. The researcher assumed the underlying theory on anxiety as expressed by acknowledged authorities such as Freud (1936) and Spielberger (1966), and the subsequent research conducted by renowned sport psychologists (Borkovec, 1978; Martens et al., 1990; and Oxendine, 1970) to be valid with respect to the relationship between anxiety and sport performance.
5. The researcher assumed that prior research conducted by a number of sport scientists (Borkovec, 1976; Klavora, 1977; Landers, 1982; Martens et al., 1990; Sonstroem & Bernardo, 1970) was valid and that the previous research had been embodied into the current research effort in such a way that the integration of the materials has not altered or detracted from the intent and meaning of the original research.

Limitations of the Methodology

There are several methodological limitations of the study that have been identified, in addition to the ones already indicated in Chapter I.

1. Due to the fact that the University of Saskatchewan teams play in a different conference than the University of Regina teams, it was not possible to control for exact exhibition game and league game situations that would produce comparable anxiety states within the respondents. The parity, rivalry and

competitiveness of the Canada West Intercollegiate Athletic Association (the conference in which the University of Saskatchewan men's and women's teams participate) produced anxiety-provoking situations not found in the less competitive Great Plains Athletic Conference (the conference in which the men's and women's teams from the University of Regina participate).

2. The richness and in-depth responses generated through a qualitative approach to gathering information were not possible by the quantitative methods employed in this study. Follow-up and exit interviews with the respondents elicited information not readily quantifiable, yet providing the researcher insight with respect to the relationship between anxiety and performance was lost.
3. The coaching staffs of the teams varied with respect to age, experience and numerical size. In addition, the composition of the coaching staffs (e.g., dominant head coach and submissive assistant coaches versus easy-going head coach and self-confident experienced assistant coaches) perhaps resulted in a greater or lesser consensus evaluation of player evaluation.
4. Equipment, budgetary and personnel discrepancies among the four teams involved in the study determined the availability of triangulation possibilities. Some of the teams had the budget and the personnel to video-tape the practices, exhibition games and league games. A comparison of the coaching staff's

subjective assessment and a video analysis of the players' performance with respect to the commission of mental errors made by each player was not possible for all teams.

Summary

Chapter III has presented discussion of the research design, subject population, the variables used in the study, a description of the instruments, the protocol employed for the survey, the statistical treatment of the data, and methodological assumptions and limitations of the study. The results of the statistical analyses, and discussion and interpretation of the findings of the research follow in Chapter IV.

CHAPTER IV

Presentation and Interpretation of the Findings

Introduction

The data analyses and discussion of the findings of the research are presented in four sections in this chapter. The first section presents the demographic data accumulated through the responses of the players on each of the teams and descriptive statistical summaries for all six data collection sessions. The categorical variables used in the analyses and description of the subject population were also used to disaggregate the various levels of each categorical variable to understand better the make-up, range, and numbers of respondents in each of the groups of interest. The second section presents the comparative statistical analyses of the data and provides a discussion and interpretation for the two (dimensions of anxiety and mental errors) dependent variables under study based on the analyses derived from the seven primary hypotheses. The third section presents the data, discussion, and interpretation of the statistical analyses of the two secondary hypotheses presented in Chapter III. The fourth section summarizes the subjective analysis of the data to

determine intra-individual differences. The chapter concludes with a summary of the major themes and findings presented in the study.

The statistical analyses of the data involved 13 one-way ANOVAs to test each of the seven primary hypotheses discussed in Chapter III and 9 two-way ANOVAs to test each of the two secondary hypotheses also described in Chapter III. The statistical analyses performed on the data collected in the study produced a total of 22 ANOVA tables and subsequent post hoc analyses tables. As noted in Chapter III, a .05 level of significance was used in all tests of statistical significance.

Section 1: The Demographics of the Subject Population

Although the groups tested were not a representative sample of the entire population of Canadian University elite men's and women's basketball teams, they were representative of Saskatchewan University elite men's and women's basketball teams. The findings of this study, therefore, are generalizable to all university men's and women's basketball players in this province, but does not generalize beyond the provincial borders of Saskatchewan.

Frequency distributions based on the 56 usable subjects yielded the following disaggregation of data by team and by gender.

Table 1

Frequency Distribution by Team

Team	Count	Percent
U of R Men	14	25%
U of R Women	14	25%
U of S Men	13	23.2%
U of S Women	15	26.8%

Of the 56 subjects taking part in the research, 14 males (25%) and 14 females (25%) were from the University of Regina. The University of Saskatchewan contributed 13 males and 15 females for 23.2% and 26.8% of the subjects respectively. University teams in Saskatchewan traditionally carry 12 to 15 players on their rosters, thereby making the frequency distribution used in this study representative of a "normal" or usual team composition. At the same time, it is not unusual for women's teams in Saskatchewan to include a greater number of players on their rosters than the men's teams (see table 2).

Table 2

Frequency Distribution by Gender

Gender	Count	Percent
Male	27	48.2%
Female	29	51.8%

There were 27 males and 29 females engaged in the study—males accounted for 48.2% of the subjects of the study while females made up 51.8% of the subject population under investigation.

Table 3

Descriptive Statistical Summary for the Dimensions of Anxiety by Levels of Competition

Dimensions of Anxiety		Levels of Competition					
		Pr.	Ex.1	Ex.2	L.1	L.2	L.3
Cognitive Anxiety	M	18.22	20.39	19.96	19.34	19.83	19.39
	S.D.	5.15	5.59	5.86	5.39	5.34	5.79
Somatic Anxiety	M	15.26	18.27	18.44	16.96	16.95	16.89
	S.D.	4.79	5.45	5.80	4.89	4.77	4.98
Self- Confidence	M	25.02	23.08	23.63	24.64	24.38	24.31
	S.D.	5.31	4.72	5.82	4.68	4.74	4.79

The practice level of competition reflected the lowest cognitive anxiety (18.22) and somatic anxiety (15.26), while recording the highest levels of self-confidence (25.02) for all levels of competition. The first exhibition game had the highest cognitive anxiety score (20.39), the

second highest somatic anxiety score (18.27) and the lowest self-confidence score (23.08).

Standard deviations remained relatively constant throughout the six data collection sessions, with the greatest standard deviation reported prior to the second exhibition encounter. All three dimensions of pre-competitive state anxiety for exhibition game two recorded the highest variability, with cognitive anxiety indicating a standard deviation of 5.85, somatic anxiety reflecting a standard deviation of 5.80, and self-confidence showing a standard deviation of 5.82.

Table 4

Descriptive Statistical Summary for the Mental Errors by Levels of Competition

Mental Errors	Levels of Competition				
	Ex.1	Ex.2	L.1	L.2	L.3
M	2.38	2.43	2.46	2.52	2.43
S.D.	.98	1.08	1.13	1.14	1.14

Range of Scores: Minimum 1 to Maximum 4

As shown in Table 4, the means for mental errors committed during the five competition testing sessions indicates that the greatest errors committed by the subjects occurred during league game 2. Similarly, the highest standard deviation score was recorded during this competition, indicating a greater variability of scores for the subjects under investigation. The lowest errors per game were committed

during the exhibition games (2.38 for exhibition game 1 and 2.43 for exhibition game 2). Additionally, the lowest standard deviations were recorded for these same exhibition games (.98 and 1.08 respectively for exhibition game 1 and exhibition game 2) .

Table 5

Frequency Distribution for the Levels of Competition by Mental Errors

Levels of Competition	Levels of Mental Errors	Count	Percent
Exhibition 1	low	9	20.0%
	medium	28	62.2%
	high	8	17.8%
Exhibition 2	low	11	26.2%
	medium	24	57.1%
	high	7	16.7%
League 1	low	13	31.7%
	medium	19	46.3%
	high	9	22.0%
League 2	low	12	30.8%
	medium	20	51.3%
	high	7	17.9%
League 3	low	14	34.2%
	medium	19	46.3%
	high	8	19.5%

Frequency Distribution for the Levels of Competition by Mental Errors

Legend for Table 5: low = (1-4) mental errors
 medium = (5-6) mental errors
 high = (7-10) mental errors

Table 5 shows that the medium or average commission of mental errors was reflected in both actual numbers (range 19 to 28), and percentage (range 46.3% to 62.2%) of the subjects for all competitive testing sessions. During league games, however, there were fewer subjects in the medium or average range for committing mental errors (19, 20 and 19 subjects and 46.3, 51.3 and 46.3 percent respectively), resulting in higher numbers and percentages for both the low and high range for making mental errors.

League games indicated that there were more subjects in the low (1-4) mental error range than there were for exhibition games—league game three had the highest number of subjects (14 for 34.2%), followed closely by league game one with 13 subjects (31.7%), and league game two with 12 subjects (30.8%). League games also had a higher percentage of subjects in the high (7-10) mental error range when compared to the exhibition games.

Section 2: Comparative Statistical Analyses of the Data and Discussion and Interpretation Based on the Analyses Derived from the Seven Primary Hypotheses

The discussion of the findings for the seven primary hypotheses will be presented one hypothesis at a time to focus attention on the

variables that produced the correlations in Hypothesis 1 and the statistically significant differences between the levels of the independent variables in Hypotheses 2 through 7. Scheffé post hoc analyses techniques were used, following statistically significant ANOVAs to determine which levels of the categorical variables were responsible for the significant differences indicated by the ANOVAs.

Hypothesis 1: The first null hypothesis stated that there would be no correlation between an athlete's trait anxiety as measured by the SCAT and each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2 for each of the six sets of data collected. Table 7 shows the correlation coefficients between the SCAT and the dimensions of pre-competitive state anxiety for each of the competitive sessions during which data were collected.

Table 6

Correlation Coefficients Between SCAT and the Dimensions of Pre-Competitive State Anxiety for Six Competitive Sessions.

Dimensions of Anxiety	Levels of Competition	Correlation Coefficient	Coefficient of Determination
Cognitive Anxiety	Practice	.485	.235
	Exhibition 1	.597	.356
	Exhibition 2	.602	.362

Correlation Coefficients Between SCAT and the Dimensions of Pre-Competitive State Anxiety for Six Competitive Sessions.

Somatic Anxiety	League 1	.445	.198
	League 2	.456	.207
	League 3	.527	.277
	Practice	.462	.213
	Exhibition 1	.672	.451
	Exhibition 2	.602	.362
	League 1	.552	.304
	League 2	.504	.254
	League 3	.505	.255
Self-Confidence Anxiety	Practice	-.520	-.270
	Exhibition 1	-.490	-.240
	Exhibition 2	-.388	-.150
	League 1	-.362	-.131
	League 2	-.408	-.166
	League 3	-.416	-.173

Cursory observation of Table 1 indicates a low to moderate correlation between SCAT and the dimensions of anxiety for the levels of competition, with correlation coefficients ranging from $-.40$ to $+.67$. Little to low positive linear relationships are evident for the dimensions of cognitive and somatic anxiety, while only a little, if any, negative linear relationship exists between SCAT and state self-confidence.

Cognitive anxiety as outlined in Table 7 reflects a low positive correlation for the practice, league game one and league game two testing sessions, while recording a moderate positive correlation coefficient for exhibition game one, exhibition game two and league game three testing sessions. The highest correlation between SCAT and cognitive anxiety was found for exhibition game two, while the lowest positive correlation was reported prior to league game one.

The correlation between SCAT and somatic anxiety indicates a low positive to moderate positive relationship for all competitive testing sessions. As with cognitive anxiety, the highest correlation between SCAT and the somatic anxiety dimension occurred during both of the exhibition pre-competitive testing sessions (+.67 and +.60 respectively for exhibition games 1 and 2). As expected, however, the lowest positive correlation (+.46) occurred during the practice testing session.

Correlations between self-confidence and SCAT produced a low negative relationship. A negative relationship between self-confidence and SCAT is to be expected since cognitive anxiety (A-state) and state self-confidence are considered to represent the opposite ends of a cognitive evaluation continuum—state self-confidence being viewed as the absence of cognitive A-state, or conversely, cognitive A-state being the lack of state self-confidence (Bandura, 1977; Martens et al., 1990; Meichenbaum, 1977; Wine, 1971). The lowest correlation—moderate negative (-.36)—between SCAT and state self-confidence was recorded during the league game 1 testing session, while the highest relationship

was evidenced during the practice testing session (also moderate negative correlation, $-.52$).

The statistical evidence presented in Table 7, however, does not support rejection of primary null hypothesis 1. It is evident from the analysis of the data that SCAT has little to moderate predictive utility for any of the dimensions of pre-competitive state anxiety in this study. As such, these findings do not support Martens et al.'s (1990) contentions that SCAT is a reliable and valid predictor of pre-competitive state anxiety. Based on these findings, it would not be prudent for SCAT to be used to predict anxiety levels prior to competition for the athletes tested in this study. It would appear, therefore, that pre-competitive state anxiety cannot be easily or accurately predicted by using the short paper-and-pencil self-report inventory to determine the emotional, cognitive or physiological state of athletes.

Hypothesis 2: The second null hypothesis stated that there would be no significant difference between the levels of gender (male and female) with respect to each of the pre-competitive state anxiety dimensions (cognitive, somatic, and self-confidence) as measured by the CSAI-2 for each of the data collection sessions ($\alpha = .05$). Table 7 shows the mean pre-competitive state anxiety scores for males and females for all six testing sessions.

Table 7

Comparison of the Dimensions of Pre-Competitive State Anxiety by Gender for Each Level of Competition

Dimensions of Anxiety	Levels of Competition	Male Mean	Female Mean	p
Cognitive Anxiety	Practice	17.65	18.72	.446
	Exhibition 1	19.91	20.81	.581
	Exhibition 2	19.05	20.73	.326
	League 1	19.29	19.39	.949
	League 2	19.00	20.57	.359
	League 3	17.81	20.83	.084
Somatic Anxiety	Practice	13.85	16.52	.037*
	Exhibition 1	17.17	19.23	.191
	Exhibition 2	16.86	19.77	.084
	League 1	17.09	16.83	.857
	League 2	17.63	16.33	.396
	League 3	16.81	16.96	.923
Self Confidence	Practice	26.50	23.69	.049*
	Exhibition 1	24.48	21.85	.050
	Exhibition 2	25.14	22.35	.098
	League 1	25.91	23.48	.085
	League 2	25.37	23.48	.211
	League 3	25.62	23.30	.109

* p < .05

Table 7 reveals that for the dimension of cognitive anxiety, males exhibited a lower A-state than females for every testing situation, although none of the ANOVAs produced a significant difference between males and females. League game three was the only competitive testing situation which came close to indicating a significant difference for the cognitive anxiety variables between males and females.

