Abstract

In today's competitive sporting environment, athletes are continually searching for ways to optimize their performance. One of the primary means of accomplishing this goal is by attaining what has been termed optimal arousal levels (Brustad & Weiss, 1987; Harger & Raglin, 1994). Numerous speculations have been put forth and explored in past literature, concerning the relationship between optimal arousal and sport performance. Despite this, the relationship itself still remains clouded. The purpose of this study was to address the lack of research conducted utilizing the directionality dimension with the IZOF model in team sports. Nineteen male varsity hockey players were followed across one complete season. Athletes completed the DM-CSAI-2, and had their performance subjectively rated by the coaching staff after each game. Further analysis was completed on 6 athletes who fit the criteria for testing the IZOF model in sport. Upon completion of inter-individual analysis, no significant findings were reported for performance when inside or outside of optimal zone, or for interpretation when inside or outside of optimal zone. Data was further analyzed intra-individually. Each athlete presented with differing results; support, partial support, and no support for the IZOF model was noted. Upon conclusion of this research study, many limitations were noted with ability of the IZOF model to be used in team sport.

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To my classmates and friends, **WE DID IT!**

Lastly, to future graduate students I believe Sir Winston Churchill (1874-1965) says it the best, "If you are going through hell, keep going."

TESTING THE IZOF DIRECTIONALITY MODEL IN A TEAM SPORT

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I. Introduction

In today's competitive sporting environment, athletes are continually searching for ways to optimize their performance. One of the primary means of accomplishing this goal is by attaining what has been termed optimal arousal levels (Brustad & Weiss, 1987; Harger & Raglin, 1994; LeUnes & Nation, 2002). Optimal arousal is defined as "a level of arousal that is ideal for the task at hand" (Cox, 1998, p.90). In sport, optimal arousal is theorized to be task specific. For instance, gross motor tasks, such as kicking a soccer ball or throwing a football, may require greater levels of optimal arousal than fine motor tasks, such as putting a golf ball or shooting a bow and arrow. Optimal arousal levels have also been theorized to vary between athletes themselves. For example, novice athletes may require lower arousal levels than elite athletes (Williams, Landers & Boutcher, 1993).

Numerous speculations concerning the relationship between optimal arousal and sport performance have been put forth and explored in past literature. Despite this, the relationship itself still remains clouded. Understanding this relationship is presently of the utmost significance to athletes, coaches and sport psychologists (D'Urso, Petrosso & Robazza, 2002). The goal of this gain in knowledge is to develop a specific performance prediction tool, for example a grid in which athletes can self-reference scores and view recommended psychological skills to utilize, which may aid performers in attaining higher levels of athletic prowess (Annesi, 1998; Gould & Udry, 1994; Hanin, 1980, 1997; Hardy, Gould, & Jones, 1996; Robazza, Bortoli & Hanin, 2004).

1.1 Definitions

In order to better grasp the concept of optimal arousal, a few terms must be clarified. Arousal refers to the activation of a person's physiological and psychological components, and can vary from deep sleep to frenzy (Gould, Greenleaf, & Krane, 2002). Anxiety refers to negative emotional states, generally characterized by worry, nervousness and apprehension (Smith, Smoll & Wiechman, 1998). In past sporting literature, arousal and anxiety have been used interchangeably in reference to negative aspects of performance (Balague, 2005; Cox, 1986; Kleine, 1990). For example, athletes' reports such as "I choked," have been cited as resulting from uncontrolled levels of arousal and anxiety. It has now been acknowledged that both arousal and anxiety can have facilitating as well as debilitating effects, depending on the sport, the specific task and the individual athlete (Jones & Swain, 1992; Mellalieu, Hanton & Jones, 2003).

Delving into the overarching concept of anxiety, there are two subcomponents that form this construct, trait and state anxiety. Athletes enter sport with certain predispositions, which are part of the athlete's personality. These personality differences produce different behavioural reactions to arousal and anxiety (Hoar, 2007). This predisposition is termed trait anxiety. Trait anxiety is defined specifically as, "relatively stable individual differences in anxiety proneness, that is...differences between people in the tendency to respond to situations perceived as threatening with elevations in A-state intensity." (Spielberger, Gorsuch & Lushene, 1970, p. 2).

State anxiety, also referred to as A-state, is defined as, "a temporary, ever changing emotional state of subjective, consciously perceived feelings of apprehension and tension, associated with activation of the autonomic nervous system" (Spielberger, 1966, p.17). Unlike trait anxiety, state anxiety is not a predisposition; it is the athlete's continuously changing state experience prior to,

during and after competition. For example, a soccer player may feel highly anxious prior to kick off, her heart racing and palms sweating, but once the ball has been kicked levels of anxiety may decline, her breathing rate and heart rate may slow down. This level may change again, if perhaps she is faced with a breakaway opportunity later in the game. This example concentrates on the physical aspects of anxiety; however there are also mental elements of anxiety being experienced by this athlete.

Both of these aspects of anxiety, physical and mental, are included as subdivisions of state anxiety, and are differentiated as somatic and cognitive state anxiety respectively. Somatic anxiety is the perception of one's physiological activation, which can change from moment-to-moment. Somatic anxiety is thought to be the conditioned responses to non-evaluative cues in the sporting environment, for example pre-game warm-up routines and fear of physical harm (Jones, Swain & Cale, 1991; Lane, Rogder & Karageorghis, 1997; Martens, Burton, Vealey, Bump & Smith, 1990). Cognitive anxiety refers to the extent of negative thoughts and worries one has, and has been noted to relate to factors in the environment which influence perceptions of success and failure, for example perceptions of opponents skill level or of one's own skill level (Gould, Petlichkoff & Weinberg, 1984; Hanton, Jones & Swain, 1994; Hardy, & Jones, 1992; Jones, Swain & Cale, 1990, 1991; Lane, Rodger & Karageorghis, 1997).

Before proceeding into further discussion, one important note must be made. Presently anxiety refers specifically to a negative emotional state. Focus should be drawn to the use of the word "negative." Jones and Swain (1995) note that it is doubtful for a positive interpretation of anxiety, in which cognitive and somatic symptoms are viewed positively, to be labeled "anxiety." They refer to the use of words such as motivated, psyched up or excited versus the term anxiety. This notion,

which parallels findings indicating that it is one's interpretation of anxiety that influences performance, rather than intensity (Jones & Swain, 1992; Butt, Weinberg & Horn, 2003), should imply the further development of more descriptive terms in attempting to understand the complex performance-anxiety relationship. Perhaps it is necessary to develop a new term to describe the positive interpretation of what is now called anxiety, or perhaps the definition of anxiety must undergo some alteration to incorporate both positive and negative aspects, such as the terms distress and eustress, which are used to in stress research (Lazarus, 2000; Selye, 1983). Therefore, the present study is limited by the use of the term anxiety, which does not allow for the separation of both positive and negative symptoms and interpretations.

1.2 Pre-competitive State Anxiety

Previous research has identified pre-competitive state anxiety as a major contributing factor in optimal performance in athletics (Harger & Raglin, 1994; Mahoney & Meyers, 1989). Pre-competitive state anxiety is the degree of state anxiety present prior to the beginning of competition. In the past, anxiety has been studied as a unidimensional construct (Anshel, 1994), meaning that the psychological tests completed in research, examine only one dimension of anxiety. Recently, the multidimensional nature of anxiety has been recognized and accepted in the realm of sport psychology research (Cohen, Pargman & Tenenbaum, 2003; Craft, Magyar, Becker & Feltz, 2003; Krane, 1994). Researchers must not simply concentrate on one aspect of anxiety, but must take into account state and trait anxiety, as well as somatic and cognitive state anxiety (Liebert & Morris, 1967). This is to ensure a complete depiction of pre-competition anxiety in athletics.

1.3 Performance-Anxiety Relationship

Utilizing the multidimensional aspects of anxiety, researchers have obtained information pertaining to overall cognitive and somatic state anxiety and their impacts on athletic performance. It has been established that pre-competitive cognitive anxiety starts high and remains relatively elevated and fixed as the start of competition draws nearer (Fenz & Jones, 1972). Somatic anxiety, alternatively, begins comparatively low until approximately 24 hours pre-competition, where we begin to see a swift, significant increase as competition draws nearer (Gould, Petlichkoff, & Weinberg, 1984; Krane & Williams, 1987; Martens, Burton, Vealey, Bump & Smith, 1990; Ussher & Hardy, 1986). Throughout the competition, cognitive anxiety levels fluctuate in response to success/failure probability, whereas a quick decline in somatic anxiety has been observed (Hardy & Parfitt, 1991; Jones & Cale, 1989; Jones et al., 1991; Martens et al., 1990; Parfitt, Hardy & Pates, 1995; Wiggins, 1998).

A small number of research studies have reported inconsistencies in these relationships (Thomas, Hanton & Maynard, 2004). These inconsistencies are thought to result from the concentration on the intensity dimension of anxiety, without acknowledging the directional aspect as well (Jones, 1995; Woodman & Hardy, 2001).

1.4 State Anxiety Measures

Pre-competitive anxiety can be measured in a variety of ways, including physiological measures such as heart rate and breathing rate, and self-report measures, for example paper and pencil questionnaires. There are several advantages and disadvantages of both measurement methods. Burton (1998) and LeUnes and Nation (2002) list some advantages to physiological measures. The first advantage is their objective nature. There is no dependence on the spoken word to relay what the athlete is experiencing. Secondly, self-awareness is not needed. Athletes do not have to be

able to reflect on their performance and on their feelings in order to communicate the appropriate information to the researcher. Lastly, disruptions caused by asking athletes to stop warm-up routines or performance, in order to complete questionnaires, are avoided.