The somatic anxiety dimension, although reflecting closer means between the levels of gender, only produced one significant difference which occurred during testing prior to the practice session, $F(1,53) = 4.545$, $p < .05$. Indicators of somatic anxiety (increased heart rate, muscle tension, shallow breathing, and clammy hands) were reported by the females prior to the practice, while the males reported significantly fewer symptoms ($p < .05$) associated with somatic anxiety. During league game 1 and league game 2, however, a comparison of the means indicated a reversal condition, with females exhibiting a lower—although not significant—somatic anxiety mean than males. Interestingly, the females also reported having higher somatic symptoms prior to a practice session (16.52), than for league game 2 (16.33).

A higher score is desirable for the dimension of state self-confidence since cognitive anxiety and state self-confidence are considered to represent opposite ends of a cognitive evaluation continuum. Similarly, it would be expected that state self-confidence and somatic anxiety would exhibit polarity, since a self-confidence state is more likely to exist in the absence of worry, stress, and tension;

conditions which are reported to elevate somatic anxiety (Borkum, 1964; Martens, 1987; Martens et al., 1990). In all cases—males and females—the state self-confidence scores were higher than either the cognitive anxiety scores or the somatic anxiety scores, indicating that although the subjects may have had psychological or physiological symptoms prior to competition, they still felt confident about their ability to perform. Additionally, in every testing situation, the male state self-confidence scores were higher than the female scores for the same anxiety dimension. Two testing situations, practice $F(1,53) = 4.051$ $p < .05$, and exhibition game 1 $F(1,53) = 4.034$ $p < .05$, produced statistically significant differences in the state self-confidence between the male and female subjects. Exhibition game 2 and league game 1 produced findings that only approached statistical significance.

Mean scores for all levels of competition show that the males perceive themselves as having a higher level of self-confidence prior to competition than do the females. This observation is substantiated by the females having higher cognitive state anxiety scores for all competitive conditions than males, and furthermore, in all but two conditions (league games 1 and 2) the females having higher somatic state anxiety scores than males.

Table 8

Comparison of Male and Female Dimensions of Pre-Competitive State Anxiety for All Competitive Testing Sessions Combined

Gender		Dimensions of Anxiety		
		Cognitive	Somatic	Self-Confidence
Males	Mean	18.758	16.462	25.523
	S.D.	4.811	4.444	4.485
Females	Mean	20.135	17.655	23.007
	S.D.	6.018	5.767	5.240
	p	.0367*	.0556	.0001*

* $p < .05$

Table 8 shows the results of the one-way ANOVA by gender for all six competitive conditions aggregated into one level of competition. The analysis of variance revealed that for cognitive anxiety, females reported greater worry ($M = 20.135$) than males ($M = 18.758$), and also indicated greater variability ($S.D. = 6.018$) than male subjects ($S.D. = 4.811$). Females self-report of having more negative thoughts and greater apprehensions prior to competition was significant when the results of all testing conditions were combined: $F(1,278) = 4.405$, $p < .05$.

Females also reported feeling more physiological (somatic) symptoms ($M = 17.655$) than males ($M = 16.462$) prior to competitive situations, and as well, indicated a greater variability in reported scores

(S.D. = 5.767) than the male subjects (S.D. = 4.444). The results of the comparisons between the reported somatic anxiety scores of females and those of males, although only approaching significance ($p = .0556$), provides some evidence that females in this study have greater physiological feelings prior to competition than do their male counterparts.

The results in Table 8 show that males have more self-confidence ($M = 25.523$) going into a competitive situation than do the females in this study ($M = 23.007$). Furthermore, the male subjects reported less variability of scores for self-confidence ($M = 4.485$) than the female subjects ($M = 5.24$). Thus, the males as a group, expressed a similar level of self-confidence prior to competition, whereas the female subjects as a group expressed a dissimilar level of self-confidence—some females reported a very high level of self-confidence while others indicated a very low level of self-confidence going into a competitive situation. It can be concluded from Table 8 that the male subjects had a significantly higher level of self-confidence, $F(1,278) = 18.403$, $p < .05$, than the female subjects.

The findings reported in Table 7 and Table 8 are not surprising, since the empirical evidence on state anxiety with respect to gender supports the findings reported in this study (Jones & Cale, 1989; Martens et al., 1990): females have higher levels of cognitive and somatic state anxiety and lower levels of self-confidence. According to Gill (1984), gender differences in expectations of success may be an important factor in determining competitive state anxiety, and

therefore, may contribute to a lower (than male counterparts) expectation of success and level of self-confidence.

Jones and Cale (1989) reported that for females, cognitive anxiety increased as the competitive situation drew near, and was higher than in the males (similar to somatic anxiety) immediately before the competition. Research reported on gender differences for the dimensions of state anxiety by Martens et al. (1990), found that cognitive and somatic state anxiety were significantly higher ($\alpha = .01$) in females than in males for individual or team competitions as well as for subjectively (e.g., gymnastics) or objectively (e.g., basketball) scored sports.

Males and females did not differ significantly ($\alpha = .05$) in their reported levels of state anxiety for each specific competitive situation (see Table 7). However, when the data were aggregated into one level of competition, significant differences ($\alpha = .05$) were evident for cognitive anxiety and self-confidence (see Table 8). Therefore, on the basis of the evidence provided in Table 7 and Table 8, the null hypothesis was rejected for each pre-competitive state anxiety dimension (cognitive, somatic and self-confidence) tested.

Hypothesis 3: The third null hypothesis stated that there would be no significant difference between the levels of gender (male and female) and the perceived commission of mental errors as measured by the MEQ. Table 9 shows the comparison of the mental errors committed by males and females for the five different levels of competition (note:

Mental Errors data were not collected for the practice session).

Table 9

Comparison of the Commission of Mental Errors by Gender for Each Level of Competition

Gender	Levels of Competition				
	Ex. 1	Ex. 2	L.1	L. 2	L. 3
Males					
Mean	2.048	2.000	2.000	1.895	1.842
S.D.	.590	.725	.707	.658	.834
Females					
Mean	1.917	1.818	1.800	1.850	1.864
S.D.	.654	.588	.768	.745	.640
p	.4868	.3759	.3906	.8439	.9260

ANOVAs by gender (male and female) on commission of mental errors shows that there are no significant differences ($\alpha = .05$) for each of the five competitive situations analyzed. In fact, none of the competitive situations even approaches significance, as both males and females committed nearly the same number of errors for each condition—a finding that is supported by the results presented in Table 10 and Table 11.

Examination of the statistical findings shows that the highest means for the commission of mental errors occurred during the exhibition game 1 testing session for both males and females (2.048 and

1.917 respectively). Surprisingly, the lowest means representing the commission of mental errors occurred during league play (1.842 for males during league game two, and 1.800 for females during league game one).

Tables 10 and 11 present the ANOVA source tables and statistical summary comparing male and female mental error commission for all testing situations aggregated into one level of competition.

Table 10

ANOVA Source Table for the Commission of Mental Errors by Gender

Source	DF	Sum Squares	Mean Square	F-test
Between groups	1	.607	.607	1.31
Within groups	206	95.470	.463	p = .2537
Total	207	96.007		

Tabel 11

Descriptive Summary of Commission of Mental Errors Data by Gender

Group	Count	Mean	Std. Dev.	Std. Error
Male	100	1.960	.695	.070
Female	108	1.852	.667	.064

Table 10 shows that there is no significant difference between the male and female subjects with respect to committing mental errors during competition. The mean for the males ($M = 1.960$) is similar to the mean for the females ($M = 1.852$), and there is very little difference in the variability of scores when the standard deviations for each gender are compared (e.g., males = .695 and females = .667). These findings contradict the notions held by some sport psychologist researchers (e.g., Bird & Horn, 1990; Davies, 1982; and Posner, 1975) who have argued that mental errors increase during athletic contests over practice conditions. This is due mainly to the concentration ability—the amount of time one can remain focused while exposed to external (environmental) and internal (thoughts) noise—of an individual on task-relevant cues. Practice conditions typically have a less busy environment than competitive events (e.g., officials, spectators, scoreclock, etc.), allowing participants to focus on cues (external and internal) that will help them to perform with fewer mental errors (Bird & Horn, 1990). Since it was determined that females have higher levels of cognitive and somatic state anxiety, and lower levels of self-confidence than males (see Table 7 and Table 8), it would follow that females would be more susceptible than males to devoting their attention to thoughts and feelings not relevant to making decisions needed to reduce mental errors. However, the female subjects in this study were not reported to have committed a greater number of mental errors than their male counterparts, regardless of the level of competition. Therefore, based on the evidence generated from the

analysis of the data and presented in Table 9, Table 10 and Table 11, the null hypothesis cannot be rejected.

Hypthosis 4: The fourth null hypothesis stated that there will be no significant difference between the dimensions of pre-competitive state anxiety (cognitive, somatic, and self-confidence) as measured by the CSAI-2 and the commission of mental errors as measured by the MEQ. The means and standard deviations for the CSAI-2 scores for each of the levels of mental error commission are given in Table 15. One-way ANOVAs were computed for each of the the three CSAI-2 subscales to assess changes in A-state (cognitive and somatic) and self-confidence with the levels of mental error commission (see Table 12, Table 13, and Table 14). Two of the dimensions were significant: CSAI-2 cognitive, $F(2, 205) = 3.85$, $p < .05$; and CSAI-2 somatic, $F(2, 205) = 4.31$, $p < .05$. No significant differences were found for state self-confidence.

Table 12

ANOVA Source Table for the Cognitive Dimension of Anxiety by Levels of Mental Error Commission

Source	DF	Sum Squares	Mean Square	F-test
Between groups	2	232.102	116.051	3.85
Within groups	205	6179.316	30.143	$p = .0228^*$
Total	207	6411.418		

* $p < .05$

Table 13

ANOVA Source Table for the Somatic Dimension of Anxiety by Levels of Mental Error Commission

Source	DF	Sum Squares	Mean Square	F-test
Between groups	2	218.396	109.198	4.31
Within groups	205	5193.681	25.335	p = .0147*
Total	207	5412.077		

*p < .05

Table 14

ANOVA Source Table for the Self-Confidence Dimension of Anxiety by Levels of Mental Error Commission

Source	DF	Sum Squares	Mean Square	F-test
Between groups	2	31.294	15.647	.625
Within groups	205	5130.317	25.026	p = .5362
Total	207	5161.611		

Scheffé post hoc comparisons indicated that for cognitive anxiety, the low and medium mental error rate groups were significantly different from the high mental error rate group, but the low mental error rate group was not significantly different from the medium mental error rate group.

Table 15

Descriptive Summary of the Dimensions of Anxiety by Levels of Mental Error Commission

Mental Errors	Cognitive Anxiety		Somatic Anxiety		Self-Confidence	
	M	SD	M	SD	M	SD
Low	20.322	5.428	19.017	5.628	23.966	5.327
Medium	20.109	5.811	16.864	4.788	23.627	4.908
High	17.487	4.559	16.487	4.751	24.667	4.754

For somatic anxiety, the low mental error rate group was significantly different from the medium mental error rate group, but was not significantly different from the high mental error rate group. Similarly, the medium mental error rate group was not significantly different from the high mental error rate group.

Contrary to the findings of other researchers (Martens et al., 1990; Morris, Davis & Hutching's, 1981), lower pre-competitive cognitive state anxiety did not result in the subjects of this study committing fewer mental errors during competition. Both low and medium mental error rate groups had higher means ($M = 20.322$ and $M = 20.109$ respectively) than the high mental error rate group ($M = 17.487$). It was also found that pre-competitive somatic state anxiety was highest for the low mental error rate group ($M = 19.017$), and lowest for the medium and high mental error rate groups ($M = 16.864$ and $M = 16.487$ respectively).

Subjects who reported being most worried about the impending competition were actually reported to make average or fewer number of mental errors during competition. Similarly, the subjects who reported heightened physiological (somatic) symptoms prior to competition also were reported to commit the fewest mental errors during the competition. Such findings do not support the postulations of Anshell (1990), Iso-Ahola and Hadfield (1986), Landers (1980), and Weinberg (1989) who argued that heightened A-state served to direct attention away from task-relevant cues and in so doing impacted on the ability to process information and make decisions.

Based on the statistical analysis applied to the data, null hypothesis 4 (with respect to cognitive and somatic anxiety dimensions) can be rejected. However, null hypothesis 4, for state self-confidence and its impact on the commission of mental errors, cannot be rejected.

Hypothesis 5: The fifth null hypothesis stated that there would be no significant difference between the levels of competition (practice, exhibition game, and league game) with respect to each of the pre-competitive state anxiety dimensions (cognitive, somatic and self-confidence) as measured by the CSAI-2. Table 16 illustrates the results generated by the one-way ANOVA which was computed to test hypothesis 5.

Table 16

Comparison of Dimensions of Anxiety by Levels of Competition

Levels of Anxiety	Levels of Competition	Mean	Standard Deviation	p
Cognitive Anxiety	Practice	18.218	5.145	.1094
	Exhibition	20.175	5.697	
	League	19.508	5.476	
Somatic Anxiety	Practice	15.255	4.789	.0016*
	Exhibition	18.351	5.601	
	League	16.930	4.846	
Self Confidence	Practice	25.018	5.314	.1014
	Exhibition	23.351	5.272	
	League	24.477	4.699	

* p < .05

The six testing sessions were aggregated into three levels of competition (practice, exhibition game, and league game). As Table 16 indicates, cognitive anxiety generated no statistically significant difference between the levels of competition ($\alpha = .05$). Moreover, all three levels of competition produced means for cognitive anxiety that were close to one-another in numerical value. Additional support for the similarities between the competitive levels and cognitive anxiety is

provided by the closeness of the standard deviations (range of 5.145 to 5.697), with the largest discrepancy between the standard deviation figures occurring between the practice (S.D. = 5.145) and the exhibition (S.D. = 5.697) levels of competition.

A difference, which was significant at $\alpha = .05$, was produced with respect to the level of competition on somatic anxiety; the mean ranged from 15.255 to 18.351. The only significant findings occurred for somatic anxiety $F(2, 277) = 6.562, p < .05$. Scheffé post hoc analysis indicated a significant difference between the practice and exhibition competition levels. It is also interesting to note that the somatic anxiety means for practice ($M = 15.255$) and league ($M = 16.93$) levels of competition did not differ as much as the means for the exhibition ($M = 18.351$) and league ($M = 16.93$) competition conditions.

State self-confidence revealed no significance with respect to the levels of competition. Consistent with the research (Martens et al., 1990), the practice condition produced the largest mean ($M = 25.018$). The most consistent trend was produced by the exhibition game level of competition, as both cognitive ($M = 20.175$) and somatic ($M = 18.351$) anxiety dimensions were greater for this level than for either practice or league game conditions. This same competitive level subsequently produced the lowest state of self-confidence mean ($M = 23.351$).

The ANOVA for somatic anxiety produced a statistically significant difference between the levels of competition. Therefore, the null hypothesis is rejected. The differences recorded between the levels of competition are believed to be a result of the anxiety produced

during each level of play and not by chance alone. No significant difference was found for cognitive anxiety or state self-confidence with respect to levels of play, and the small differences observed in the data are assumed to be produced by chance alone.

Hypothesis 6: The sixth null hypothesis stated that there would be no significant difference between the levels of competition (practice, exhibition game, and league game) with respect to the perceived commission of mental errors as measured by the MEQ. Table 17 shows the results of a one-way ANOVA of the differences between the levels of competition (exhibition and league only) and the commission of mental errors, specifically with respect to the probability of significance. Table 18 presents the results of the one-way ANOVA of the differences between the levels of competition (exhibition and league only) and the commission of mental errors with respect to the means and standard deviations.

Table 17

ANOVA Source Table for Comparison of Mental Errors by Level of Competition

Source	DF	Sum Squares	Mean Square	F-test
Between groups	1	.224	.224	.481
Within groups	206	95.853	.465	p = .4888
Total	207	96.077		

A one-way analysis of variance applied to the data did not reveal any significant differences between the levels of competition (which includes only exhibition and league levels due to the absence of mental errors data for the practice session). In fact, results presented in Table 17 show that the findings do not even approach significance for $\alpha = .05$ ($p = .4888$).

Table 18

Descriptive Statistical Summary of Commission of Mental Errors by Levels of Competition

Group	Count	Mean	Std. Dev.	Std. Error
Exhibition	87	1.943	.635	.068
League	121	1.876	.714	.065

It is interesting to note that the mean of the mental errors committed during the exhibition level of competition ($M = 1.943$) was greater than the mean of the mental errors committed during league games ($M = 1.876$). This is consistent with the findings presented in Table 10; both males and females were reported committing more mental errors during the exhibition game level of competition than the league game level of competition. Males committed a mean of 2.024 mental errors for exhibition games and a mean of 1.912 mental errors for league games. Similarly, females committed a mean of 1.867 mental errors for exhibition games and a mean of 1.838 mental errors for league games. The variability of scores was found to be greater for

league games (S.D. = .714) over exhibition games (S.D. = .635), indicating that for some subjects, the league game condition resulted in a higher commission of mental errors, while for others, league games resulted in making fewer mental errors.

Table 19 shows that, as in Table 10, there is no statistically significant difference between the levels of competition (as calculated for each of the five exhibition game and league game testing sessions). From the results of the one-way ANOVA, neither the male subjects nor the female subjects were reported to have their performances affected adversely by the level of competition (as determined by the commission of mental errors).

Table 19

ANOVA Source Table for Commission of Mental Errors by All Game Situations (Levels of Competition)

Source:	DF	Sum Squares	Mean Square	F-test
Between groups	4	.389	.097	.207
Within groups	203	95.688	.471	p = .9346
Total	207	96.077		

Table 20 indicates that the perceived commission of mental errors (as measured by the MEQ) declines steadily from the first exhibition game ($M = 1.978$) to the third league game ($M = 1.854$). Also, as indicated in Table 20, there appears to be little variability (standard deviation range between .621 to .735) in the scores for all testing

sessions, and would lead to the conclusion that performances (with respect to the commission of mental errors) remain consistent across the levels of competition and for the different conditions within each of the levels of competition.

Table 20

Descriptive Statistical Summary of Commission of Mental Errors by All Game Situations (Levels of Competition)

Group	Count	Mean	Std. Dev.	Std. Error
Exhibition 1	45	1.978	.621	.093
Exhibition 2	42	1.905	.656	.101
League 1	41	1.902	.735	.115
League 2	39	1.872	.695	.111
League 3	41	1.854	.727	.113

Mental errors are believed to occur as a result of divided attention (Bird & Cripe, 1986; Nideffer, 1980, 1981, 1989) which in turn is influenced by an increase in anxiety (Easerbrook, 1959; Kahneman, 1973). However, from the results presented in Table 17, Table 18, Table 19, and Table 20, such postulations are not supported. There is no evidence, based on statistical analysis of the data for exhibition game and league game sessions, to suggest that different levels of competition are significant in causing the subjects in this study to commit a significantly different number of mental errors.

The ANOVA for mental errors by aggregated levels of competition produced no statistically significant difference between exhibition and league levels of competition. Therefore, the null hypothesis is not rejected, as the differences observed in the data are assumed to be produced by chance alone. Similarly, the ANOVA for mental errors by all five game situations produced no statistically significant difference, and the differences observed in the data are also assumed to be produced by chance. Consequently, based on the results as indicated in the above tables, there is no evidence on which to reject the null hypothesis.

Hypothesis 7: The seventh null hypothesis stated that there would be no significant predictive value between the independent or predictor variables (pre-competitive state anxiety dimensions: cognitive, somatic, and self-confidence) and the criterion variable (mental errors) for the two levels of competition (two exhibition games and three league games). Table 21 shows the multiple regression analysis results for all subjects involved in the study for each of the five competitive conditions (exhibition and league), and the dimensions of pre-competitive state anxiety (cognitive, somatic, and self-confidence) versus the recorded mental errors (low, medium, and high).

Table 21

Multiple Regression Analysis of All Subjects for Each Game vs the Recoded MEO

Levels of Competition	Multiple Correlation	Beta Weights			p
		CA	SA	SC	
Exhibition 1	.375	-.010	-.252	-.373**	.0987
Exhibition 2	.282	.098	-.167	.201	.3621
League 1	.223	-.229	.097	.051	.5914
League 2	.472	-.501**	-.092	-.504**	.0302*
League 3	.364	-.024	-.290	.122	.1489

* Denotes significant multiple R ($p < .05$, $df = 3,41$)

** Denotes significant predictor variable ($p < .05$, $df = 3,41$)

When multiple regression analysis was conducted on the data for all subjects under all five competitive testing sessions, there was little in the way of predictive value for any of the dimensions of anxiety. For the exhibition game one competitive condition, R approached significance, but when the beta weights were analyzed for the dimensions of anxiety, only state self-confidence was found to be significant as a predictor variable ($-.373$, $p < .05$). From the results on Table 21, it would appear that for exhibition game 1, state self-confidence had a significant negative effect on the commission of mental errors—lower self-confidence is indicated to have contributed significantly to making more mental errors.

League game two produced a significant R ($.472$, $p < .05$), and when the beta weights were calculated for each of the dimensions of

anxiety, cognitive state anxiety and state self-confidence were determined to be significant predictor variables ($-.501$ and $-.504$, $p < .05$ respectively). Since cognitive anxiety and self-confidence are thought to occupy opposite ends of the same cognitive evaluation continuum (Bandura, 1977; Martens et al., 1990; Meichenbaum, 1977; Wine, 1971), it would follow that if one dimension was found to be a significant predictor, the other would be also—heightened cognitive anxiety would lead to decreased self-confidence and vice-versa. However, the results posted in Table 21 are equivocal with respect to the relationship described above. The significant predictor variable self-confidence does not appear with a significant predictor variable cognitive anxiety for the exhibition game one condition, but does appear as expected for the league game two testing session.

Table 22

Mutiple Regression Analysis of the MEO for Each Game for the Male Subjects

Levels of Competition	Multiple Correlation	Beta Weights			p
		CA	SA	SC	
Exhibition 1	.662	-.194	-.216	-.623**	.018*
Exhibition 2	.322	.120	-.239	.182	.6129
League 1	.364	.026	.330	-.060	.4782
League 2	.325	-.006	.048	-.320	.6306
League 3	.200	-.112	-.113	.048	.8896

* Denotes significant multiple R ($p < .05$, $df = 3,17$)

** Denotes significant predictor variable ($p < .05$, $df = 3,17$)

Results of the multiple regression analysis conducted for males (see Table 22) show that there is a significant R (.662, $p < .05$) only for the exhibition game 1 condition. As well, only state self-confidence is computed to be a significant predictor variable, with none of the other dimensions of anxiety for any of the competitive conditions approaching significance as predictor variables. The reported lack of self-confidence for males prior to exhibition game one may have been a significant indicator that males would commit more mental errors for that particular event. Such conclusions, however cannot be made as the results in Table 22 do not provide any further or consistent support.

Table 23

Multiple Regression Analysis of the MEO for Each Game for the Female Subjects

Levels of Competition	Multiple Correlation	Beta Weights			p
		CA	SA	SC	
Exhibition 1	.228	.070	-.143	-.225	.7775
Exhibition 2	.219	.044	-.029	.226	.8232
League 1	.509	-.486	-.006	.029	.1755
League 2	.726	-.846**	-.216	-.775**	.0064*
League 3	.548	.077	-.480	.208	.0855

* Denotes significant multiple R ($p < .05$, $df = 3,20$)

** Denotes significant predictor variable ($p < .05$, $df = 3,20$)

State self-confidence does not appear as a significant predictor variable for exhibition game one for females (see Table 23). Therefore,

it follows that the significance for the state self-confidence predictor variable shown in Table 22 may be attributed to the males.

Multiple regression analysis performed on the data for females indicates that league game two is the only competitive condition for which there is a significant R (.726, $p < .05$). In addition, there are two significant predictor variables indicated—cognitive state anxiety (-.846) and state self-confidence (-.775). Since these predictor variables did not reach a significant level ($\alpha = .05$) when computed for males only (see Table 22), it can be concluded that the significance for anxiety dimensions listed in Table 21 can be attributed to the female subjects only. The levels of cognitive anxiety and self-confidence reported by the female subjects for league game two could have been used to predict an increase in mental errors. However, since the league game two testing session was an isolated case, no trends which would aid in predicting mental errors can be determined.

On the basis of the results presented in Tables 20, 21, and 22 the null hypothesis cannot be rejected. Although there appears to be some support to reject the null hypothesis based on a significant R computed for league game two, none of the other competitive conditions appear to approach a significant R value. Significant beta weight values for exhibition game one and league game two (see Table 15) also provide evidence to reject the null hypothesis. State self-confidence as a predictor variable is due to the scores generated by the male subjects and does not hold for the females (see Tables 14 and 15). Conversely, the significance indicated for cognitive state anxiety and state self-

confidence of the independent variable (see Table 15) is due mainly to the scores reported for the females (see Table 17), and does not hold true for the males (see Table 16).

Section 3: Analyses and Discussion of the Two Secondary Hypotheses

Two secondary hypotheses were used to investigate the interaction effects between the levels of the independent or categorical variables. The presentation and interpretation of data and the discussion of results will focus on the two secondary hypotheses listed in Chapter III.

Hypothesis 1: Secondary hypothesis one stated that there would be no significant interaction effect between the levels of competition (practice, exhibition game, and league game) and the levels of gender (male and female) with respect to the dimensions of pre-competitive state anxiety (cognitive, somatic and self-confidence). The two-way ANOVAs generated only one significant interaction of the three variables examined, and the following figures illustrate the interaction effects determined through the calculation of the two-way ANOVAs. Appendix D lists the ANOVA tables and the incidence tables.

Figure 1. Secondary Hypothesis 1: Interaction effects between the aggregated levels of competition and gender for the dimensions of anxiety variable: cognitive anxiety.

Figure 1 depicts the results of the two-way (gender and levels of competition) analysis of variance on the cognitive state anxiety dimension. Cell means are plotted for gender for all three levels of competition. From the illustration in Figure 1, the females, although reporting higher levels of cognitive anxiety across all levels of competition, exhibit a parallel relationship to that of the males with respect to cognitive anxiety. Additionally, both male and female subjects reported being more worried (anxious) for the exhibition level of competition, than for either practice or league game conditions. Therefore, the data indicate that the level of competition had a similar effect on both males and females, and it can be determined with relative certainty that there is no interaction between the two independent variables.

When a second two-way analysis of variance is computed for the same independent variables with respect to somatic anxiety, and the cell means plotted, a parallel relationship is evident for the practice and

exhibition game competition levels. Somatic anxiety can be seen to increase for both the males and the females from the base level established at the practice testing session to the level recorded for the exhibition testing sessions. This elevated (above base level) somatic anxiety which is represented in Figure 2, is maintained for the males during the league conditions, but does not hold for the females. The females' somatic anxiety level decreases markedly (from a mean of 19.5 for the exhibition level of competition to a mean of 16.7 for the league level of competition), finishing below that of the mean for the males ($M = 17.1$). Therefore, the analysis of the data indicates that there is an interaction between the gender of subjects and the level of competition. Males report having greater physiological symptoms prior to exhibition game competition than they do for practice sessions, which would support the contentions of Martens et al. (1990), but do not report any distinction of somatic indicators for league game over exhibition game conditions. Females, however, are more physiologically aroused for exhibition games than for practice conditions, but less somatically aroused prior to league games than before exhibition games and practice sessions.

Figure 2. Secondary Hypothesis 1: Interaction effects between the aggregated levels of competition and gender for the dimensions of anxiety variable: somatic anxiety.

The results of the two-way ANOVA for the independent variables with respect to state self-confidence are presented in Figure 3, and are similar to the results for cognitive anxiety; that is, when the lines are connected to the cell means in the interaction plot, they appear to be nearly parallel (within sampling fluctuation). Both male and female subjects reported the highest levels of state self-confidence during the base or practice condition, declining during the exhibition conditions and then rising slightly for the league competition conditions. Males and females both report having less self-confidence during the exhibition level of competition than they do for either practice or league situations. As expected, the configuration of the graphs for cognitive anxiety and self-confidence appear as mirror images. Cognitive anxiety begins with the lowest score during the practice condition, rising to its highest position during the exhibition level and then declining somewhat for the league level. In contrast, self-confidence begins with the

highest scores reported during the practice session, then falling off to its lowest position during the exhibition level before showing a modest increase for league competition.

It can be concluded from the results of the two-way ANOVA (see Figure 3) that there is no interaction between the independent variables gender and levels of competition with respect to self-confidence. Of note, however, is that both male and female subjects report having less self-confidence for the exhibition level of competition than for the league level. Such findings are consistent when compared to the results shown in Figure 1.