There are also several major limitations to using physiological state anxiety measures (Burton, 1998; LeUnes & Nation, 2002). The first limitation pertains to the individual differences in responses to anxiety. As Raglin and Hanin (2000) note, one individual may pace, a physiological symptom, however pacing may not simply be a reaction to anxiety, but perhaps a mechanism used to effectively cope with anxiety. Athletes may show increases in heart rate, but not report feeling anxious, while others may report slight increases in heart rate as being self-consuming, and extremely detrimental to performance. Therefore researchers do not have a "standard" to set anxiety responses to, leaving grey areas where subjective measures take over. Secondly, the differences may be so minute that different results may be reported depending on the measurement guide used by the researcher. Thirdly, and most relevant to the sport domain, is the inability for physiological measures to be accurately assessed while athletes are in a continuous, altering state of movement. Finally, it is difficult to differentiate between what constitutes a physiological anxiety measure and a physiological arousal measure as both may manifest in the same manner (Burton, 1998; LeUnes & Nation, 2002). This notion also reflects the weakness of term definitions in the anxiety-arousal literature, as anxiety would be considered the solely negative physiological symptoms.

Due to these limitations, the majority of sport psychology researchers have elected to use self-report measures, generally in the form of paper and pencil questionnaires, to measure anxiety (Harger & Raglin, 1994). Self-report measures are

limited by their pre-competition disruption and subjective interpretation; however researchers have now provided options to counterbalance these limitations. Several short versions of pre-competitive anxiety questionnaires have been put forth in order to minimize the disruption of pre-competition routines and performance. Authors have also adjusted administration time of questionnaires, as in the D'Urso et. al. (2002) rugby study. The authors employed monitoring procedures once a week, to reduce this interference.

Earlier research examining the anxiety-performance relationship relied heavily on the self-report measure titled Spielberger's State-Trait Anxiety Inventory (STAI) (Spielberger, Gorush, & Lushene, 1970). This questionnaire is a self-report measure which assesses levels of both state and trait anxiety. The STAI consists of two sets of 20 questions, one set measuring trait anxiety, the other state anxiety, with each item being rated on a 4-point Likert scale. Reponses to this measure produce scores ranging from 20-80. Test-retest reliability correlations of the STAI, have been reported by Spielberger et al. (1970) as ranging from .73 to .84 for both genders. Crocker and Algina (1986) note that there are no clear standards for establishing acceptable values for test-retest reliability, but quality personality tests have reported coefficients of approximately .80, meaning the STAI appears to consistently measure the construct it is intended to. Internal consistency reliability coefficients are reported as ranging from .83 to .92. These coefficients relate to how well items of a test measure the same construct (Trochim, 2001), again supporting that the STAI measures what it is intended to measure. This measure was frequently used in past literature. It is generally agreed that the STAI, although aiding in anxiety measurement advancement, has outlived its usefulness due to its separation of state and trait anxiety (Smith, Smoll & Wiechman, 1998). Several theories, including

multidimensional anxiety theory and individualized zones of optimal functioning theory, have now proposed that both types of anxiety *interact* to affect performance, therefore an appropriate measure of the multidimensional nature of anxiety must now be utilized.

It is important to discuss an additional measurement tool, which was regularly utilized in past research. The Competitive State Anxiety Inventory (CSAI) was developed by Martens, Burton, Rivkin and Simon in 1980. This inventory was modified from the STAI in order to distinctively measure competitive anxiety related to sport. Ten items were selected by Martens, on the basis of best reflection of competitive anxiety, from the original 20-item STAI and put to a 4-point Likert scale. Initial research using this tool proved promising (Gruber & Beauchamp, 1979; Martens, et al., 1980; Martens et al., 1990), with results indicating high internal consistency, and alpha reliability coefficients ranging from .94 to .97. This confirmed that the CSAI was a more accurate tool in measuring sport specific pre-competitive anxiety, than were the general anxiety tools previously utilized (Martens et al., 1980). The use of this measure also aided in advancing research, but like the STAI its use quickly dissipated, as the multidimensional nature of anxiety became apparent (Burton, 1998).

Upon the identification of the multidimensional nature of anxiety, Martens, et al. (1990) modified the CSAI to include both cognitive and somatic state anxiety, as well as a self-confidence dimension, and titled the new questionnaire the CSAI-2. Initially, the reconstruction of the CSAI to the CSAI-2 included 102 items measuring not only cognitive and somatic state anxiety and self-confidence, but also fear of physical harm and general anxiety (Burton, 1998). The items were rated for face validity, syntax and clarity, by three independent judges. Subsequent versions, of

which there were five, of the CSAI-2 were developed in a step-by-step process, each step including the review of items by large numbers of participants and confirmatory statistical analysis. The final version of the CSAI-2, the one most widely used today, includes the three subscales of somatic state anxiety, cognitive state anxiety and state self-confidence. Each subscale is allotted 9-items on the questionnaire. In total then, the CSAI-2 is composed of 27-items, each are rated on a 4-point Likert scale, producing scores ranging from 9 to 36. Research indicates internal consistency values ranging from .76 to .91 (Hammermesiter & Burton, 1995; Jones & Hanton, 1996; Krane, 1993, Martens, et al., 1990; Ryska, 1993; Taylor, 1987). Presently, the CSAI-2 is a generally accepted and widely used self-report tool in sport anxiety research (LeUnes & Nation, 2002).

Several short versions of the CSAI-2 have been developed in attempts to make data collection more efficient and less intrusive. The Anxiety Rating Scale (ARS) was developed by Cox, Russell, and Robb (1998; 1999). The original items of the CSAI-2 were used, and put into a stepwise multiple regression analysis, to compound the original 27-items into three-items for each of the three subscales (total nine items). These three items were then collapsed into one-item, representing each of the three subscales (total three items), and rated on a 7-point Likert scale. Cox et al., (1998; 1999) established the concurrent validity of the ARS with team sport athletes and with individual athletes, respectively. Concurrent validity is established by administering a questionnaire to two distinct groups, and analyzing the results in order to confirm that the questionnaire distinguishing between the groups used (Trochim, 2001). Research has indicated that scores on the ARS have been shown to correlate with Martens et al.'s inventory (.60-.70) (Cox et al, 1998; 1999).

Similar to the CSAI, the ARS was also recently modified. Cox, Robb and Russell (1999) reverted back to the original list of nine items per construct, and subjectively choose one item, which they believed to best represent each subscale. This three-item list became what is now known as the ARS-2. The subscales of the ARS-2 provided higher correlations with the CSAI-2 (r =.67 for cognitive anxiety, r =.69 for somatic state anxiety, r =.75 for self-confidence; Cox , Robb & Russell, 1999) than did the original ARS.

Akin to Cox et al. (1989), Murphy, Greenspan, Jowdy and Tammen (1989) developed a questionnaire to aid in time constraints with athletes prior to competition, and to act as a field measure for the CSAI-2. It is titled the mental readiness form (MRF). The MRF is comprised of three items, a single item allotted to each of the CSAI-2 subscales. These items are marked using a 10-cm line, with either end representing a high and low level of each subscale. The MRF was modified by Krane (1994) who added an 11-point Likert scale, and termed the scale the MRF-2. She then further modified the scale to include more descriptive end points, naming the scale the MRF-3. Reliability coefficients are not possible to correlate with a single item measure (Burton, 1998). However, the few studies that have used this measure report moderate correlations between all three versions of the MRF and the items of the CSAI-2 (Krane, 1994).

The latest self-report measure to be developed and utilized in anxiety research is called the directional modification of the competitive state anxiety inventory-2 (DM-CSAI-2). This tool was developed in response to the acknowledgement of the importance of directionality in competitive anxiety research (Jones & Swain, 1992). This acknowledgment stemmed from research reporting no significant findings on the intensity measure of anxiety (CSAI-2) in relation to performance, but finding

significant differences in the interpretation of anxiety by athletes (Jones & Swain, 1992). This self-report measure incorporates a directional scale, alongside the 27-items of the original CSAI-2. The directional scale simply asks the athlete to identify whether each CSAI-2 item is interpreted as facilitative or debilitative to their performance. The modified CSAI-2 is rated on a 7-point Likert scale, from -3 (very debilitative) to +3 (very facilitative). Initial studies completed by Jones and Hanton (1996) reported internal consistency reliability values of .89 for cognitive state anxiety and .81 for somatic state anxiety, providing evidence that the scores are reliable.

With this knowledge and understanding of measurement tools and terms, it is appropriate to now explore anxiety-performance theories. These theories have been developed and offered in attempts to calculate and explain the nature of pre-competitive anxiety, and its impacts on performance.

1.5 Inverted-U Theory

Perhaps the most widely acknowledged and employed theory of anxiety is the Inverted-U theory (Gould & Tuffey, 1996). Before commencing a discussion regarding the inverted-U it is important to acknowledge the use of both arousal and pre-competitive state anxiety as terms within this theory. Although, as covered earlier, state anxiety is a specific aspect of arousal, Inverted-U theory uses the terms interchangeably to characterize the same facet.