Figure 3. Secondary Hypothesis 1: Interaction effects between the aggregated levels of competition and gender for the dimensions of anxiety variable: state self-confidence.

When a two-way analysis of variance is computed for the independent variables for each testing session, it is again evident that there is no interaction between gender and level of competition. The female subjects report generally having greater cognitive anxiety than males, and indicate that for competitive situations, their level of

cognitive anxiety remains constant. One exception (a decrease) can be seen for league game one (see Figure 4).

Figure 4. Secondary Hypothesis 1: Interaction effect between the levels of competition and gender for the dimensions of anxiety variable: cognitive anxiety.

Males also report having consistent levels of cognitive anxiety prior to competition. Figure 4 shows that primarily, males worry less than females for all competitive conditions—even for league game one, the reported male scores ($M = 19.28$) were lower than those reported for females ($M = 19.39$). Of note is the sharp decline in cognitive anxiety for the male mean ($M = 17.81$) for league game three; a decline which appears to be responsible for the lower male cognitive anxiety reported for league level of competition shown in Figure 1. Similarly, the decline in mental worry reported for females for league game 1 may be responsible for the slightly lower cognitive anxiety for league games also depicted in Figure 1. On the basis of the evidence provided by Figure 1 and Figure 4, the null hypothesis with respect to cognitive anxiety cannot be rejected.

Figure 5 indicates the parallel levels of somatic anxiety reported by both male and female subjects for practice and exhibition conditions; a finding that is supported by, and illustrated in Figure 2. Females report having higher levels of physiological anxiety than males during the time prior to practice and exhibition games, but then report levels similar to those of males for league games, fluctuating only for league game two. Although there appears to be an interaction between gender and the level of competition with respect to somatic anxiety (as would be interpreted by the graph in Figure 5), when the levels of competition are aggregated into practice, exhibition and league conditions, there is in fact no interaction supported. Therefore, on the basis of the results reported for somatic anxiety, secondary null hypothesis 1 cannot be rejected.

Figure 5. Secondary Hypothesis 1: Interaction effect between the levels of competition and gender for the dimensions of anxiety variable: somatic anxiety.

State self-confidence, as illustrated in Figure 6, shows a similar parallel configuration to that presented in Figure 3, when the plotted cell means for each testing condition are connected. The slight decline in self-confidence reported for the exhibition game condition in Figure 3 appears to be the result of the lower means computed for males and females prior to exhibition game 1.

As noted earlier (see Figure 3), the males report having more confidence than do females prior to all competitive conditions. Both male and female subjects, however, indicate having the same level (relative to their gender) of self-confidence for exhibition and league levels of competition. From the results shown in Figure 6, there appears to be no interaction between gender and the level of competition when viewed for state self-confidence, and therefore null hypothesis 1 cannot be rejected on the basis of the self-confidence anxiety dimension.

Figure 6. Secondary Hypothesis 1: Interaction effect between the levels of competition and gender for the dimensions of anxiety variable: state self-confidence.

When the two-way analysis of variance was computed for all testing situations and viewed with respect to male subjects by teams, the lines connecting the cell means (for cognitive anxiety) in the interaction plot in Figure 7 do not show a significant interaction.

Figure 7. Secondary Hypothesis 1: Interaction effect between the men's teams and the levels of competition for the dimensions of anxiety variable: cognitive anxiety.

Figure 7 indicates that the male subjects from the University of Saskatchewan (U of S) team tend not to worry as much prior to competition as the male team members from the University of Regina (U of R). Further, both male teams report not being any more worried (anxious) prior to exhibition games than they do prior to league games. The results reported in Figure 2 in which cognitive anxiety showed a slight decrease in league competition may have been due to the sharp decline reported for the U of R team for league game 3.

Somatic anxiety for males prior to competition was reported to be the same for exhibition games and league games (see Figure 2). This finding is supported by Figure 8, which shows the results of the means computed for somatic anxiety across all levels of competition.

Figure 8. Secondary Hypothesis 1: Interaction effect between the men's teams and the levels of competition for the dimensions of anxiety variable: somatic anxiety.

As indicated in the graph in Figure 8, the males from the U of R report having higher elevations of physiological symptoms prior to all levels of competition than do the male subjects from the U of S. At the same time, the U of R male team members report greater fluctuations between the competitive conditions than their male counterparts from the U of S. In contrast, the male subjects from the U of S report a very consistent level of somatic anxiety across all competitive conditions.

No significant interactions for the male teams from the U of S and the U of R for self-confidence are evident according to the graph in Figure 9.

Figure 9. Secondary Hypothesis 1: Interaction effect between the men's teams and the levels of competition for the dimensions of anxiety variable: state self-confidence.

As would be expected from the results shown in Figure 7—male subjects from the U of R reported higher levels of cognitive anxiety than the males from the U of S across all testing situations—U of S male subjects reported having more self-confidence for all competitive situations than did the males from the U of R. Each of the male teams reported lacking self-confidence for one of the two exhibition games, reaching levels lower than for any of the other competitive conditions. For the most part, both male teams indicated having a stable level of self-confidence going into a competitive situation.

Figure 10. Secondary Hypothesis 1: Interaction effect between the women's teams and the levels of competition for the dimensions of anxiety variable: cognitive anxiety.

Figure 10 shows the cell means plotted for the female subjects from the U of R and the U of S, indicating three significant interactions. The first interaction occurred between the base or practice cognitive anxiety reported by both female teams and the first exhibition game; the U of S females, although beginning with a higher level of worry for the practice session, did not report the same magnitude of cognitive anxiety increase for exhibition game one that was reported for the U of R females. However, the second interaction which occurred between exhibition game one and exhibition game two indicated a reversal in the amount of reported cognitive anxiety; worry increased for the U of S females, while showing a decrease for the females from the U of R.

The third interaction between the female teams from each of the universities, occurred between exhibition game two and league game one. U of S females dropped dramatically in their reported pre-competitive cognitive state anxiety while the U of R females remained at the same level for both conditions. Thereafter, both teams

demonstrated a parallel and steady increase for successive league game testing sessions.

Somatic anxiety expressed by each of the female teams in the study indicates only one instance (prior to exhibition game two) in which interaction approaches significance. Both female teams follow a similar pattern, reporting higher physiological symptoms for exhibition games than for the practice session and the league games.

Figure 11. Secondary Hypothesis 1: Interaction effect between the women's teams and the levels of competition for the dimensions of anxiety variable: somatic anxiety.

As indicated by the graph plotted in Figure 11, the U of R females report having greater physiological anxiety prior to most competitive situations. Similar to cognitive anxiety (see Figure 10) the U of S females exhibit an elevation in somatic anxiety from exhibition

game 1 to exhibition game 2, while the females from the U of R show a marked decline over these same conditions.

Figure 12. Secondary Hypothesis 1: Interaction effect between the women's teams and the levels of competition for the dimensions of anxiety variable: state self-confidence.

Figure 12 reveals no significant interaction between the female teams in the study and the level of competition for state self-confidence. As expected, however, there are relationships between the self-confidence reported by both female teams and the cognitive anxiety noted (see Figure 10). Both teams reported not feeling anxious prior to practice, while indicating that they did feel self-confident. Similarly, as the female subjects' cognitive anxiety rose for exhibition game 1, their level of self-confidence declined. For the U of S females, a rise in cognitive anxiety for each successive league game was accompanied by a decrease in self-confidence. Surprisingly—in contrast—the U of R females demonstrated an increase in cognitive anxiety for league games while also showing an increase in self-confidence. Such results are

contrary to the notions expressed by Martens et al. (1990), who argued (as previously mentioned) that cognitive anxiety and self-confidence occupy opposite ends of the same cognitive evaluative continuum.

Hypothesis 2: Secondary null hypothesis two stated that there would be no significant interaction effect between the levels of competition (exhibition game, and league game) and the levels of gender (male and female) with respect to the perceived commission of mental errors.

Based on the information presented in Figure 13, which indicates no significant interaction between the sex of subjects and the level of competition for the commission of mental errors, the null hypothesis cannot be rejected. Specifically, the males were reported to make more mental errors ($M = 2.5$) during the exhibition conditions than the females ($M = 2.31$), although the difference was minimal. During league conditions, however, the number of mental errors committed by the males and the females for the participating teams computed to be almost identical (male mean = 2.48 and female mean = 2.46). It can be concluded from the graph in Figure 13 that the females in this study will make more errors during exhibition games than for league games, while the males in this study will make fewer errors during league games than they will make during exhibition games.

Figure 13. Secondary Hypothesis 2: Interaction effect between the aggregated levels of competition and gender for the commission of mental errors variable.

When a two-way ANOVA was computed for teams by gender on the aggregated levels of competition, they showed support for the findings indicated in Figure 13.

Figure 14. Secondary Hypothesis 2: Interaction effect between the men's teams and the aggregated levels of competition for the commission of mental errors variable.

The graph in Figure 14 shows a nearly perfect parallel relationship between the men's teams from the U of R and the U of S.

Each male team was reported to make the same number of mental errors for league games as they made for exhibition games. Therefore, it would appear that the level of competition has no effect on the commission of mental errors. Figure 14 also indicates that the male subjects from the U of R were reported to commit more mental errors than the males from the U of S for each of the competitive conditions.

Figure 15. Secondary Hypothesis 2: Interaction effect between the women's teams and the aggregated levels of competition for the commission of mental errors variable.

The female subjects, as evidenced by Figure 15, displayed similar results to that of the male subjects when viewed by gender on the aggregated level of competition for mental errors (as measured by the MEQ). The female subjects on the U of R team were reported to commit fewer mental errors than their female counterparts from the U of S, although both groups made nearly the same number of mental errors for each level of competition.

The evidence presented in Figures 13, 14, and 15 does not indicate any significant interaction effect between the levels of competition and the levels of gender when applied to the commission of mental errors. Consequently, the secondary null hypothesis 2 cannot be rejected.

Section 4: Inspection of the data to determine intraindividual differences with respect to optimal levels of anxiety and their relationship to the commission of mental errors

Some of the studies (see Martens et al., 1990), using the CSAI-2 instrument to test the anxiety-performance relationship, may have lacked the precision necessary to assess accurately the subtle influence of anxiety on performance. Martens et al. (1990) speculated that the lack of validity evidence that CSAI-2 components correlated with performance in a theoretically consistent pattern, may be the result of weak performance measures as opposed to conceptual limitations of the CSAI-2 questionnaire. Grouping subjects allows only between-subjects (e.g., interindividual) rather than more precise within-subjects (e.g., intraindividual) comparisons. The major limitation of interindividual performance measures is that they make it impossible to determine whether differences among competitors' performance measures for a particular competition are the result of mediating factors (e.g., anxiety) or simply because of differences in skill level. Intraindividual performance measures, however, afford greater precision because they

evaluate current performance on the basis of comparison to previous or other performances for an individual.

The purpose of inspecting the data is to "tease out" any differences that anxiety has on performance for the individual by making a visual comparison of all performances for each individual. Optimal scores for the dimensions of anxiety (cognitive, somatic, and self-confidence) were established for each male and female subject based on the reported middle score for the three league games (as determined by the CSAI-2). Each of the CSAI-2 raw scores and corresponding reported MEQ scores for all five (exhibition game and league game) testing sessions were then listed to determine if the optimal score for each dimension of anxiety corresponded with the lowest commission of mental errors (signifying optimal performance). Table 24 shows the percentage comparison for all subjects in the study of the optimal level of anxiety corresponding to the optimal level of performance, while Table 25 does the same for comparing gender.

Table 24

Comparison of the Optimal Dimensions of Anxiety with the Commission of Mental Errors for each Individual by Team

Team	Dimension of Anxiety		
	Cognitive	Somatic	Self-Confidence
U of R Females	46%	33.3%	23%
U of S Females	25%	0%	25%
U of R Males	64%	36%	45%
U of S Males	30%	60%	60%

Table 25

Comparison of Optimal Anxiety with the Commission of Mental Errors for each Individual by Gender

Gender	Dimension of Anxiety		
	Cognitive	Somatic	Self-Confidence
Females	36%	24%	24%
Males	48%	48%	52%

As indicated by Table 24, there is no obvious trend for any of the teams with respect to matching optimal anxiety levels with optimal

performance levels. The male subjects for the U of R, however, did record a 64% relationship between cognitive anxiety and the lowest commission of mental errors, while the U of S male subjects recorded two 60% relationships (for somatic anxiety and self-confidence and the commission of mental errors). Males recorded a higher percentage than females of matching their optimal anxiety levels with their best decision-making performances (see Table 25). When all the subjects were combined (in an attempt to determine a trend), optimal cognitive anxiety scores corresponded to optimal mental error commission at 41%, followed by self-confidence at 37%, and somatic anxiety at 35%. The results do not lead to a great deal of confidence in using the pre-competitive state anxiety scores for predicting optimal levels of anxiety which will generate peak performance conditions.

The data were also inspected to determine whether cognitive anxiety and self-confidence occupied opposite ends of the same cognitive evaluation continuum. Each individual's results were categorized (using Martens et al.'s, 1990 CSAI-2 norms for college athletes) according to higher than the norm for cognitive anxiety matched with a lower than the norm self-confidence and vice versa. The following results for each of the teams were noted: (1) U of R females, 69%; (2) U of S females, 67%; (3) U of R males, 82%; and (4) U of S males, 70%. These results support the contention by Martens et al. (1990) that cognitive anxiety and self-confidence occupy opposite ends of the cognitive evaluation continuum.

Table 26

Comparison of the Scores for the Male and Female Subjects with the Norms for College Male and Female Athletes for the Dimensions of Anxiety

Gender		Dimension of Anxiety		
		Cognitive	Somatic	Self-Confidence
Females	Above	64%	44%	36%
	Below	32%	56%	52%
	Norm	4%	0%	12%
Male	Above	52%	33%	48%
	Below	29%	38%	52%
	Norm	19%	29%	0%

Table 26 shows a comparison of the anxiety scores for the study's subjects by gender as compared to the norms for college male and female athletes. The results show that the subject population for this study was above the norm for cognitive anxiety and below the norm for self-confidence—college athletes (those who play for the university basketball teams) in the province of Saskatchewan report being more worried and having more negative thoughts, and feeling less self-confident than the norms established for college athletes in the United States.

Summary

The Sport Competition Anxiety Test (SCAT)—developed by Martens et al. (1990) to assess competitive A-trait—was found to predict state anxiety (as measured by the CSAI-2) at a low to moderate level. As such, the utility of employing this short, easy to administer and assess instrument, in order to determine pre-competitive state anxiety levels may be questioned.

When subjects were compared by the levels of the independent variables based on the primary hypotheses generated to guide the study, 6 significant differences were produced through the ANOVAs. Scheffé post hoc procedures identified the level(s) of the variable responsible for the significant difference in the ANOVA.

A comparison of the dimensions of anxiety with respect to gender for the six testing sessions indicated significant differences for somatic anxiety and self-confidence. Females exhibited higher somatic anxiety than males for the practice condition and lower self-confidence for the practice and exhibition game 1 sessions. When competition was aggregated into practice, exhibition, and league conditions, a significant difference was evidenced for cognitive anxiety, with females recording higher levels than males. No significant differences were found with respect to gender and the commission of mental errors. However, when the effect of anxiety on the commission of mental errors was analyzed, both cognitive and somatic anxiety demonstrated significant differences. For cognitive anxiety, the low and medium levels of mental errors were significantly different from the high level, but not significantly different

from each other, while for somatic anxiety, the low level of mental errors was significantly different from the medium and high levels, but the medium and high levels were not significantly different from each other.

Comparing levels of competition and dimensions of anxiety produced a significant difference between somatic anxiety and the practice condition. When competition was compared to the commission of mental errors, however, no significant differences were found.

Multiple regression analysis for dimensions of anxiety, level of competition and mental errors produced three significant predictor variables: (1) self-confidence for exhibition game 1; (2) cognitive anxiety for league game 2; and (3) self-confidence for league game 2. In addition, one significant multiple R was found for the league game 2 condition.

For the two secondary hypotheses, no significant interaction effects were found between levels of competition and gender with respect to dimensions of anxiety, and similarly, no significant interaction effects between levels of competition and gender with respect to the commission of mental errors. Therefore, neither gender nor the level of competition appeared to have a significant impact on the pre-competitive levels of anxiety or the commission of mental errors.

Chapter IV has presented the major findings surrounding the seven primary and two secondary hypotheses tested in the study. The data suggest some importance and utility for being able to determine the pre-competitive levels of anxiety for athletes, but for the most part,

some of the anticipated results, with respect to the effect of anxiety on the commission of mental errors for increased levels of competition, were not realized. Chapter V will present a summary of the research project and delineate the conclusions drawn from the data presented in Chapter IV. Chapter V will conclude with recommendations for further study.

CHAPTER V

Summary, Conclusions and Discussion, and Recommendations

Overview of the Study

Chapter V presents the summary, conclusions and recommendations for further study. The first section advances a summary of the purpose, the theoretical background and literature related to the outcomes of the study. The second section cites the conclusions and subsequent discussion drawn from the findings, while the third section gives recommendations for practice. The fourth and final section offers recommendations for future study based on the findings of the research.

The purpose of the study was to explore the anxiety-performance relationship in an applied, field-tested manner with elite male and female university basketball players in the Province of Saskatchewan (Canada). If the effects of anxiety prior to competition can be delineated and understood, the anxiety demands of a particular sport determined, and the anxiety levels of individual athletes assessed, then athletes, coaches and sport psychologists can determine appropriate anxiety levels that will produce the highest levels of performance for each individual participant. An understanding of the determinants of

competitive state anxiety will provide valuable information for both anxiety-reduction and performance enhancement intervention. This study sought to determine the relationship between competitive state anxiety and the incidence of mental error commission under various levels of competition.

Recently, concern has been raised by coaches, the media and the public over the inconsistent performance of athletes at all levels of sport. Newspapers and television interviews are quoting coaches or team officials with phrases such as "I don't know what's wrong with their heads"; "They just didn't have their heads in it tonight"; "I thought we were ready to play, but . . ." and so on. The dilemma facing athletes and coaches does not appear to be related to physical or skill preparation, but to appropriate mental preparation for competition. The province of Saskatchewan, intent on raising the performance level of athletics to national standards, has allocated funds to improve the preparation of its coaches and athletes. As a result, universities and high schools as well as community organizations are eager to become involved in studies that have the potential to contribute to the success of their programs, especially at the cognitive level.

Some sport psychologists (e.g., Alderman, 1979; Martens, 1979) have emphasized the need for more relevant field research in order to better understand the complex social interaction inherent in sport competition. Martens (1979) argues that the richness of field settings is important when one is interested in increasing the potency of an independent variable (e.g., competition). Much of the research into the

competitive stress response (almost universally referred to as anxiety), has focused on the period preceding competition, called pre-competitive anxiety state (A-state). According to Silva and Hardy (1984), research using this time-to-event sequence is based on the assumptions that: (1) the athlete's mental set prior to competition can affect subsequent performance; (2) the athlete has some control over mental preparation during the pre-competition period; (3) this period is much more accessible to researchers than the period of competition itself; and (4) if pre-competition anxiety is a (negative) source of performance variance, then the coach or clinician can assist in developing an appropriate pre-competition state.

Measurement of anxiety at the cognitive level has mainly relied on self-report questionnaires. In keeping with the multidimensional design of the present study, trait anxiety was measured by the Sport Competition Anxiety Test (SCAT, Martens, 1977), while state anxiety was measured by the Competitive State Anxiety Inventory-2 (CSAI-2, Martens et al., 1983). Empiricists have measured A-trait and A-state against a dependent variable (swimming, Burton, 1988; wrestling, Gould, Petlichkoff & Weinberg, 1984; pistol shooting, Gould et al., 1987) based on objective outcomes—success/failure as it relates to win/loss, score or some other performance outcome criteria (Gould, Petlichkoff & Weinberg, 1984; Klavara, 1978; and Weinberg & Hunt, 1976). This study, however, measured anxiety against a dependent variable—mental errors committed during competition—based on a subjective performance process outcome in the form of decision-

making. Using a performance process measure reduces the possibility of confounding variables such as the skill level of the athlete to influence the performance outcome. The Mental Error Questionnaire (MEQ), utilized to measure the dependent variable in this investigation, was developed by the researcher in conjunction with the coaching staffs of the teams involved in the study. The instrument measured individuals' performance against their base or normal performance level which was determined to be their performance during practice.

The relationship between anxiety and performance in sport has developed into a popular and specialized area for academic inquiry, but has proven to be elusive for researchers. Knowledge concerning this relationship has occurred within a general, cognitive psychological framework, although this knowledge has been slow to filter through to the discipline of sport psychology. However, sport psychology is becoming increasingly applied in nature, with limited concern devoted to the measurement of precise parameters in controlled environments. The move towards ecologically valid field settings and away from laboratories has been highlighted by Martens (1979). A significant factor in this development is the realization that the sport environment provides a natural laboratory in which to study behavior in general, and anxiety-related behavior in particular.

Research findings on the anxiety-performance theme have been equivocal. There are numerous studies that support a multidimensional approach to the measurement of state anxiety, postulating that the relationship between performance and state anxiety depends on the

dimension of anxiety being measured (Sonstroem & Bernardo, 1982; Gould et al., 1987). Although Martens et al. (1990), Morris and Liebert (1973), and Schwartz, Davidson and Goleman (1978) considered the dimensions of state anxiety to be conceptually independent, it has been suggested by Deffenbacher (1978) and Smith and Morris (1977) that the cognitive and somatic components of anxiety co-vary, since many stressful situations contain elements related to the onset of each component. Each component of anxiety may serve a conditional or discriminatory function for the other component (Borkovec, 1976), and cognitive changes are not experienced in isolation. Every change in the mental-emotional state is consciously accompanied by an appropriate change in the bodily (somatic) state (Green & Green, 1977). If powerful somatic responses have been conditioned to a particular stimulus, these responses may indicate to the individual that there is reason to worry, and conversely, cognition in the form of images of failure may trigger a pattern of somatic responses.

While some theorists (Liebert & Morris, 1967; Davidson & Schwartz, 1976) favor the notion of a two-component model of anxiety which includes cognitive and somatic anxiety, Martens et al. (1990) proposed the existence of a third dimension—self-confidence. This factor according to Martens et al. (1990) occupied the opposite end of the cognitive evaluation continuum, and was defined as the absence of cognitive anxiety.

The Competitive Sport Anxiety Inventory-2 (CSAI-2, Martens et al., 1990), one of the most widely used and validated instruments was

administered to the four (two male and two female) university basketball teams to assess the multidimensional state anxiety components (dependent variable one) of the subjects. A base anxiety level was established prior to a practice session, followed by five additional data collection sessions (prior to two exhibition games, and three league games). Coaching staffs' ratings (using the Mental Error Questionnaire) for each of their player's game performance with respect to the commission of mental errors (dependent variable two) against their practice or non competitive performance standard was obtained at the conclusion of each of the five testing session competitions.

The two independent variables—level of competition and gender—were identified as possible factors affecting the dimensions of state anxiety and the performance process (the commission of mental errors). Seven primary hypotheses were developed to statistically test for differences and relationships between the levels of the independent variables. In addition, two secondary hypotheses were developed to test for significant interaction effects between the independent variables. Correlation and multiple regression procedures as well as one-way ANOVAs were used to test the primary hypotheses. Two-way ANOVAs were used to test the secondary hypotheses. An $\alpha = .05$ was used in all tests of significance. Following a significant finding, a Scheffé post hoc analysis was calculated to determine which of the levels of the independent variables was significantly different from the other levels. The ANOVA source tables, post hoc analyses, and incidence

tables from the two-way ANOVAs for the secondary hypotheses can be found in Appendices F and G.

Findings of the Study

The focal points of the theoretical foundation for the study have been the Competitive Sport Anxiety Inventory -2 (CSAI-2) developed by Martens et al. (1990), and the Mental Error Questionnaire (MEQ) which was developed by the researcher in conjunction with the coaching staffs of the teams involved in the study. Central to the state anxiety inventory is Martens et al.'s theory of the competitive process which includes:

- (1) the objective competitive process which specifies "what the individual must do to obtain a favorable outcome when compared to a standard" (p. 15);
- (2) the subjective competitive situation which relates to how the person perceives, accepts, and appraises the objective competitive process;
- (3) the response which is determined by the perception of subjective competitive situation; and
- (4) the consequences which for competition are frequently viewed in terms of success (positive consequences) and failure (negative consequences).

The MEQ is based on the notion that athletes participating in basketball are constantly having to evaluate their environment, taking in and processing information from internal and external sources in order to

make decisions which will translate into responses that are appropriate for the given situation. Under optimal anxiety/arousal levels, the decisions made will lead to the correct (successful) response.

The comparative statistical analyses of the data resulted in 7 significant differences out of the 13 ANOVAs that were calculated for the dependent variables. Three of the five primary hypotheses for which ANOVAs were employed produced at least one significant difference. Each of the hypotheses is reviewed and discussed below.

Hypothesis 1 investigated the relationship between an athlete's trait anxiety (A-trait) as measured by the SCAT, and the cognitive, somatic and self-confidence dimensions of pre-competitive state anxiety (A-state) as measured by the CSAI-2. Low negative correlations were found between the measurement of trait anxiety and self-confidence, while low to moderate positive correlations resulted between cognitive anxiety and A-trait. The somatic anxiety dimension reflected the highest correlation (a moderate positive correlation) to trait anxiety.

Hypothesis 2 examined the effects of gender on state anxiety. Somatic anxiety produced a significant finding ($\alpha = .05$) for the practice condition, while self-confidence generated significant results ($\alpha = .05$) for the practice and exhibition game one conditions. Cognitive anxiety produced no significant findings. Females expressed greater somatic manifestations than males for the practice condition, and also indicated feeling less self-confident than males prior to the practice and the first exhibition game testing sessions.

Hypothesis 3 investigated the effects gender had on the commission of mental errors. The one-way ANOVA applied to the data produced no significant difference findings ($\alpha = .05$). Males were assessed by their respective coaching staffs as committing more mental errors during competition than were females, although the mean for males showed a steady decline over successive league games while the trend for females showed an increase over the same number of league games.

Hypothesis 4 investigated the effects of anxiety on the commission of mental errors, and found two significant differences ($\alpha = .05$). Cognitive anxiety and somatic anxiety were found to have a significant effect on the commission of mental errors, whereas state self-confidence did not. Subjects who reported having greater cognitive anxiety (worry, negative thoughts etc.) were found to make significantly more errors during the course of competition than those who reported having lower levels of worry. Similarly, subjects who identified having greater physiological symptoms prior to competition, also were found to commit a greater number of mental mistakes during competition.

Hypothesis 5 explored the effect of levels of competition on anxiety. The practice condition was found to produce a significant difference for the dimension of somatic anxiety ($\alpha = .05$). Subjects reported being more aware of and having a greater number of somatic anxiety indicators (rapid heart rate, shallow and rapid breathing, sweaty palms, muscle tension etc.) prior to practice conditions, than they reported prior to exhibition or league competition conditions.

Hypothesis 6 examined the effects of competition on the commission of mental errors. When an analysis of variance was applied to the data, no significant differences ($\alpha = .05$) were found for any of the levels of competition on the making of mistakes. Coaches did not indicate that subjects were any more affected by the level of competition with respect to making inappropriate decisions.

Hypothesis 7 investigated the predictive ability between the independent variable (pre-competitive state anxiety) and the dependent variable (commission of mental errors) for the different levels of competition. State self-confidence was found to be a significant predictor of mental errors for the exhibition game one testing session. Greater worry (cognitive anxiety) and lower self-confidence reported by subjects prior to league game two were significant ($\alpha = .05$) in predicting the commission of mental errors for the league game two condition.

Two secondary hypotheses were developed to examine specific interactions between the independent variables. Of the 13 two-way ANOVAs calculated, 1 significant interaction was identified ($\alpha = .05$). Secondary hypotheses 1 and 2 are summarized as follows:

Hypothesis 1, which examined the interaction between the levels of competition and the levels of gender with respect to the dimensions of anxiety, showed that females reported experiencing greater cognitive anxiety across all levels of competition than males, although there was no significant interaction. Males and females both expressed feeling greater worry and negative thoughts for the exhibition level of

competition, than they did for league game conditions. Hypothesis 1 produced a significant interaction effect between somatic anxiety and the practice and exhibition levels of competition. Females reported experiencing greater physiological sensations prior to practice and exhibition games than males, but then indicated feeling fewer symptoms to that of the male subjects for league competition situations. No significant interaction effects surfaced between self-confidence and levels of competition, although females reported feeling less self-confident than males for all three levels of competition.