Inverted-U theory was developed by Yerkes and Dobson in 1908. It hypothesizes that the relationship between performance and arousal is curvilinear, and takes the form of an inverted-U. It assumes that all athletes reach optimal performance in the midrange of the arousal continuum. If arousal levels are too low or too high, athletes will experience a poor performance. If the athlete experiences moderate arousal, their resulting performance will be optimal.

In addition to the general arousal-performance predictions, the Inverted-U also makes specific hypotheses concerning the type of sporting task involved (Yerkes & Dobson, 1908). It hypothesizes that for gross motor tasks high levels of arousal are needed to attain optimal performance. The opposite is alleged true for fine motor tasks, as the theory predicts that lower levels of arousal are needed to achieve optimal performance. For example, for a fine motor task such as golf, athletes in the lower portion of the moderate arousal range experience optimal performance. For a gross motor task, such as weightlifting, athletes must be in the high portion of the moderate arousal range in order to experience optimal performance. Furthermore the theory attempts to explain the differences in relation to arousal and skill level. Beginners are theorized to require lower levels of arousal, as when arousal is too high, relevant cues are blocked out, resulting in poor performance (Easterbrook, 1959). Alternatively elite athletes, or high level athletes, are believed to require high levels of arousal, because when arousal is too low, too many irrelevant cues are taken in, again resulting in poor performance.

The Inverted-U has been the most researched theory utilized in pre-competitive anxiety research to date (Gould & Tuffey, 1996). Numerous studies have provided support for the theory's hypotheses. Klavora (1978) conducted a study, which measured the pre-competitive state anxiety levels of 145 male high-school basketball players. Upon completion of the games played, coaches rated each player's performance as low, average or exceptional. Results indicated that players were reported as having their best performances when at their moderate range of pre-competitive anxiety. Worst performances were reported when players had either low or high pre-competitive anxiety levels. When plotted on a table the data take the form of an Inverted-U, supporting the tenets proposed by Yerkes and Dobson (1908).

Another study that supported the Inverted-U theory was published by Sonstroem and Bernardo in 1982. Thirty female basketball players were studied in order to examine the levels of anxiety present in three games played and their subsequent relationship to performance. They also examined the impacts of trait anxiety on performance. Upon assessment of anxiety and performance data, it was established that performance across all trait anxiety levels increased and decreased in relation to state anxiety levels. It was found that basketball performance was at its best when the athletes were within the moderate range of arousal. This finding was replicated in a study completed by Arent and Landers (2003), using 104 college participants, completing a simple response time task. Results indicated that performance took the shape of an Inverted-U.

Partial support was found for the Inverted-U theory by Martens and Landers in 1970. Male high school athletes were separated into three trait anxiety groups: low, medium, and highly anxious athletes, and subjected to three separate levels of psychological stress. Results indicated that for both the stress and anxiety factors individually, support was found for the Inverted-U curve. However, when combined, the result did not support the Inverted-U curve.

Not all research testing the Inverted-U theory has provided support for the hypotheses. Turner and Raglin (1995) tested the variability in pre-competition anxiety and the ensuing performances of sixty-seven track and field athletes. Each athlete completed the state portion of the STAI, and a retrospective recall measure of pre-competitive anxiety. There were no significant differences ($p>0.05$) found between athlete's performances when they were inside or outside of the moderate range of arousal. This fails to support the tenets of the Inverted-U theory. The explanation offered by the authors described the complexity of the anxiety-performance

relationship, noting that the nature of the inverted-U may be too simplistic to account for all of the interactions involved in the relationship.

Recently there have been numerous limitations and criticisms of the Inverted-U theory documented. The leading criticism cited in the literature is the assemblage of all athletes' optimal performance being attained within the moderate range of arousal (Landers & Arent, 2001). Although the theory differentiates between sports and between skill levels, it does not acknowledge individual differences amongst athletes in the same sport and at the same level. For example, because an athlete has reached the elite level of their sport does not mean that their optimal arousal level will be identical to another elite athlete in the same sport. This is assumed to be true in the tenets of the Inverted-U theory.

This limitation is due to the researching of the unidimensional nature of the Inverted-U theory (Krane, 1992; Woodman & Hardy, 2001). In the example given earlier, two elite archers will undoubtedly differ in personality predispositions, as well, depending on the competition they are in, their state anxiety levels will be changing, and not in identical patterns to one another. These, possibly minute, subtle differences can have enormous impacts on performance, causing one athlete to "choke" and one athlete to triumph. Therefore, the relationship between performance and pre-competition anxiety cannot be summed up, by merely positioning all athletes within equivalent confines; individuality and multidimensionality must be acknowledged.

Another significant criticism of the Inverted-U is the theory's invulnerability to falsification (Neiss, 1988). In order for a theory to be considered scientific, it must admit the possibility of being "false" (Popper, 1963). This simply means that even if it is the remotest possibility, a theory must be able to be proved wrong. For example,

if one sees a black dog, one cannot state that all dogs are black, because even if there is one dog that is white the statement is false. These blanket type statements, are termed universal, and are generally only accepted in concerns to scientific laws (Popper, 1963).

Neiss (1988) asserts that the Inverted-U theory makes universal statements, in that it can be adjusted to accommodate any results, which emerge from the research. For example, if a golfer is unsuccessful at completing a fine motor task, such as a short putt, it may be said that this specific task was slightly higher than "fine", and therefore required slightly higher levels of arousal. On the reverse, a football player may be extremely successful, making a magnificent tackle, yet he may consider himself highly aroused. In either example the Inverted-U would be correct, as the theory can claim small differences in arousal levels, making the performance outcome fall either below or above what is considered moderate arousal. It is the theory's dependence on constructing explanations after performance has occurred, versus predictions prior to performance beginning, which augments this weakness.

As stated previously, an additional problem lies in the relationship inferred by the theory. Does it propose a correlational or a casual relationship between arousal and performance? Hardy and Fazey (1988) commented on the inverted-U's inferred relationship, stating that this theory has "an apparent lack of predictive validity in practical situations" (p.4). Krane (1992) and Neiss (1988) are also significant critics of the Inverted-U's inferred relationship. They claim that the theory is not explanatory in nature, but is simply descriptive, inferring a relationship between anxiety and performance, but not furthering the understanding of cause and effect.

Trochim (2001) notes that in order for cause and effect to be established three criteria must be met. The first is temporal precedence, which states that in order to

prove a cause and effect relationship between two variables, you must be able to show that the cause happened *before* the effect. The Inverted-U theory does not state whether it is the arousal level an athlete has which subsequently impacts performance, or if it is the reverse, with level of performance subsequently impacting the athlete's level of arousal. The second criteria listed by Trochim (2001), is the covariation of the cause and effect. This includes establishing a relationship between two variables, in that when one is present the other is present, and when one is absent the other is also absent. Research has noted that optimal performance can be evident without the athlete experiencing moderate arousal, and vice versa, moderate arousal has been present, with optimal performance not present (Turner & Raglin, 1995). Lastly,

Trochim (2001) suggests that in order for cause and effect to be supported, there must be no other plausible explanations. With respect to the arousal performance relationship, alternative explanations such as opponent skill level (Thuot, Kavouras, & Kenefick, 1998), importance of competition (Slaminen, Liukkonen, Hanin, & Hyvonen, 1995), and self-confidence (Thomas, Maynard, & Hanton, 2004), have been noted in research. Due to the inability to meet these three criteria, it has been concluded that the theory is ineffective in furthering the understanding of the arousal and performance relationship.

1.6 Reversal Theory

Building from these criticisms, there have been four main alternatives to the Inverted-U theory advanced. The first of these theories to be discussed is Kerr's (1985, 1997) application of Apter's Reversal Theory (1982). Again, like the inverted-U, arousal and anxiety are used interchangeably to represent the same construct. The basic tenet of reversal theory is that performance is influenced by his or her interpretation of their arousal. This interpretation is influenced by the

metamotivational states of athletes, which includes telic (playful and activity seeking) and paratelic (serious and goal oriented). The theory postulates that when an athletes is in a telic state, high arousal will be interpreted as unpleasant anxiety, whereas if experienced in a paratelic state it would be interpreted as excitement (Naylor, Burton, & Crocker, 2002). When an athlete experiences low arousal in a telic state, interpretation is likely to be positive relaxation, compared to a paratelic state, which would result in an interpretation of negative boredom. The specific hypothesis forwarded by reversal theory, is that low cognitive anxiety and high somatic anxiety will result in best performance (Burton, 1997).

Research outside of the sport domain has found support for the tenets of reversal theory. Martin, Kuiper, Olinger, and Dobbin (1987) separated participants into two groups. Group one was instructed to play a video game for fun, group two was instructed to play the video game to the best of their ability, and were told they were being assessed by the experimenter. Heart rate and skin conductance were monitored, and participants were asked, every ten minutes, to report how they felt while playing the game. Those who were paratelic (playful) dominant reported significantly higher performance scores during the high stress condition, compared to those who were telic (serious) dominate. Overall telic dominate individuals reported being less satisfied with their performance, in both the non-stressful and moderately stressful conditions, than did the paratelic individuals.

Kerr and Cox (1988) completed a lab study, examining the effects of metamotivational state and telic dominance on the performance of a squash task. Results of the study suggested that those athletes who were of higher skill experienced less tension-stress, when compared to athletes of novice or average skill. Similar results were reported by Mackay, Cox, Burrows, and Lazzerini (1978) and Cox and

Mackay (1985), both reporting that athletes of higher skill levels, when compared to novice athletes, experienced lower stress, even when accompanied by high levels of arousal.

Specific to sport, support has also been found for the hypothesis presented by reversal theory. Athletes who are paratelic dominant, who are serious and goal-oriented, experience lower levels of somatic anxiety, characterized by lower heart rates and lower muscular tension, even when faced with highly arousing conditions (Svebak, 1982). Those individuals who are in a telic state, and are presented with arousing situations, such as a sport competition, report experiencing high levels of somatic symptoms, such as increases in heart rate and muscular tension (Svebak & Murgatroyd, 1985). Overall support for reversal theory has been found in both the non-sport setting and the sport setting. The findings presented by reversal theory have been updated by Jones (1995) and are now included, in part, in the facilitative-debilitative model.

1.7 Facilitative -Debilitative Model

The facilitative-debilitative model (Jones, 1995) poses that some stressor occurs in the athlete's environment (e.g., competing in a championship game). The way this stressor is experienced depends on individual-differences, such as one's self-confidence. These factors then allow the athlete to perceive a level of control over the stressor. If the athlete feels he/she has control over the stressor, the anxiety will be interpreted as facilitative. If the athlete feels he/she has little control and cannot cope with the stressor, then debilitative anxiety results. Facilitative anxiety has been found to enhance performance and debilitative anxiety to hinder performance (Butt et. al., 2003; Jones, 1995).

Testing the differences in facilitative versus debilitative anxiety, Jones and Swain (1995) conducted a study with male cricketers, who were divided into two groups, elite (n=68) and non-elite (n=65). Each athlete was administered the DM-CSAI-2. No differences were noted between the two groups with concern to the intensity dimension of anxiety. However, significant differences ($p<0.05$) were noted with respect to the directional aspect of anxiety. The elite group typically interpreted both somatic and cognitive anxiety as more facilitative than did the non-elite group, meaning that athletes at the higher skill level consistently reported anxiety as positive, while athletes at the lower skill level reported their anxiety as negative. This finding was again reported in a study of rugby players and rifle shooters (Hanton, Jones & Mullen, 2000).

Direction and intensity of anxiety were once more studied using sixty-two field hockey players (Butt et al., 2003). Each player completed the MRF thirty-minutes post competition. Changes in both direction and intensity throughout competition were studied. It was found that there were considerable variations of self-confidence intensity, cognitive anxiety intensity and direction and somatic anxiety intensity throughout competition. Self-confidence intensity and direction, and cognitive anxiety direction were found to be the best gauges of performance.

Overall reversal theory offers two key contributions to the comprehension of the arousal-performance relationship. The first is the acknowledgement of the directional aspect of anxiety, as noted. The second is the ability to develop cognitive interventions, which are aimed at changing athlete's interpretation of their arousal. Instead of simply changing the levels of anxiety incurred by athletes, we can alter the way in which levels are perceived, therefore allowing high levels of anxiety to benefit performance (Balague, 2005).

1.8 Multidimensional Anxiety Theory

The second alternate theory to the Inverted-U is Multidimensional Anxiety Theory (Martens et al., 1990). As the title implies, Martens et al. are accredited with being the original researchers to acknowledge and study pre-competitive anxiety as a multidimensional construct. The theory distinguishes between the two subcomponents of state anxiety, acknowledging that each subcomponent - cognitive and somatic state anxiety - relate to performance in different manners. Specifically this theory predicts that cognitive state anxiety is negatively related to performance (Martens et al., 1990). Consequently, any increases in cognitive anxiety result in decreases in performance. Alternatively, somatic anxiety is believed to be related to performance in the shape of an inverted-U. Therefore as somatic anxiety increases, so does performance to an optimal point, after which increases in somatic anxiety cause a steady decline in performance.

Burton (1988) and Gould, Petlichkoff, Simons and Vevera (1987) studied the tenets of multidimensional theory amongst pistol shooters and swimmers respectively. Both studies confirmed the relationship between somatic anxiety and performance to be curvilinear (i.e., following an inverted-U). Burton's results also supported a negative linear relationship between cognitive anxiety and performance. However, Gould and colleagues found no relationship between cognitive anxiety and performance.

Although there has been support in the literature for making the distinction between somatic and cognitive anxiety, as well as recognition that both types influence performance differently, there has been little empirical support for the tenets of multidimensional anxiety theory (Gould et. al., 2002; Hardy et. al., 1996). The most cited limitation regarding this theory is the inconsistent empirical support for its

precise predictions, and its essential lack of support for the notion that cognitive anxiety negatively impacts performance in all cases. Since predictions of the theory have not been supported the theory is now believed to be of little use in the research domain.

1.9 Catastrophe Model

The third alternative to the Inverted-U theory to be discussed is Hardy and Fazey's Catastrophe Model (1988). Unlike Multidimensional anxiety theory, Catastrophe model concentrates on the intricate interaction between cognitive state anxiety, physiological arousal and performance. The Catastrophe model discusses somatic anxiety as a subcomponent of physiological arousal (Gould & Krane, 1992). It is consistent with the Inverted-U hypothesis relating to the relationship between somatic state anxiety and performance, but states that this relationship only follows the inverted-U pattern when cognitive anxiety is low. If at any point, the athlete begins to worry or suffer from negative thoughts, their cognitive state anxiety will rise to an optimal point, after which the athlete incurs a "catastrophe." This catastrophe is distinguished by a rapid, dramatic decline in performance. Once the catastrophe has occurred, athletes must undergo a lengthy recovery process in order to be able to achieve optimal performance once more. Explicitly, the theory then predicts that, "physiological arousal is related to performance in an inverted-U fashion, but only when an athlete is not worried or has low cognitive state anxiety." (Weinberg & Gould, 2003, p.88). This negative influence of cognitive anxiety, in relation to somatic anxiety level, has been reported throughout the literature (Krane, 1992; Gould, Weiss & Weinberg, 1981; McAuley, 1985).

The key contribution of the Catastrophe model is the identification of the positive aspect of cognitive anxiety. In past literature, cognitive anxiety has always

been assumed to have negative impacts on performance. It is now known that cognitive anxiety mediates the effects of physiological arousal on performance (Anshel, 2003). Catastrophe theory poses that cognitive anxiety is not necessarily detrimental to performance, in that as long as physiological arousal levels do not get too high, some worry can benefit performance (Gould & Krane, 1992).

Several studies have shown promising results for the tenets of the Catastrophe model. In attempts to test the model, researchers have manipulated levels of both cognitive anxiety and physiological arousal. Setting cognitive anxiety high, and subsequently increasing physiological arousal, Edwards and Hardy (1996), Hardy and Parfitt (1991), and Hardy, Parfitt and Pates (1994) witnessed catastrophic declines in performance of athletes studied. In congruence with the hypothesis that low cognitive anxiety does not affect performance, all authors reported observing minimal changes in performance when cognitive anxiety was low and physiological arousal was gradually increased. These findings suggest that lower levels of cognitive anxiety may enhance performance, while verifying that high levels of cognitive anxiety diminish performance catastrophically.

A revised catastrophe model has been put forth, with somatic anxiety replacing physiological arousal. Several studies have been conducted, in the same means as the previously discussed studies, with cognitive anxiety set high, and somatic anxiety gradually increased (Durr, 1996; Krane, Joyce & Rafeld, 1994). However, conclusions of these studies did not support the hypotheses put forth by the catastrophe theory. Rather than observing a catastrophic decrease in performance, the researchers witnessed a gradual, curvilinear decline supporting an inverted-U relationship between somatic anxiety and performance.

Evidence against the tenets of Catastrophe model was also reported in a study completed by Cohen, Pargman and Tenenbaum (2003). The authors had sixteen male participants complete the mental readiness form (MRF) prior to completing a dart-throwing task. No support was found for either the theory or empirical evidence of the Catastrophe model. The authors conceded that the model does not serve as a solid framework to explore the multidimensionality of anxiety, nor serve as a tool for adequately explaining performance catastrophes.

From this and other studies completed on the Catastrophe model there is one key limitation: its unmistakable complexity and difficulty to test (Balague, 2005; Hardy, 1996; Krane, 1992). To begin with, in order to test the Catastrophe model an athlete must first "choke" or experience a catastrophic decline in performance. This raises a principle concern, in that athletes cannot be forced to fail. It also brings about questions concerning the definition of choking. Choking has been defined as an individual's failure, in important situations, to perform at the level of previously set standards (Anshel, Freedson, Hamill, Haywood, Horvat & Plowman, 1991). What is considered the previously exhibited standard? Is it an athlete's all time best performance, their average or regular performance? Clear definitions need to be given in order to collect relevant data, which can be used by all athletes.

Another limitation is the possibility that athletes are not accurately reporting their excessive levels of anxiety. Krane and Williams (1987) noted that some athletes repress their true feelings and levels of anxiety, giving off a false high level of self-confidence, and producing inaccurate data sets. Again, due to the fact that what is considered catastrophic is not clear, it is nearly impossible to assign individual and general measurements to what is considered failure, and catastrophic failure.

Statistical problems, associated with the complexity of the model itself have been noted as well. Cohen et al. (2003) note that in order to accurately test the model, physiological arousal, cognitive anxiety, somatic anxiety and performance must be examined. It is insufficient to test only one or two of the variables in question. These limitations were also noted by the model creator himself, stating that "a full range of cognitive anxiety and physiological arousal scores is necessary in order to perform a strong test of the model, otherwise, performance scores may be clustered on a single part of the model's performance surface" (Hardy, 1996, p. 145-146). It has also been noted, that in order to accurately attain these measures, repeated assessments of the same athlete must be taken (Anshel, 1995).