Hypothesis 2 looked at the interaction effects between competition and the levels of gender with respect to the commission of mental errors. No significant interaction effects were produced. Females were perceived to commit fewer mental errors than males during both exhibition and league levels of competition.

Conclusions and Discussion

The study has examined the effects that competition and gender have had on pre-competitive state anxiety and the commission of mental errors. Some statistically significant differences were identified and significant interactions between the independent variables were found to exist. Based on the findings of the research, the following conclusions have been delineated:

1. According to Martens et al. (1990), SCAT has been shown to be positively related to the sport-specific dispositions of cognitive and somatic anxiety as measured by the CSAI-2. Conversely, competitive

A-trait has been shown to be negatively related to the sport-specific disposition of self-confidence. The findings of this study substantiate the above contentions. Additionally, field studies by Martens, Rivkin, and Burton (1980), and Martens and Simon (1976) which have supported SCAT's ability to predict competitive A-state have been further validated by the results of this study. As such, this study joins the efforts of other researchers who have supported competitive A-trait as a significant predictor of competitive A-state in competitive situations (Cooley, 1987; Gerson & Deshaies, 1978).

While research examining differences in competitive A-trait on gender is equivocal, this study found that females reported higher levels of A-trait ($M = 26.2$) than males ($M = 19.8$).

In support of Huband and McKelvie (1986), this study found that athletes who were high in A-trait (as measured by SCAT) were higher in competitive A-state (as measured by CSAI-2) for competitive conditions than were low competitive A-trait athletes. Also, competitive A-state for high competitive A-trait athletes increased more sharply between practice and competition—again supporting the findings of Huband and McKelvie (1986).

2. When A-state was examined with respect to gender for each of the testing sessions (1 practice, 2 exhibition games and 3 league games), it was concluded that although females reported higher levels of cognitive anxiety and lower levels of self-confidence, there was no significant difference for cognitive anxiety and gender. Self-confidence indicated significant differences only for the practice and exhibition

game 1 testing conditions, while somatic anxiety recorded one significant difference for gender during the practice testing session. No significant differences were evident when the testing sessions were aggregated into practice, exhibition and league levels of competition for somatic anxiety or self-confidence. A significant difference ($\alpha = .05$), however was found for cognitive anxiety and gender when the testing sessions were aggregated into the three levels of competition. Thus, it can be concluded that for this study the females do not exhibit significantly higher levels of anxiety than males, and that any differences in levels encountered fluctuate from game to game within the levels of competition.

Greater cognitive anxiety reported by subjects prior to exhibition games as compared to league games may be attributed more to the unique nature of the competitive situation than to the level of competition (e.g., exhibition game versus league game). For the female subjects, both exhibition games were the first games of the season, and as such, a number of decisions were still dependent on the performance during these games (e.g., starting positions, playing time, travelling roster etc.). Additionally, both exhibition games were against each other, and a strong rivalry between schools/programs may have placed special significance for the competitions. Some players may have felt that they had something to prove to the institution (coaches) which had not recruited them, thereby attaching special significance to the competition.

The male subjects' greater cognitive anxiety during exhibition games as compared to league games may also have been a result of extenuating circumstances. For both male teams, the first exhibition game represented competition for the Mayor's Cup which symbolized basketball supremacy between the major cities in the Province of Saskatchewan, and as such received great media attention. The second exhibition game for both teams occurred during the first game of a highly prestigious tournament—a tournament in which the U or R was clearly an underdog and not expected to perform well, and the U of S, by virtue of being the defending champions, were cast in the role of favorites. For the U of S team, additional importance was attached to the game because they were matched against a nationally-ranked powerhouse in the feature game of the evening.

3. According to Husman (1969), as emotion goes up functioning intelligence goes down and there is little question about the distracting effects of extreme levels of emotion on any type of performance involving reasoning powers, quick thinking or fast decision-making (e.g., basketball game). Initial increases in either physiological arousal or cognitive worry may quickly create a negative thought-anxiety cycle. Husman's hypothesis was not supported in this study. It was shown (see hypothesis 2), that although females in this study reported having greater levels of state anxiety than males, the elevated anxiety states did not result in females committing significantly more mental errors than males during competition. In fact, quite unexpectedly the females

committed fewer (although not significantly so) mental errors than the male subjects.

Conceivably, the above results may be due to the coaching staffs' evaluations of players' performances—females reportedly are more concerned with how they perform, whereas males place greater emphasis on the outcome of a contest. Therefore, it is possible that female coaches evaluated their players based on effort rather than on whether the decisions which were made resulted in a mental error—results may have been overshadowed by commitment to doing well.

In contrast, males reportedly are more concerned with outcome than they are about process. If this assumption is valid, the male coaching staffs may not have evaluated their players on whether their decisions (responses) were correct, but rather on the outcome of the players' actions (e.g., stepping in to take a charge, but being called for a block).

4. When anxiety was compared to the commission of mental errors, cognitive and somatic anxiety indicated significant differences, but not self-confidence. Subjects in this study, who were reported committing low and medium number of mental errors, reported feeling greater cognitive anxiety prior to competition. Additionally, subjects who had the highest level of somatic anxiety, were reported by the coaching staffs of their respective teams as committing the fewest mental errors during competition. It appears therefore, that based on the findings of this study and contrary to the literature (Feltz, 1982; Klavora, 1978; Landers & Boutcher, 1986; Martens, 1974; Sonstroem

& Bernardo, 1982), greater feelings of state anxiety and lower levels of self-confidence do not contribute to the commission of a greater number of mental errors during competition.

The results obtained above do not support the literature on anxiety and performance (Yerkes & Dodson, 1908), nor the findings of other studies (Klavora, 1978; Martens et al., 1990). Other studies (Klavora, 1978; Sonstroem & Bernardo, 1982), however, utilized between group comparisons, and this may have resulted in not establishing optimal levels of anxiety for each athlete which would theoretically lead to optimal performance. As well, the results of this study may have been influenced more by the accuracy of subjective evaluation on the part of the coaching staffs than on the actual performance of the athletes.

5. Based on this study, it appears as though the level of competition (practice, exhibition game and league game) does not have the predicted effect on the levels of pre-competitive state anxiety as argued by Burton (1988), Cherry (1978), Martens et al. (1990), McGrath (1970), and Spielberger (1989), that the higher the level of competition, the greater the level of anxiety and the lower the level of self-confidence. Furthermore, the results are surprising and do not support Spielberger's (1989) contention that state anxiety level changes are produced by perceived or experienced success or failure, and level of competition. Anxiety or stress (threat) is reported to occur only when the consequences of failure to meet the demand are perceived to be important (as in league competitions where standings and rankings

are at stake and where a greater audience means greater and closer scrutiny or evaluation) (Cratty, 1984).

All three dimensions of state anxiety followed a similar pattern when compared to the levels of competition. As expected, the base or practice condition produced the lowest levels of cognitive and somatic anxiety and the highest level of self-confidence (as predicted).

Surprisingly, however, the exhibition game condition generated the greatest levels of cognitive and somatic anxiety combined with the lowest level of self-confidence, whereas it was anticipated that league competition level would result in the reporting of the highest levels of cognitive and somatic anxiety and the lowest level of self-confidence.

Such results may be due more to the specific conditions within each team than to the level of competition. The players on teams which had an established player hierarchy (U of S men and U of R women) did not report the elevated levels of anxiety as the less established and younger (age and experience) teams (U of S women and U of R men).

As previously mentioned, the exhibition games between rival programs may have generated unusually high pre-competitive state anxiety for the females, while playing for rival city supremacy and tournament prestige may have affected the state anxiety of the male subjects in this study.

The unusually high pre-competitive state anxiety experienced by the female subjects for the practice (non-competitive) condition may be attributed to the self-report results submitted by the U of S females. Observation of practice sessions revealed high levels of criticism (self

and other), with little evidence of positive reinforcement. Subjects performed tentatively, and appeared unusually upset when they did not perform as expected. Public criticism appeared to result in reduced self-confidence and embarrassment and may have led to even lower performance expectations.

6. Based on the research examining the anxiety-performance relationship, and on the contention that higher levels of competition produce higher levels of anxiety (Burton, 1988; Klavora, 1978), it would follow that the higher levels of competition would be associated with a greater number of mental errors committed. This assumption is based on the belief that mental errors occur as a result of divided attention (Bird & Cripe, 1986; Nideffer, 1980, 1981, 1989). However, the findings of this study indicated that higher levels of competition did not lead to committing a greater number of mental errors. To the contrary, higher levels of competition resulted in the subjects reportedly committing fewer mental errors.

The above results may be due in part to the decreased level of anxiety for league games as compared to exhibition games—exhibition games for which testing occurred were found to contain unusual circumstances which may have had an influence on the statistical findings. As well, the exhibition games may have occurred at a time when the offensive and defensive schemes may not have been sufficiently learned to allow for spontaneous or automatic responses, and therefore, would lead to player decisions which were made too late to achieve positive results. It is also possible that a greater number of

players were optimally aroused for league competition, resulting in effective attentional focus and improved performance.

7. Since the decision-making process which leads to the commission of mental errors is cognitively based (Weinberg, 1989), cognitive state anxiety would be expected to be the dimension of anxiety that is the greatest predictor of mental error rate. Additionally, since self-confidence is at the opposite end of the cognitive evaluation continuum, it too would be expected to highly predict mental error rate. However, according to this study, cognitive anxiety and state self-confidence appeared as significant predictor variables for the league game two condition only, and cannot on that basis be considered to consistently predict the commission of mental errors. Somatic anxiety was not able to predict mental error commission for any of the conditions. Therefore the dimensions of pre-competitive state anxiety do not accurately or consistently predict mental error commission for any level of competition.

The study has examined a number of factors that had been identified by previous research as factors having a significant impact on pre-competitive state anxiety and decision-making (as measured by mental error commission). Athletes who compete in basketball at the university level spend countless hours honing their physical skills (strength, power, conditioning etc.) and their sport skills (shooting, ball handling, passing etc.). If these same athletes can apply the findings of this study to enhance their psychological skills (control worry and negative thoughts about the impending competition, control muscle

tension and slow down the heart rate, and increase the level of self-confidence), they will have a greater chance for achieving a peak performance state. Similarly, if coaches and clinicians can determine the optimum level of pre-competitive state anxiety of their athletes, competition outcomes will favor their teams—consistent higher quality performances leading to greater joy and satisfaction from competition will result and these may be translated into success experiences commonly known as wins.

Recommendations for Practice

Based on the findings of this study, some practical implications of the research have come to light and are presented for consideration.

1. According to Martens and Simon (1976) and Martens, Rivkin and Burton (1980), coaches are not accurate predictors of their players' levels of competitive A-state ($r = .12$ between coaches' ratings and actual responses). Instruments such as SCAT, and CSAI-2 however, that have been used to predict (SCAT) and assess (CSAI-2) the levels of pre-competitive state anxiety and coaches could find the utilization of such self-report instruments beneficial. The traditional "win one for the Gipper" type of pre-game speech designed to arouse players to exceptional performances may not be appropriate for all athletes. A knowledge of and a sensitivity to each athlete's psychological needs prior to competition would help coaches, players and clinicians use appropriate methods for game preparation.

2. An assessment of athletes' pre-competitive state anxiety and the evaluation and recording of game performances (cognitive and motor variables) utilized to determine the relationship between anxiety levels and the actual performance, could help athletes and coaches in establishing a performance trend. Consequently, preparation for competitive events could include a short cognitive and somatic assessment (e.g., self-report questionnaire similar to the one used in this study) in order to determine the readiness state and, if necessary, employ appropriate intervention procedures. The practice of pre-competitive state anxiety assessment and evaluation of game performances for relationship comparisons conducted over the course of a season would: (i) make the athletes more sensitive as to their pre-competitive anxiety state; (ii) identify pre-competitive states conducive to each athlete's best performance; (iii) direct intervention procedures to create the peak performance state for each individual; and (iv) employ appropriate cognitive strategies (e.g., relaxation techniques, imaging, affirmations, positive self-talk, centering etc.) as a regular part of practices, so that athletes will be able to best perform their physical skills during competition.

3. Anxiety may not necessarily affect athletes in an adverse manner. If the information from this study can be used to convince athletes that having a high anxiety/arousal level prior to competition may actually be beneficial, athletes would not become too concerned about being nervous or anxious. As a result, athletes would not become preoccupied with their anxiety state (which has the potential to lead to

hyper-distractability) and would therefore be able to focus on game-relevant cues. Confidence in an appropriate anxiety state would also have the potential to elevate an individual's self-confidence about their ability to meet objective performance demands (Martens et al., 1990), thus creating a self-fulfilling prophecy.

4. Often, a concern of coaches is that deviating from normal or traditional pre-competition preparation (e.g., focusing on something that will divert the attention of athletes away from thinking about the contest) may be detrimental to performance. The findings of this study demonstrate that completing short self-report questionnaires prior to competition does not have a negative effect on the performance of athletes—that identifying cognitive, somatic and self-confidence feelings does not raise the anxiety level of the athlete. If completing questionnaires designed to identify readiness states are incorporated as part of the pre-competition preparation, they will be viewed not as a distraction, but as a tool that may help athletes focus more successfully on game relevant tasks and appropriate readiness states.

5. This study lends support to the notion that trait anxiety has predictive ability on state anxiety. Therefore, if it can be established (through the use of a trait anxiety identification instrument such as SCAT) that athletes are predisposed to viewing competition with some anxiety, it can be assumed that they will be affected by state anxiety prior to competition. Knowledge of such information may enable coaches and/or clinicians to implement intervention strategies aimed at

viewing competition as a positive challenge—a challenge to be welcomed, not to be feared or avoided.

6. Utilization of the information delineated from this study has the potential to involve coaches as professionals who are aware of the need for developing the physical and psychological aspects of their players. Equal importance devoted to physical and psychological skill development will provide coaches with tools to insure that athletes will consistently be able to perform near their potential.

Recommendations for Future Study

A number of recommendations for future study have evolved from the current research project.

1. Future research investigating the pre-competitive state anxiety-performance relationship, may choose to include additional levels of competition to the study. For example, the exhibition game level could include tournament games that might involve playing for the tournament championship. Similarly, the league game level of competition could include early season league games when teams still have a chance to make the playoffs, mid season games and end of season league games (when a team is posturing for playoff seeding and home court advantage). A level of competition to include beyond league game could be the playoff level. Greater distinction between the levels of competition (e.g. league competition where the games have special significance) would allow researchers an opportunity to evaluate athletes on low, moderate, high and extremely high anxiety producing

situations. There may not have been enough distinction between the practice exhibition game and league game levels of competition to "tease out" any significant findings.

2. At least three evaluation sessions per level of competition are advocated for future research into pre-competitive state anxiety in order to establish an optimum level of anxiety for each individual for each level of competition. In this manner, researchers can better determine if greater anxiety leads to optimum performance for exhibition games and conversely if lower levels of pre-competitive anxiety will reflect superior performances during higher levels of competition.

3. Subjective evaluation of mental error commission as was the method used in this study, has brought to light some inherent problems. Perhaps the result experienced by females—fewer errors committed even though they reported a greater amount of pre-competitive state anxiety—was due in part to the fact that females generally are less critical in their expectations of performance and the subsequent evaluation. Subjective evaluation also may be less accurate as a procedure than objective evaluation—if a particular athlete has played well (e.g. scored a large number of points or had an outstanding game getting offensive and defensive rebounds) the coaching staff may be less critical of the mistakes made and award the player a better rating for mental error commission than actually existed. Similarly, if a player committed few mental errors, but was not particularly effective scoring or rebounding or being aggressive, the coaching staff may attribute a greater number of errors to that individual. Therefore, future research

using a similar performance process to measure performance might do well to use video tapes of each competition to evaluate performance based on what has been recorded. Using a video tape allows the evaluator to back over the same action to evaluate each individual on the floor at that particular time for every play. As well, one evaluator who is impartial and who will consistently evaluate using the same criteria, has a better chance of obtaining more accurate results.

4. The Mental Error Questionnaire may have to be modified for future research involving the evaluation of performance using mental errors as the criterion. Developing a questionnaire may benefit from involving a greater number of coaches to decide on items for inclusion. As well, the instrument may benefit from adding more levels for evaluation (e.g. low, moderately low, average, moderately high and high). Greater distinction between the levels of error commission may make the instrument more sensitive to any significant differences.

5. The small number of actual subjects may have skewed the results of the findings, and future investigations into the anxiety-performance relationship might do well to involve the male and female high school basketball teams in both of the same cities. The high school leagues in the two major cities (Saskatoon and Regina) in the Province of Saskatchewan have pre-season exhibition games, tournaments at various times throughout the basketball season, ample league games on a home-and-home schedule, and playoff games which include city and provincial levels. Utilizing the high school teams as subjects would meet a number of the recommendations: (1) increase the total number

of subjects; (2) increase the number of levels of competition; and (3) increase the number of coaches who would be involved in designing the MEQ.

6. In addition to the investigation of performance based on a cognitive assessment, future study into the anxiety-performance relationship should include a motor performance task (e.g., shooting percentage—field goal or free throw, points scored, rebounds etc.). In this way, all three dimensions of state anxiety (cognitive, somatic and self-confidence) can be studied as to their effects on performance.

Being able to assess and predict levels of pre-competitive state anxiety that will lead to optimum performance levels, will allow athletes and coaches to feel some control over an area that causes so much concern. Predicting optimum levels of anxiety will allow the athlete, coach or clinician to use intervention techniques to raise or lower levels conducive to enhanced performance. The ability to use such interventions will also aid in the reduction of dysfunctional levels of pre-competitive state anxiety, thus making the anticipation of competition an enjoyable and successful experience for all participants.

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APPENDIX A

Illinois Competition Questionnaire

Form A

Name _____

Directions : Below are some statements about how persons feel when they compete in sports and games. Read each statement and decide if you **HARDLY EVER**, or **SOMETIMES**, or **OFTEN** feel this way when you compete in sports and games. If your choice is **HARDLY EVER**, blacken the square labeled A, if your choice is **SOMETIMES**, blacken the square labeled B, and if your choice is **OFTEN**, blacken the square labeled C. There are no right or wrong answers. Do not spend too much time on any one statement. Remember to choose the word that describes how you usually feel when competing in sports and games.

	Hardly Ever	Sometimes	Often
1. Competing against others is socially enjoyable.	A ☐	B ☐	C ☐
2. Before I compete I feel uneasy.	A ☐	B ☐	C ☐
3. Before I compete I worry about not performing well.	A ☐	B ☐	C ☐
4. I am a good sport when I compete	A ☐	B ☐	C ☐
5. When I compete I worry about making mistakes.	A ☐	B ☐	C ☐
6. Before I compete I am calm.	A ☐	B ☐	C ☐
7. Setting a goal is important when competing.	A ☐	B ☐	C ☐
8. Before I compete I get a queasy feeling in my stomach.	A ☐	B ☐	C ☐
9. Just before competing I notice my heart beats faster than usual.	A ☐	B ☐	C ☐
10. I like to compete in games that demand considerable physical energy.	A ☐	B ☐	C ☐
11. Before I compete I feel relaxed.	A ☐	B ☐	C ☐
12. Before I compete I am nervous.	A ☐	B ☐	C ☐
13. Team sports are more exciting than individual sports.	A ☐	B ☐	C ☐
14. I get nervous wanting to start the game.	A ☐	B ☐	C ☐
15. Before I compete I usually get uptight.	A ☐	B ☐	C ☐

APPENDIX B

Anti-Social Desirability Instructions

The effects of highly competitive sports can be powerful and very different among athletes. The inventory you are about to complete measures how you generally feel about competition. Please complete the inventory as honestly as you can. Sometimes athletes feel they should not admit to any nervousness, anxiety, or worry about competition because this is undesirable. Actually, these feelings are quite common, and to help us understand them we want you to share your feelings with us candidly. If you are worried about the competition or have butterflies or other feelings that you know are signs of anxiety, please indicate these feelings accurately on the inventory. Similarly, if you feel calm and relaxed, indicate these feelings as accurately as you can. Your answers will not be shared with anyone except yourself (unless we have your permission to do so). We will be looking at group as well as individual responses (in order to help each individual identify his or her level).

APPENDIX C

Illinois Self-Evaluation Questionnaire

Name: _____ Sex: M F Date: _____

Directions: A number of statements that athletes have used to describe their feelings before competition are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate *how you feel right now*—at this moment. There are no wrong answers. Do *not* spend too much time on any one statement, but choose the answer which describes your feelings *right now*.

	Not at All	Somewhat	Moderately So	Very Much So
1. I am concerned about this competition.....	1	2	3	4
2. I feel nervous.....	1	2	3	4
3. I feel at ease.....	1	2	3	4
4. I have self-doubts.....	1	2	3	4
5. I feel jittery.....	1	2	3	4
6. I feel comfortable.....	1	2	3	4
7. I am concerned that I may not do as well in this competition as I could.....	1	2	3	4
8. My body feels tense.....	1	2	3	4
9. I feel self-confident.....	1	2	3	4
10. I am concerned about losing.....	1	2	3	4
11. I feel tense in my stomach.....	1	2	3	4
12. I feel secure.....	1	2	3	4
13. I am concerned about choking under pressure.....	1	2	3	4
14. My body feels relaxed.....	1	2	3	4
15. I'm confident I can meet the challenge.....	1	2	3	4
16. I'm concerned about performing poorly.....	1	2	3	4
17. My heart is racing.....	1	2	3	4
18. I'm confident about performing well.....	1	2	3	4
19. I'm concerned about reaching my goal.....	1	2	3	4
20. I feel my stomach sinking.....	1	2	3	4
21. I feel mentally relaxed.....	1	2	3	4
22. I'm concerned that others will be disappointed with my performance.....	1	2	3	4
23. My hands are clammy.....	1	2	3	4
24. I'm confident because I mentally picture myself reaching my goal.....	1	2	3	4
25. I'm concerned I won't be able to concentrate.....	1	2	3	4
26. My body feels tight.....	1	2	3	4
27. I'm confident of coming through under pressure.....	1	2	3	4

APPENDIX D

Anti-Social Desirability Instructions

The effects of highly competitive sports can be powerful and very different among athletes. The inventory you are about to complete measures how you feel about this competition at the moment you are responding. Please complete the inventory as honestly as you can. Sometimes athletes feel they should not admit to any nervousness, anxiety, or worry they experience before competition because this is undesirable. Actually, these feelings are quite common, and to help us understand them we want you to share your feelings with us candidly. If you are worried about the competition or have butterflies or other feelings that you know are signs of anxiety, please indicate these feelings as accurately on the inventory. Equally, if you feel calm and relaxed, indicate those feelings as accurately as you can. Your answers will not be shared with anyone except yourself (unless we have your permission to do so). We will be looking at group as well as individual responses (in order to help each individual identify his or her optimal level).

APPENDIX E

Mental Error Questionnaire

U of S Huskie Men	MEQ

Subject 1	
Subject 2	
Subject 3	
Subject 4	
Subject 5	
Subject 6	
Subject 7	
Subject 8	
Subject 9	
Subject 10	
Subject 11	
Subject 12	
Subject 13	

Instructions:

1. Please use these mental error classifications as guidelines for determining the error-rate commitment of your athletes:

- a. any violation (i.e. travelling, 3 seconds etc.)
- b. a foul committed as a result of a poor decision (i.e. being out of position, reaching etc.)
- c. not boxing out (free throw/field goal attempt)
- d. not running the offense
- e. not playing the defense the way it is designed
- f. making the second mistake as a result of the first mistake (i.e. committing a foul after making a bad pass etc.).

2. Rate your players on the mental errors they committed for this particular competition (i.e. low, average, or high). Use the player's mental error-rate during a normal practice as a comparison.

U of S Huskie Women	MEQ

Subject 1	
Subject 2	
Subject 3	
Subject 4	
Subject 5	
Subject 6	
Subject 7	
Subject 8	
Subject 9	
Subject 10	
Subject 11	
Subject 12	
Subject 13	
Subject 14	
Subject 15	

- a. 1-4 (low)
- b. 5-6 (average)
- c. 7-10 (high)

3. Please indicate those players who did not play in this particular competition (i.e. DNP).

APPENDIX F

One Way ANOVA by Mental Errors for the Dimensions of Anxiety

One Factor ANOVA X₁ : Recode of MEQ Y₁ : Cognitive

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	232.102	116.051	3.85
Within groups	205	6179.316	30.143	p = .0228
Total	207	6411.418		

Model II estimate of between component variance = 1.366

One Factor ANOVA X₁ : Recode of MEQ Y₁ : Cognitive

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
A	59	20.322	5.428	.707
B	110	20.109	5.811	.554
C	39	17.487	4.559	.73

One Factor ANOVA X₁ : Recode of MEQ Y₁ : Cognitive

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
A vs. B	.213	1.747	.029	.24
A vs. C	2.835	2.234*	3.13*	2.502
B vs. C	2.622	2.018*	3.283*	2.562

* Significant at 95%

One Way ANOVA by Mental Errors for the Dimensions of Anxiety

One Factor ANOVA X ₁ : Recode of MEQ Y ₁ : Somatic

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	218.396	109.198	4.31
Within groups	205	5193.681	25.335	p = .0147
Total	207	5412.077		

Model II estimate of between component variance = 1.333

One Factor ANOVA X ₁ : Recode of MEQ Y ₁ : Somatic

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
A	59	19.017	5.628	.733
B	110	16.864	4.788	.457
C	39	16.487	4.751	.761

One Factor ANOVA X ₁ : Recode of MEQ Y ₁ : Somatic

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
A vs. B	2.153	1.602*	3.514*	2.651
A vs. C	2.53	2.048*	2.966	2.435
B vs. C	.376	1.85	.081	.401

* Significant at 95%

One Way ANOVA by Mental Errors for the Dimensions of Anxiety

One Factor ANOVA X₁ : Recode of MEQ Y₁ : S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	31.294	15.647	.625
Within groups	205	5130.317	25.026	p = .5362
Total	207	5161.611		

Model II estimate of between component variance = -.149

One Factor ANOVA X₁ : Recode of MEQ Y₁ : S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
A	59	23.966	5.327	.694
B	110	23.627	4.908	.468
C	39	24.667	4.754	.761

One Factor ANOVA X₁ : Recode of MEQ Y₁ : S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
A vs. B	.339	1.592	.088	.42
A vs. C	-.701	2.036	.23	.679
B vs. C	-1.039	1.838	.621	1.115

Multiple Correlation for SCAT on CSAI-2

Correlation Matrix for Variables: X₁ ... X₄

	SCAT	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...
SCAT	1			
CSAI-2 Prac...	.485	1		
CSAI-2 Prac...	.462	.418	1	
CSAI-2 Prac...	-.52	-.593	-.409	1

Note: 1 case deleted with missing values.

Correlation Matrix for Variables: X₁ ... X₇

	SCAT	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...
SCAT	1						
CSAI-2 E...	.597	1					
CSAI-2 E...	.672	.596	1				
CSAI-2 E...	-.49	-.585	-.358	1			
CSAI-2 E...	.602	.787	.542	-.567	1		
CSAI-2 E...	.544	.422	.726	-.378	.581	1	
CSAI-2 E...	-.388	-.51	-.405	.649	-.673	-.657	1

Note: 11 cases deleted with missing values.

Correlation Matrix for Variables: X₁ ... X₁₀

	SCAT	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...	CSAI-2 ...
SCAT	1							
CSAI-2 L...	.427	1						
CSAI-2 L...	.519	.401	1					
CSAI-2 L...	-.356	-.606	-.453	1				
CSAI-2 L...	.443	.847	.363	-.534	1			
CSAI-2 L...	.465	.291	.696	-.12	.373	1		
CSAI-2 L...	-.405	-.457	-.314	.639	-.579	-.259	1	
CSAI-2 L...	.491	.792	.355	-.561	.906	.307	-.594	1
CSAI-2 L...	.457	.355	.693	-.196	.402	.89	-.238	.383
CSAI-2 L...	-.343	-.533	-.353	.815	-.591	-.197	.905	-.643

Note: 18 cases deleted with missing values.