1.10 Overall Conclusions

The fourth alternative to be discussed, and the basis on which this study relies, is Hanin's (1980) Individualized Zones of Optimal Functioning Model (IZOF). Unlike the overly simplistic, and unidimensional nature of the Inverted-U, the IZOF identifies the importance of multidimensionality, measuring both somatic and cognitive anxiety, as well as self-confidence. There is also an abundance of empirical research supporting the tenets of the model, in contrast to reversal theory, which has minimal empirical research completed on it. In comparison to the Catastrophe model, the IZOF is straightforward to test, with the basic use of self-report measures, and subsequent development of individualized zones.

II. Individualized Zones of Optimal Functioning Model

2.1 Introduction

Theoretically, the Individualized Zones of Optimal Functioning (IZOF) model attempts to explain the relationship between pre-competitive anxiety and athletic performance. It does this by acknowledging the multidimensional nature of anxiety, as well as the variability between individual athletes' optimal anxiety and performance levels (Kamata, Tenenbaum, & Hanin, 2002). The IZOF has consistently demonstrated its applicability as a descriptive model in analyzing athletic performance (Balague, 2005). Despite using the terms anxiety and arousal interchangeably in the past, the IZOF model has advanced to using solely the term anxiety.

The IZOF was developed specifically in response to two limitations identified of the inverted-U, the first of which concerns the notion that all athletes attain optimal performance at the midpoint of the arousal continuum. IZOF concedes that athletes differ in their optimal arousal levels (Hanin, 1986). Some may reach peak performance when arousal is low, others in the moderate range, and some when arousal is high. This conclusion was derived initially from research completed by Hanin (1986), who showed that of pre-competitive anxiety measures taken from 46 elite rowers who completed the STAI, participant's optimal arousal scores ranged from 26 to 67. The mean for the group of elite rowers was 43.8 with a standard deviation of 12.23 (possible scores on the STAI can range from 20 to 80). Similar findings have since been reported by several researchers including Gould, Tuffey and Lochbaum (1993), Randle and Weinberg (1997), Robazza et al. (2004) and Turner and Raglin (1995). Summarizing these findings in their meta-analysis, Jokela and Hanin stated "it is remarkable that we were unable to identify a single study that

demonstrated that different athletes had the same (or similar) optimal anxiety" (1999, p.882).

Another limitation identified is the single point in space allotted to optimal arousal levels versus the bandwidth offered by the IZOF (Hanin, 1980). The bandwidth most commonly identified by this model represents the athlete's mean pre-competitive anxiety scores on the STAI plus and minus 4 points or 0.5 a standard deviation. Original research conducted by Hanin (1978, 1983) spanning a variety of sports, and using several hundred athletes, resulted in large intra- and inter-individual variability in anxiety scores, prior to both optimal and non-optimal performances. This variability was interpreted as support for the notion that there is not one single space in which athletes attain optimal performance, rather a range of anxiety levels in which athletes can adequately cope, and produce optimal performances. Validity evidence for the use of 0.5 SD is seemingly non-existent. The researchers who have chosen to follow this method, do so without acknowledging whether this is a valid means of developing a zone. The decision to use 4 points, or 0.5 standard deviation, as the limiters for upper and lower boundaries of the bandwidth (zone), was decided upon, as it was considered the "best fit" for group-oriented research . Krane (1993) followed the recommendations of Hanin with a sample of soccer players. She found no significant effects for in versus out of zone performance when using the 0.5 SD method of developing ZOFs. However, when utilizing 1.0 SD to develop the individual zones, she found significant effects for both cognitive anxiety ($F(2, 142)=3.25$, $p<0.05$) and for somatic anxiety ($F(2, 142)=7.69$, $p<0.001$). Unfortunately no further explanation is provided for the differences in significance between Hanin's 0.5 SD method and the 1.0 SD method used by Krane.

The intuitive appeal of the model has been identified as one of the foremost advantages of using the IZOF in athletics (Jokela & Hanin, 1999). The model acknowledges that optimal arousal levels can still be reached, but may differ slightly depending on the task at hand and the athletes themselves. The model also serves as a motivational tool, wherein athletes are given numerical standards at which they have reached peak performance in the past, allowing them to strive to these levels in subsequent performances (Hanin, 2000). IZOF also provides coaches and athletes with an identifiable optimum, which can be achieved through the appropriate use of arousal control techniques.

An additional advantage of the IZOF model is its ecological validity, or its practical use in the sporting domain. The majority of empirical research done on the IZOF has been done in actual sport settings (Jokela & Hanin, 1999). Therefore results from these studies are easily transferred into the everyday sporting environment. This ecological validity is furthered in the model's ability to generate new hypotheses, as it describes when optimal arousal and performance can be reached, in a correlational manner. Despite this model's present inability to explain causation, the hypotheses and ensuing testing of the model's tenets will allow for further understanding of the anxiety-performance relationship. It is only with small steps, that research will be able to adequately describe and understand the affiliation between anxiety controlling methods in sport and their consequent effect on performance.

2.2 Development of Individualized Zones

Prior to reviewing the literature, it is essential to restate the data collection methods used to test the tenets of the IZOF. In past literature researchers have relied heavily upon Spielberger's State-Trait Anxiety Inventory (STAI) as a self-report measure, which results in scores ranging from 20 to 80. Recently there has been a

shift with the Competitive State Anxiety Inventory-2 (CSAI-2) being the foremost means of assessing pre-competition anxiety levels. CSAI-2 scores can range from 9 to 36 on each of the three subscales (i.e., somatic anxiety, cognitive anxiety, and self-confidence). Even more recently, although still in the preliminary phases, there has been an emphasis on the use of the directional modification of the CSAI-2 (DM-CSAI-2), which includes the subjective interpretation of anxiety as being either facilitative or debilitative. Scores on the DM-CSAI-2 intensity scale range from 9 to 36 and scores on the directional scale range from -21 to +21, for each of the three subscales. With the exception of the directionality scale of the DM-CSAI-2, to construct the zones, all totaled scores have 4 points or 0.5 a standard deviation subtracted from the lower score and added to the high score. For example, if an athlete scored 40 on the STAI, they would have four points subtracted and added to that score, to result in an optimal range of 36-44. Hanin (1989) stated that 4 points corresponded to 0.5 *SD* in pre-competitive anxiety scores. This formula accounts for random error in defining an optimal level of anxiety for individuals. Random error accounts for any variations in measurement that occur randomly, for example the mood of an individual (Trochim, 2001). The optimal zones, which are developed from the measurement of anxiety, are done so on an individual basis. Random error adjusts scores randomly, on an individual basis, versus consistently across the sample as a whole. By using the .5 SD to account for random error, Hanin's formula allows for the random increase and decrease of anxiety scores across an individual to be accounted for. These adjusted scores formulate the upper and lower boundaries of the individual's zone of optimal functioning.

2.3 Empirical Research on the IZOF

Support for the first tenet of the IZOF - variability in athletes'optimal pre-competition anxiety levels - was provided by Woodman, Albinson and Hardy (1997). They conducted a study using 25 ten-pin bowlers. Each bowler was administered the CSAI-2 within 20-minutes of one 10-frame game. Results indicated a wide range of optimal anxiety scores between players, ranging from 12 to 27 (somatic anxiety), and from 9 to 23 (cognitive anxiety). This finding was replicated in runners, with scores ranging from 12 to 27 (somatic) and from 12 to 32 (cognitive) (Gould, Tuffey, Hardy & Lochbaum, 1993), in volleyball players, with 22% of players scoring in the low range, 44% in the moderate range, and 33% in the high range (Raglin & Morris, 1994), as well as in softball players, with scores ranging from 9 to 14 (somatic) and from 9 to 23 (cognitive) (Randle & Weinberg, 1997). Note that range was selected as a dispersion statistic to parallel previous research reports.

A second tenet of the IZOF - those who are within their IZOFs outperform those outside of their IZOFs has been supported both using inter- and intra-individual analysis. Turner and Raglin (1995) completed an inter-individual analysis using 67 track and field athletes. Athletes completed a retrospective best of their previous season, to determine individual zones of optimal functioning. During the season, athletes completed the state portion of the STAI (STAI-Y1) prior to four meets. It was found that athletes who were within their IZOFs significantly outperformed ($p<0.01$) those who were outside of their IZOFs. This inter-individual finding was also supported by Salminen et al. (1995), who reported that prior to difficult matches those who were within their zone significantly ($p <0.05$) outperformed those who were outside of their zone. Imlay, Carda, Stanborough, Drieling and O'Connor (1995) completed an intra-individual analysis reporting that their track and field athletes performed significantly ($p< 0.05$) better when they were within their zone, than when

they were outside of their zone. A similar intra-individual finding was reported by Annesi (1998) using tennis players. He reported that the athletes performed significantly (p <0.05) better when they were inside of their zones, versus when they were outside of their zone.

Interestingly, intra- and inter-individual empirical research has also indicated that athletes who are within or below their zone of optimal functioning still out-perform athletes who are solely above their IZOF for either somatic or cognitive anxiety (Krane, 1993). It has also been found that the further athletes are from their IZOF the greater decline in performance is observed (Gould et al., 1993).

A meta-analysis on the ability of the IZOF to discriminate between successful and unsuccessful athletes was conducted by Jokela and Hanin in 1999. The analysis included nineteen studies completed from 1978 to 1997. Overall the findings provided moderate support for the IZOF model. With respect to the in-out zone hypothesis, inter-individual analyses found that athletes within their zone outperformed those outside of zone. The effect size for this finding was $d = +0.44$, which converts into nearly half a standard deviation higher for performance in zone versus out. Larger effect sizes were noted when comparison was made to athlete's best performance ($d = +0.45$), meaning that being in zone was a moderate to strong (Cohen, 1988) predictor of optimal performance. Interestingly, when using average or usual performance as the criterion, the effect size was $d = -0.27$, meaning that being in zone did not predict differences in performance, as compared to being out of zone.

Despite this meta-analytic conclusion, there is some empirical research that contradicts the tenets of the IZOF. Utilizing thirteen female varsity softball players, Randle and Weinberg (1997) found that when multidimensional anxiety was used to define the player's ZOF coupled with subjective performance, no significant

differences between zones were found. Further when using objective performance ratings, and population means to calculate standard deviation, it was found that players performed significantly ($p < 0.05$) better when outside of the IZOFs, versus inside. It is important to note that this significance was found using the population means in establishing one-half standard deviation, from which zones were constructed. Supplementary to this finding, it was established that athlete's performance levels increased equivalently to the distance from the IZOF; as they moved further from their IZOF, their performance continued to escalate.

2.4 Actual, Predictive and Retrospective Methods

The basis on which testing the IZOF model lies is in researchers' abilities to develop individual zones of optimal functioning for each athlete. There are three different methods in which researchers can administer self-report tools in order to create the IZOFs: direct, retrospective and predictive. The direct method entails measuring each athlete's pre-start competitive anxiety immediately before each competition. Athletes would complete the questionnaire prior to stepping onto the playing surface. It has been recommended in the literature that this be done as close to competition beginning as possible (Raglin & Morris, 1994; Raglin & Turner, 1993). Research using the direct method of administration has ranged from two hours prior to competition, up to ten minutes prior to (Imlay et al., 1995; Salminen et al., 1995; Woodman et al., 1997).

The retrospective method is the most widely employed method in current research (Hanin, 2000). In this method athletes are asked to reflect and respond to self-report measures based on previous performances (Cox, 2002). Meta-analytic analysis was completed on the accuracy of retrospective methods, with effect sizes ranging from $r = +0.25$ to $r = +0.98$ (Jokela & Hanin, 1999). Specifically significant

correlations between direct and retrospective methods were found by Hanin (1986) $r_w = +0.74$, Harger and Raglin (1994) $r_w = +0.98$, Imlay et al., (1995) $r_w = +0.85$, Raglin & Morris (1994) $r_w = +0.69$, and Raglin & Turner (1993) $r_w = +0.95$. Note, in their analysis r_w refers to the weighted population effect size.

The last method of administration is the predictive method. In the predictive method athletes are asked to predict anxiety levels prior to an upcoming competition. Accuracy of prediction of anxiety levels have been assessed, with effect sizes ranging from $r = +0.21$ to $r = +0.98$ (Jokela & Hanin, 1999). Jokela and Hanin (1999) state that "...the weighted population effect size between anticipatory and actual anxiety assessments was r_w=+0.69...Based on this result, there would be substantial association between anticipatory and actual self-ratings" (p. 880). It was noted that this finding was to be taken tentatively, as it accounted for only 35% of the variance, with 65% of variance remaining unexplained. Analysis ensued to aid in explaining the 65% variance. Moderating variables were acknowledged including gender and age. Males were found to more accurately predict pre-competitive anxiety ($r_w = +0.75$) than females ($r_w = +0.63$). Older athletes were more accurate predictors ($r_w = +0.75$) than younger athletes ($r_w = +0.64$). Lastly, predictions made closer to competition were found to be more accurate ($r_w = +0.74$) than predictions made over one week precompetition ($r_w = +0.62$). Other researchers have also found empirical evidence supporting the use of prediction methods (Hanin, 1980, 1989; Raglin & Morgan, 1988; Raglin, Morris & Wise, 1990; Raglin, Wise & Morgan, 1990; Raglin & Turner, 1992, 1993; Raglin & Morris, 1994).

2.5 Criticisms of the IZOF

There have been a few criticisms made of the IZOF model in past literature. The first addresses the past unidimensional nature of the IZOF (Woodman et al.,

1997). Several steps have been taken recently to address this issue. The first is the development of multidimensional tools, including the CSAI-2; as previously noted the CSAI-2 measures three subscales: somatic anxiety, cognitive anxiety and self-confidence. These components have been shown to be independent from one another ensuring that multidimensional anxiety is measured. Reported correlations include: (a) .63 between cognitive and somatic anxiety, (b) -.64 between cognitive anxiety and self-confidence and (c) -.51 between somatic anxiety and self-confidence (Gould et al., 1984; Martens et al., 1990; McAuley, 1985; Taylor, 1987). Researchers have gone further to ensure this, asking athletes to respond to the questionnaire reporting how they "usually" feel, which certifies a measure of trait anxiety (Albrecht & Feltz, 1987).

A second criticism lies in the model's concentration on the intensity dimensions of anxiety, failing to acknowledge the direction of anxiety. Direction, also referred to as interpretation, entails identifying whether the anxiety being experienced by an athlete is viewed as either facilitative or debilitative to their performance. This limitation is now being addressed in several domains, including, but not limited to, skill level (Jones, Hanton & Swain, 1994; Jones & Swain, 1995), competitiveness (Jones & Swain, 1992) and sporting performance (Jones, Swain & Hardy, 1993). To accurately measure the directional aspect of anxiety Jones and Swain (1992) developed the DM-CSAI-2 as discussed in chapter one. Initial studies utilizing this tool have shown promising results.

Jones and Swain (1995) conducted a study assessing differences in anxiety interpretations between elite and non-elite athletes. Athletes included 133 male cricketers, with 68 elite and 65 non-elite. All athletes were administered the DM-CSAI-2 prior to competition. Results indicated no significant differences between

elite and non-elite athletes on the intensity dimension of anxiety, but significant differences were found on the directional dimension of anxiety. The elite players reported interpreting anxiety as significantly more facilitative than did their non-elite counterparts ($p < 0.01$). These findings were also reported in a wide variety of sporting environments including rugby (Hanton et al., 2000; Jones & Swain, 1992), basketball (Jones & Swain, 1992), soccer (Jones & Swain, 1992; Wiggins, 1998), field hockey (Butt et al., 2003; Jones & Swain, 1992), swimming (Wiggins, 1998) and rifle shooting (Hanton et al., 2000).

One study conducted by Davis and Cox (2002) reported finding no support for the notion of directionality in the IZOF model. These authors compared athletes' interpretations of arousal with being in or out of zone. It was found that higher reports of positive interpretations were independent of athletes being inside or outside of their ZOFs. The authors suggested, in congruence with what has been previously stated by Jokela and Hanin (1999) and Jones and Swain (1995), that the athletes studied were novice athletes, therefore not able to accurately recognize and report their interpretations of their arousal. This limitation was also noted in studies conducted on novice soccer players (Krane, 1993) and novice cricketers (Thelwell & Maynard, 1998).

2.6 Individual versus Team Sport Research

A deficiency, not with the IZOF model itself, but in the empirical research conducted on the IZOF model, is the focus on individual sport athletes versus team sport athletes. Empirical evidence has largely been fashioned from studies of individual sport athletes. These studies have spanned a wide range of sports including distance running (Gould et al., 1993; Hammermeister & Burton, 1995), rock climbing (Maynard, MacDonald & Warwick, 1997), swimming (Davis & Cox, 2002; Raglin et

al., 1990; Wiggins, 1998), track and field (Imlay et al., 1995; Turner & Raglin, 1995), rifle shooting (Hanton et al., 2000), gymnastics (Annesi, 1997; Krane & Williams, 1987; Matheson & Mathes, 1991; Salminen, et al., 1995), karate (Robazza et al., 2004) and golf (Guest & Cox, 1999; Krane & Williams, 1987; McAuley, 1985). Testing the IZOF in individual sports does prove simpler than in team sports, as researchers can readily identify variables, which may moderate the anxiety-performance relationship, such as gender, age and playing experience. This is not so for team sports. Team sports can have both genders on one team, age is generally varied amongst team members, as is playing experience.

Studies have consistently shown that team athletes exhibit lower levels of anxiety and higher levels of self-confidence than their individual sport counterparts (Furst & Tenenbaum, 1984; Simon & Martens, 1979; Wong, Lox & Clark, 1993). This may be due to the collective nature of performance in team sports, in that the team can be used as a social dispersion mechanism in anxiety inducing situations, or a source of attribution after incompetent performance. For example, it has been found that for both male and female athletes, team confidence will suffer after a loss, but self-confidence will remain high (Feltz & Lirrg, 1998; Myers, Payment, & Feltz, 2004). Due to the research concentration on individual sport athletes, and the operational differences in team sport, examining the individual roles of pre-competition anxiety within a team may prove to be useful for furthering the understanding of team performance.

There have been several studies conducted assessing the applicability of the IZOF in team sports including soccer (Krane, 1993), volleyball (Raglin & Morris, 1994), cricket (Jones & Swain, 1995; Thelwell & Maynard, 1998), softball (Randle &

Weinberg, 1997), rugby (Hanton et al., 2000) and field hockey (Butt et al., 2003), but these studies are limited.