Correlation Matrix for Variables: X₁ ... X₁₀

	CSAI-2 ...	CSAI-2 ...
CSAI-2 Leag...	1	
CSAI-2 Leag...	-.261	1

One Way ANOVA by Gender for the Dimensions of Anxiety

One Factor ANOVA X₁ : Gender Y₁ : Cognitive

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	132.403	132.403	4.405
Within groups	278	8355.54	30.056	p = .0367
Total	279	8487.943		

Model II estimate of between component variance = .733

One Factor ANOVA X₁ : Gender Y₁ : Cognitive

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	132	18.758	4.811	.419
Female	148	20.135	6.018	.495

One Factor ANOVA X₁ : Gender Y₁ : Cognitive

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-1.378	1.292*	4.405*	2.099

* Significant at 95%

One Way ANOVA by Gender for the Dimensions of Anxiety

One Factor ANOVA X₁ : Gender Y₁ : Somatic

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	99.349	99.349	3.694
Within groups	278	7476.236	26.893	p = .0556
Total	279	7575.586		

Model II estimate of between component variance = .519

One Factor ANOVA X₁ : Gender Y₁ : Somatic

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	132	16.462	4.444	.387
Female	148	17.655	5.767	.474

One Factor ANOVA X₁ : Gender Y₁ : Somatic

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnnett t:
Male vs. Female	-1.193	1.222	3.694	1.922

One Way ANOVA by Gender for the Dimensions of Anxiety

One Factor ANOVA X₁ : Gender Y₁ : S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	441.661	441.661	18.403
Within groups	278	6671.925	24	p = .0001
Total	279	7113.586		

Model II estimate of between component variance = 2.993

One Factor ANOVA X₁ : Gender Y₁ : S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	132	25.523	4.485	.39
Female	148	23.007	5.24	.431

One Factor ANOVA X₁ : Gender Y₁ : S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	2.516	1.155*	18.403*	4.29

* Significant at 95%

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base Cog.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	15.704	15.704	.589
Within groups	53	1413.678	26.673	p = .4463
Total	54	1429.382		

Model II estimate of between component variance = -.4

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base Cog.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	26	17.654	4.988	.978
Female	29	18.724	5.318	.987

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base Cog.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-1.07	2.798	.589	.767

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base Som.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	97.81	97.81	4.545
Within groups	53	1140.626	21.521	p = .0377
Total	54	1238.436		

Model II estimate of between component variance = 2.782

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base Som.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	26	13.846	4.027	.79
Female	29	16.517	5.124	.952

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base Som.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnnett t:
Male vs. Female	-2.671	2.513*	4.545*	2.132

* Significant at 95%

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	108.275	108.275	4.051
Within groups	53	1416.707	26.73	p = .0492
Total	54	1524.982		

Model II estimate of between component variance = 2.974

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	26	26.5	5.398	1.059
Female	29	23.69	4.958	.921

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Prac.: Base S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	2.81	2.801*	4.051*	2.013

* Significant at 95%

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Ex. 1: Cog.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	9.768	9.768	.309
Within groups	47	1487.865	31.657	p = .5812
Total	48	1497.633		

Model II estimate of between component variance = -.897

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Ex. 1: Cog.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	23	19.913	5.274	1.1
Female	26	20.808	5.92	1.161

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Ex. 1: Cog.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-.895	3.24	.309	.555

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X 1 : Gender Y 3 : CSAI-2 Ex. 1: Som.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	51.631	51.631	1.764
Within groups	47	1375.92	29.275	p = .1906
Total	48	1427.551		

Model II estimate of between component variance = .916

One Factor ANOVA X 1 : Gender Y 3 : CSAI-2 Ex. 1: Som.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	23	17.174	4.207	.877
Female	26	19.231	6.282	1.232

One Factor ANOVA X 1 : Gender Y 3 : CSAI-2 Ex. 1: Som.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-2.057	3.116	1.764	1.328

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₄ : CSAI-2 Ex. 1: S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	84.55	84.55	4.034
Within groups	47	985.124	20.96	p = .0504
Total	48	1069.673		

Model II estimate of between component variance = 2.605

One Factor ANOVA X₁ : Gender Y₄ : CSAI-2 Ex. 1: S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	23	24.478	3.883	.81
Female	26	21.846	5.112	1.003

One Factor ANOVA X₁ : Gender Y₄ : CSAI-2 Ex. 1: S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	2.632	2.637	4.034*	2.008

* Significant at 95%

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X ₁ : Gender Y ₅ : CSAI-2 Ex. 2: Cog.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	33.847	33.847	.985
Within groups	46	1580.07	34.349	p = .3261
Total	47	1613.917		

Model II estimate of between component variance = -.021

One Factor ANOVA X ₁ : Gender Y ₅ : CSAI-2 Ex. 2: Cog.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	22	19.045	5.305	1.131
Female	26	20.731	6.29	1.234

One Factor ANOVA X ₁ : Gender Y ₅ : CSAI-2 Ex. 2: Cog.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-1.685	3.418	.985	.993

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X ₁ : Gender Y ₆ : CSAI-2 Ex. 2: Som.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	100.606	100.606	3.12
Within groups	46	1483.206	32.244	p = .084
Total	47	1583.812		

Model II estimate of between component variance = 2.868

One Factor ANOVA X ₁ : Gender Y ₆ : CSAI-2 Ex. 2: Som.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	22	16.864	5.817	1.24
Female	26	19.769	5.559	1.09

One Factor ANOVA X ₁ : Gender Y ₆ : CSAI-2 Ex. 2: Som.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-2.906	3.311	3.12	1.766

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X ₁ : Gender Y ₇ : CSAI-2 Ex. 2: S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	92.774	92.774	2.848
Within groups	46	1498.476	32.576	p = .0983
Total	47	1591.25		

Model II estimate of between component variance = 2.526

One Factor ANOVA X ₁ : Gender Y ₇ : CSAI-2 Ex. 2: S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	22	25.136	5.506	1.174
Female	26	22.346	5.872	1.152

One Factor ANOVA X ₁ : Gender Y ₇ : CSAI-2 Ex. 2: S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	2.79	3.328	2.848	1.688

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 1: Cog.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.122	.122	.004
Within groups	42	1249.764	29.756	p = .9492
Total	43	1249.886		

Model II estimate of between component variance = -1.35

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 1: Cog.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	21	19.286	4.617	1.007
Female	23	19.391	6.118	1.276

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 1: Cog.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-.106	3.323	.004	.064

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 1: Som.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.795	.795	.032
Within groups	42	1029.114	24.503	p = .8579
Total	43	1029.909		

Model II estimate of between component variance = -1.08

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 1: Som.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	21	17.095	3.767	.822
Female	23	16.826	5.82	1.214

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 1: Som.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	.269	3.015	.032	.18

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 1: S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	64.633	64.633	3.093
Within groups	42	877.549	20.894	p = .0859
Total	43	942.182		

Model II estimate of between component variance = 1.992

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 1: S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	21	25.905	4.582	1
Female	23	23.478	4.561	.951

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 1: S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	2.427	2.784	3.093	1.759

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 2: Cog.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	24.632	24.632	.861
Within groups	38	1087.143	28.609	p = .3593
Total	39	1111.775		

Model II estimate of between component variance = -.199

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 2: Cog.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	19	19	4	.918
Female	21	20.571	6.321	1.379

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 2: Cog.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-1.571	3.429	.861	.928

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 2: Som.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	16.812	16.812	.735
Within groups	38	869.088	22.871	p = .3966
Total	39	885.9		

Model II estimate of between component variance = -.304

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 2: Som.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	19	17.632	3.715	.852
Female	21	16.333	5.571	1.216

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 2: Som.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	1.298	3.066	.735	.857

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 2: S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	35.716	35.716	1.616
Within groups	38	839.659	22.096	p = .2113
Total	39	875.375		

Model II estimate of between component variance = .683

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 2: S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	19	25.368	3.218	.738
Female	21	23.476	5.715	1.247

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 2: S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	1.892	3.013	1.616	1.271

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 3: Cog.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	99.889	99.889	3.13
Within groups	42	1340.542	31.918	p = .0841
Total	43	1440.432		

Model II estimate of between component variance = 3.096

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 3: Cog.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	21	17.81	4.49	.98
Female	23	20.826	6.527	1.361

One Factor ANOVA X₁ : Gender Y₁ : CSAI-2 Leag. 3: Cog.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-3.017	3.442	3.13	1.769

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 3: Som.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.237	.237	.009
Within groups	42	1066.195	25.386	p = .9235
Total	43	1066.432		

Model II estimate of between component variance = -1.145

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 3: Som.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	21	16.81	3.995	.872
Female	23	16.957	5.827	1.215

One Factor ANOVA X₁ : Gender Y₂ : CSAI-2 Leag. 3: Som.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	-.147	3.069	.009	.097

One Way ANOVA by Gender for each Level of Competition

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 3: S.C.

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	58.814	58.814	2.668
Within groups	42	925.822	22.043	p = .1099
Total	43	984.636		

Model II estimate of between component variance = 1.675

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 3: S.C.

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	21	25.619	3.708	.809
Female	23	23.304	5.439	1.134

One Factor ANOVA X₁ : Gender Y₃ : CSAI-2 Leag. 3: S.C.

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Male vs. Female	2.315	2.86	2.668	1.633

One Way ANOVA by Gender for the Recoded MEQ

One Factor ANOVA X₁ : Gender Y₁ : Recode of MEQ

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.607	.607	1.31
Within groups	206	95.47	.463	p = .2537
Total	207	96.077		

Model II estimate of between component variance = .001

One Factor ANOVA X₁ : Gender Y₁ : Recode of MEQ

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Male	100	1.96	.695	.07
Female	108	1.852	.667	.064

One Factor ANOVA X₁ : Gender Y₁ : Recode of MEQ

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnnett t:
Male vs. Female	.108	.186	1.31	1.145

One Way ANOVA by New Levels of Competition for the Recoded MEQ

One Factor ANOVA X 1 : New Levels Of Competition Y 1 : Recode of MEQ

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.224	.224	.481
Within groups	206	95.853	.465	p = .4888
Total	207	96.077		

Model II estimate of between component variance = -.002

One Factor ANOVA X 1 : New Levels Of Competition Y 1 : Recode of MEQ

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Exhibition	87	1.943	.635	.068
League	121	1.876	.714	.065

One Factor ANOVA X 1 : New Levels Of Competition Y 1 : Recode of MEQ

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Exhibition vs. League	.066	.189	.481	.693

One Way ANOVA by All Levels of Competition for the Recoded MEQ

One Factor ANOVA X₁ : Level of Competition Y₁ : Recode of MEQ

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	4	.389	.097	.207
Within groups	203	95.688	.471	p = .9346
Total	207	96.077		

Model II estimate of between component variance = -.009

One Factor ANOVA X₁ : Level of Competition Y₁ : Recode of MEQ

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Exhibition 1	45	1.978	.621	.093
Exhibition 2	42	1.905	.656	.101
League 1	41	1.902	.735	.115
League 2	39	1.872	.695	.111
League 3	41	1.854	.727	.113

One Way ANOVA by All Levels of Competition for the Recoded MEQ

One Factor ANOVA X₁ : Level of Competition Y₁ : Recode of MEQ

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Exhibition 1 vs. Exhibitio...	.073	.29	.061	.496
Exhibition 1 vs. League 1	.075	.292	.065	.508
Exhibition 1 vs. League 2	.106	.296	.124	.706
Exhibition 1 vs. League 3	.124	.292	.175	.837
Exhibition 2 vs. League 1	.002	.297	5.937E-5	.015

One Factor ANOVA X₁ : Level of Competition Y₁ : Recode of MEQ

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Exhibition 2 vs. League 2	.033	.301	.012	.216
Exhibition 2 vs. League 3	.051	.297	.029	.339
League 1 vs. League 2	.031	.303	.01	.2
League 1 vs. League 3	.049	.299	.026	.322
League 2 vs. League 3	.018	.303	.003	.118

APPENDIX G

Gender by New Levels of Competition Factorial Design ANOVA - Secondary Hypothesis One

Anova table for a 2-factor Analysis of Variance on Y₁ : Cognitive

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Gender (A)	1	105.231	105.231	3.508	.0621
New Levels Of Compe...	2	131.747	65.874	2.196	.1132
AB	2	2.642	1.321	.044	.9569
Error	274	8219.921	30		

There were no missing cells found.

The AB Incidence table on Y₁ : Cognitive

New Levels Of...		Practice	Exhibition	League	Totals:
Gender	Male	26 17.654	45 19.489	61 18.689	132 18.758
	Female	29 18.724	52 20.769	67 20.254	148 20.135
Totals:		55 18.218	97 20.175	128 19.508	280 19.486

Gender by New Levels of Competition Factorial Design ANOVA - Secondary Hypothesis One

Anova table for a 2-factor Analysis of Variance on Y 2 : Somatic

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Gender (A)	1	151.683	151.683	5.954	.0153
New Levels Of Compe...	2	334.487	167.243	6.565	.0016
AB	2	155.685	77.842	3.055	.0487
Error	274	6980.576	25.477		

There were no missing cells found.

The AB Incidence table on Y 2 : Somatic

New Levels Of...		Practice	Exhibition	League	Totals:
Gender	Male	26 13.846	45 17.022	61 17.164	132 16.462
	Female	29 16.517	52 19.5	67 16.716	148 17.655
Totals:		55 15.255	97 18.351	128 16.93	280 17.093

Anxiety by New Levels of Competition Factorial Design ANOVA - Secondary Hypothesis One

Anova table for a 2-factor Analysis of Variance on Y 1 : S.C.

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Gender (A)	1	410.661	410.661	17.166	.0001
New Levels Of Compe...	2	111.034	55.517	2.321	.1001
AB	2	4.799	2.4	.1	.9046
Error	274	6554.79	23.923		

There were no missing cells found.

The AB Incidence table on Y 3 : S.C.

New Levels Of...		Practice	Exhibition	League	Totals:
Gender	Male	26 26.5	45 24.8	61 25.639	132 25.523
	Female	29 23.69	52 22.096	67 23.418	148 23.007
Totals:		55 25.018	97 23.351	128 24.477	280 24.193

Commission of Mental Errors by New Levels of Competition Factorial Design ANOVA -
Secondary Hypothesis Two

Anova table for a 2-factor Analysis of Variance on Y   1 : MEQ

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Gender (A)	1	.552	.552	.453	.5015
Level of Competition ...	4	.584	.146	.12	.9754
AB	4	.627	.157	.129	.972
Error	270	329.285	1.22		

There were no missing cells found.

The AB Incidence table on Y   1 : MEQ

Level of Comp...		Exhibition...	Exhibition...	League 1	League 2	League 3	Totals:
Gender	Male	27 2.481	27 2.519	27 2.444	27 2.519	27 2.481	135 2.489
	Female	29 2.276	29 2.345	29 2.483	29 2.517	29 2.379	145 2.4
Totals:		56 2.375	56 2.429	56 2.464	56 2.518	56 2.429	280 2.443