The first limitation concerns the anxiety measures used. Two studies used previously accepted measurements, the STAI (Raglin & Morris, 1994) and MRF-2 (Butt et al., 2003). As discussed previously, the STAI was a heavily used measurement tool in past research; however, as the multidimensional nature of anxiety became apparent, the STAI's separation of trait and state anxiety was no longer adequate. The MRF is used as a field measure of the CSAI-2, of which its goal is to aid in time constraints prior to competition. Although the version used by Butt et al. (2003) has been shown to produce higher correlations with the CSAI-2 than the original MRF, no reliability coefficients can be calculated on single-item measures (Burton, 1998). Reliability ensures that the measure being used consistently measures the intended construct. Therefore when measuring pre-competition anxiety, over several competitions, the MRF may not be the wisest choice of measurement tool. Furthermore, two studies used the CSAI-2 (Krane, 1993; Randle & Weinberg, 1997), and only three studies used the newly promoted DM-CSAI-2 (Hanton et al., 2000; Jones & Swain, 1995; Thelwell & Maynard, 1998). Use of the CSAI-2 as a measurement tool is widely accepted in the sport psychology domain, however, it does not include the directional modification, which has been reported in research to be more influential on performance, versus the intensity of anxiety measured by the CSAI-2 (Jones & Swain, 1992; Jones & Swain, 1995).

The second limitation concerns the administration of the self-report measure used. Of the three studies, which utilized the DM-CSAI-2, only one (Thelwell & Maynard, 1998) assessed the anxiety-performance relationship. The major limitation noted in this study, was in the administration of the self-report methods. Athletes

completed the DM-CSAI-2 over 10 games, reporting scores from 1 (worst performance) to 10 (best performance). Only 8 of the 20 participants reported scores of 8/10 or higher within those 10 games. This provides evidence that when assessing the anxiety-performance relationship, Thelwell and Maynard were assessing based on usual, or sub-usual performances. When testing the IZOF optimal performance(s) must be identifiable (Hanin, 1980). Both alternative studies using the DM-CSAI-2, aimed to assess differences in interpretation (direction) of anxiety, as compared to the intensity of anxiety felt in their athletes, with performance measures being secondary (Jones & Swain, 1995; Hanton et al., 2000).

2.7 Subjective versus Objective Performance Measures

The last limitation of these studies was the choice of subjective versus objective measures of performance. Subjective measures refer to the individual's personal interpretations of performance. Objective refers to definite, factual measures. It is recommended in the literature to use both methods in order to accurately portray performance (Raglin, 1992; Weinberg, 1990). Only one study of team sports, softball, (Randle & Weinberg, 1997) used both performance measures. Within their objective measure of performance Randle and Weinberg assessed both offensive and defensive success, this included batting average, slugging percentage and on-base percentage. Separate ratings were given to pitchers, including strikeouts, walks earned, and run average. Players were asked to subjectively rate their own performance on four categories: (1) defensive, (2) offensive, (3) intangibles and (4) overall performance. This was completed after each competition. Each category was rated by the player on an 11-point Likert scale, from 1 (played much poorer than usual) to 11 (played much better than usual). The coach of the team also rated each players performance using the same scales. Both subjective and objective

performance scores were combined, resulting in an overall performance score. Correlations between performance measures ranged from 0.2 to 0.4.

Although research done concerning the IZOF in team sports has been conducted, it remains limited. The current study aims to address the previously noted limitations, through the use of the DM-CSAI-2 as an anxiety measure, administering the questionnaire over the course of a full season, and utilizing both objective and subjective performance ratings.

2.8 Overall Conclusions

While the IZOF model may not serve as an explanatory cause and effect theory, it does serve as a predictive theory and a descriptive model, allowing athletes and coaches to better identify required levels of arousal for optimal performance. Upon identification, athletes and coaches may then take appropriate steps utilizing arousal control techniques to aid in attaining these levels. Empirical research has shown support for this model, and its practical use in the athletic domain. Despite this, there are evident gaps in the literature in relation to the IZOF in team sports, more specifically assessing the directionality dimension of anxiety.

2.9 Research Questions and Hypotheses

Therefore the goal of this study is to test the basic tenets of the IZOF model in team sport, with one central purpose: (1) to address the lack of research conducted utilizing the directionality dimension with the IZOF in team sports. It was hypothesized that: (1) performance would be significantly better when players were inside their optimal zone, versus outside; and (2) anxiety would be interpreted as more facilitative when athletes were inside their zone versus outside of their zone.

III. Methods

3.1 Participants

The participants in this study included nineteen male varsity hockey players between the ages of 21 to 25 years, with a mean age of 21.9 years. Numbers of years playing with the current team ranged from one year to four years (*M*=1.68; *SD*=1.00), with eleven players in their first year, five in their second year, one in his third year and two in their fourth year. Positions of the participating players included defensemen (26.3%), wingers (15.8%), centers (26.3%), forwards (21%), and goalies (10.5%). Participants gave their informed consent to take part in the current study.

3.2 Instrumentation

3.2.1 Subjective Performance Measure

The subjective rating scale used in the current study was developed by the current head coach and coaching staff of the hockey team. It is rated on a 4-point Likert scale: 1 (poor performance, could not be relied upon), 2 (below average), 3 (above average), and 4 (one of the best players on the ice). Players are graded in relation to their specific role and expectations of their role on the team. For example: a defensive type player (checking forward) may score a goal, but still be graded a 2 (below average) because his responsibilities as a checker may not have been fulfilled; an offensive player (scorer) may create or get a high number of scoring opportunities, but not score a goal and still be graded a 3 (above average) because he fulfilled his role by creating offensive opportunities.

The coaching staff has used this performance measure for several seasons. It is based on the first hand evaluation of the game as well as game tape analysis post-competition. It represents the consensus opinion of the entire coaching staff, which

includes one head coach, three assistant coaches and a goaltending coach. Each individual member of the staff team rates each player's performance during the game.

3.2.2 Objective Performance Measure

Objective statistics included number of games played, shots per game, goals per game, assists per game, total points per game, and save percentage (for goalies). All statistics were attained from the varsity athletics statistician. Such statistics are available to the public on request, and do not require special permission. Upon review of previous literature (Davis & Cox, 2002; Gould et al., 1993; Raglin et al., 1990), total points per game, was selected as the objective measure to be used to supplement the subjective ratings. Total points per game, takes into account goals per game, and assists per game, and therefore allows for comparisons across athletes and across games (Gould et al., 1993).

3.2.3 Somatic and Cognitive Anxiety Measure

The directional modification of the competitive state anxiety inventory-2 (DM-CSAI-2) was used for all anxiety assessments (See Appendix A). This questionnaire contains three subscales: somatic state anxiety, cognitive state anxiety and state self-confidence. Each is allotted nine items, which are rated on a 4-point Likert scale, from 1 (not at all) to 4 (very much so). Scores can range from 9 to 36 on each subscale. Example items are, "I am concerned that I may not do as well in this competition as I could" a cognitive item, "My body feels tense" a somatic item, and "I feel self-confident" a self-confidence item. The directional modification contains the same 27 items as the CSAI-2, subdivided into the same three subscales. It is rated on a 7-point Likert scale, from -3 (very debilitative) to +3 (very facilitative). Scores can range from -27 to +27. Martens et al. (1990) report reliability coefficients for the

CSAI-2 ranging from .88-.90 on the self-confidence items, .79-.81 on the cognitive items, and .82-.83 on the somatic items.

3.3 Procedure

3.3.1 Briefing

Athletes met with the researcher at their home arena, prior to a pre-season practice. Athletes were informed as to what participation would consist of, in terms of time commitment and assessment. They were then given an informed consent form, of which they signed if choosing to participate in the study. Those athletes who agreed to participate (n=19) then remained for the DM-CSAI-2 familiarization season. It should be noted that there was a total of 23 players on the varsity team approached. Of the four players who did not choose to participate, two were first year players, one was a second year player, and one was a third year player. These players included one defensive player, one wing offensive player, one center offensive player, and one goal tender. There were no obvious differences between those who agreed to participate and those who did not. No reasons for not participating, were supplied by those choosing this option, however speculation around the goaltender, suggests that his lack of playing time may have been a factor (third string).

3.3.2 DM-CSAI-2 Familiarization

Participants of the study attended one, half-hour DM-CSAI-2 familiarization session. In this session the researcher introduced the athletes to the DM-CSAI-2. Each item on the inventory was read aloud, and discussed to ensure that everyone interpreted the items uniformly. Each player was asked to give an example to show the understanding of each item, for example for the item “I feel mentally relaxed”, an explanation provided included aspects such as, no stressful thoughts or worries, my mind is clear. Understanding of the Likert-scale to be used in ranking each item on

the DM-CSAI-2 was also explained. The interpretation aspect of the inventory was explained, ensuring understanding of the terms facilitative and debilitative, again using real life examples of what it means to feel anxiety as facilitative and debilitative. Examples provided were the rush that butterflies in your stomach gives one individual, versus the nausea it provided another individual. Each player completed a mock trial of the questionnaire, to again ensure understanding, as well as to allow for quicker completion in the future. Specifically, the players were asked to fill the out the DM-CSAI-2, referring to how they felt at the present moment. Data from the mock trial could not be analyzed, as it was done assessing the present moment, and lacked a performance measure from which to develop individualized zones. Lastly, the schedule for administration of the questionnaires was covered in depth with the players, captain of the team and head coach.

3.3.3 Administration of Questionnaires

After discussion with the head coach and the team a reasonable time was set aside, after warm-up and within 30 minutes prior to the beginning of each game of the season in which the DM-CSAI-2 would be self-administered. The captain of the team volunteered and was allotted the responsibility by the primary researcher to distribute and collect the questionnaires prior to each game. The captain of the team sealed the questionnaires in an envelope and delivered them to the primary researcher after each game. A subjective performance measure for each player was collected from the head coach of the team after each game. This performance rating was written at the bottom of each participant's DM-CSAI-2 form, and coded by game.

3.4 Data Analysis

3.4.1 Selection of Participants for Analysis

It is important to note that only a subset of the original 19 participants was used in the final analysis. Raw data for each of the nineteen participants can be viewed in Appendix B. Attention should be drawn to participant's performance ratings for each game. For the purposes of testing the IZOF model an optimal score must be readily identifiable (Hanin, 1980). Close analysis of the data reveals that only three players had one single identifiable optimal performance score. As a result of this, and following the recommendations of Woodman et al., (1997) participants were chosen who had two optimal performance scores. This narrowed the original 19 participants to a sample of six participants. There were also two participants who had three optimal performance scores, which was also recommended for use by Woodman et al. (1997), however the largest sub-sample of participants had two identifiable best performance scores.

3.4.2 Zone Formation

Zone formation was completed in congruence with recommendations of Davis and Cox (2002). Best two performance scores were identified for each participant. "Best" was considered the highest two subjective ratings of performance. In table one below (raw data for participant number one), these are identified in italics. The choice to use two best performances, versus one, follows the research recommendations of Woodman, et. al., (1997) who rationalize that the use of multiple performance scores enables more confidence to be placed in the validity of the methods for deriving individual zones. After these two best performances were identified, associated raw anxiety scores, for both the somatic and cognitive subscales were totaled and averaged (also identified in italics). For example, the best two performance scores for participant one resulted in somatic anxiety scores of 21 and 17. To calculate the total

optimal score, you would add these two together, which equals 38, and divide by two, resulting in a total optimal score of 19.

Table 1

Example Zone Formation

Performance Rating	Somatic Anxiety Score	Cognitive Anxiety Score
3	*21*	*20*
2	19	13
2	11	12
1	19	13
1	17	12
3	*17*	*12*
2	18	12

In order to formulate the optimal *zone*, Hanin (1980) recommends adding and subtracting 0.5 standard deviations from the total somatic and cognitive anxiety scores, which is equal to 4 points. This statistic is generally calculated using the entire groups standard deviation versus individual standard deviation. Recently, however, as noted by Davis and Cox (2002) the use of each individual's standard deviation is more effective as it controls for variation in best performance which are independent of ability (Baumgartner& Jackson, 1999), and also controls for instability across multiple performances (Safrit & Wood, 1989). Following these recommendations, standard deviations for each individual's cognitive and somatic anxiety were calculated. In the example provided in table two, the somatic anxiety scores were entered into SPSS, and the standard deviation was then calculated, in the above example equaling 3.15. This would then be divided in two as Hanin (1980) recommends, totaling 1.58. To

develop this participants optimal zone then, you would add 1.58 to 19, 20.58, formulating the upper boundary, and subtract 1.58 from 19, 17.42 formulating the lower boundary. In summary, participant one's optimal somatic anxiety zone ranges from 17.42 to 20.58. This process was followed for each individual player, and for both somatic and cognitive anxiety.

3.4.3 Inter-individual Analysis

A series of independent t-tests were run to test the in versus out of zone tenet presented by the IZOF model, as well as the interpretation dimension presented by Jones and Swain (1995). Independent t-tests were utilized for several reasons: (1) "in" zone performance is independent of "out" zone performance, that is all the performances "in zone" are one group and all those "out of zone" are another group, an individual can not be in both groups at one time; (2) the tenet of the IZOF compares the means of these two scores (in versus out); (3) goal of the study was to asses the tenet of the IZOF, and report if the differences between these two scores were statistically different from one another. The first independent t-test was run for the dependent variable of performance, and the independent variable of in versus out of somatic anxiety optimal zone. The second independent t-test was run for the dependent variable of performance and the independent variable of in versus out of cognitive anxiety zone. The third independent t-test was run for the dependent variable of direction (interpretation) and the independent variable of in versus out of somatic anxiety zone. The last t-test was run for the dependent variable of direction (interpretation) and the independent variable of in versus out of cognitive anxiety zone.

3.4.4 Intra-individual Analysis

Intra-individual analysis was done in two ways. The first was through the use of graphs. In order to examine differences within the individual each participant's optimal z one, for both somatic and cognitive anxiety, was placed onto graphs. Using this graphed optimal zone, the raw scores for somatic and cognitive anxiety were plotted by game. This enabled closer examination of differences occurring within the individual, from game to game. The second means of completing intra-individual analysis was through the use of tables. Tables were completed separately for each of the six participants. The tables contain the player's mean and standard deviations for performance when inside and outside of zone, and interpretations when inside and outside of zone.

IV. Results

4.1 Missing Data

Tabachnick and Fidel (2001) offer different strategies to deal with missing data. As this analysis is theory driven and the theory assumes that anxiety is a state dependent measure and as such will display a wide amount of variation within individuals and across games, it was not deemed appropriate to replace this missing data. In total there were 192 player-games. A player-game reflects a completed and returned DM-CSAI-2. This number decreased slightly when looking at the number of active player-games (183). A player-game was considered active when there was both a completed DM-CSAI-2 and a corresponding performance score. For example, one participant was the second string goalie. He completed DM-CSAI-2 scales, but did not end up playing in games, therefore not producing a performance score, and not being included in the active player-games.

Systematic error refers to error that occurs consistently, across data collection (Vincent, 1995). Systematic error was apparent in this study as one participant consistently did not complete the directional modification of the CSAI-2. Aside from this player there was no consistent pattern of missing data. Upon isolation of this particular case, there were a total of 23 missing data points, which accounts for .0002% of the data.

4.2 Statistical Assumptions

For a t-test to be used several assumptions must be met. These include (Vincent, 1995): (1) the sample must be drawn from a population that is normally distributed; (2) the sample must be drawn at random from the population; (3) variances of two samples should be approximately equal; (4) data must be interval or ratio (parametric). The current study did violate several assumptions of the t-test.

Assumption one was tested by obtaining skewness and kurtosis values for each dependent variable. For the dependent variable of performance, skewness = -.091 and kurtosis = -.873. These values are both <1.00, meaning the population for the dependent variable of performance was normally distributed. For the dependent variable of interpretation of cognitive anxiety, skewness = -.531 and kurtosis = .776. This conforms to the assumption. For interpretation of somatic anxiety, skewness = .817, and kurtosis = 1.344. The kurtosis value for interpretation of somatic anxiety shows that this sample did not come from a population that was normally distributed, and therefore violates the t-test assumption.

Assumption two was violated, as one specific team was sought out for analysis purposes. This does not signify random selection.

Assumption three was tested by computing Levene's statistic for each of the independent t-test completed. For the t-test including the dependent variable of performance and independent variable of in/out of cognitive anxiety zone, equal variances were assumed, as Levene's statistic $p>.05$. For the second t-test using performance as the dependent variable and in/out of somatic anxiety zone as the independent variable equal variances were not assumed as Levene's statistic $p<.05$. This violates the assumption of the t-test. Therefore, results for the t-test were reported with equal variances not assumed. For the last two tests using the dependent variable of interpretation, both in/out of somatic and cognitive anxiety zones had Levene's statistics of $p>.05$, so equal variances were assumed.

Assumption four was met as the performance scores represented interval data. Interval data has no natural zero, and the differences between values are important. Interpretation scores can range from -27 to +27, with 0 meaning interpretation was not

significantly facilitative or debilitative, but not inferring that there was no interpretation. Therefore, this assumption was not violated.

4.3 Reliability and Validity Evidence of Test Scores

4.3.1 Criterion-Related Validity for Performance Measures

Pearson correlations were computed for the variables of points per game (an objective performance rating) and coaches rating (a subjective performance rating). Pearson correlations indicate the extent to which two variables are related to one another, with values closer to 1.00 representing stronger relationships (Vincent, 1995). Messick (1995) would suggest that correlations between the objective performance measure and the subjective performance measure supply concurrent validity, which can be concluded when two measures of the same variable are taken at time points which are close together. The two performance measures used in this analysis were taken during the same game, for each time point. Performance scores were added together, and entered into SPSS where correlations were calculated. Correlations between subjective performance ratings and objective ratings of performance ranged from 0.07 to 0.66, with a mean correlation of 0.43. Table two shows correlations between subjective ratings and objective ratings by game played.

Table 2

Correlations between subjective and objective ratings of performance.

Game	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Correlation	.66	.16	.66	.59	.25	[a]	.37	[a]	.37	.65	[a]	.40	.07	.38	.41	.55	.54
N	9	11	12	8	9		11		10	9		12	12	10	12	6	8

a. Could not be computed as at least one of the variables was constant
Note: changes in n values, reflect the difference in data obtained for number of participants per game

4.3.2 Reliabilities of CSAI-2 Scores

Before completing data analysis testing the IZOF tenets, alpha reliability coefficients for the scores on the CSAI-2 were calculated for each game (Cronbach, 1951). These can be viewed in table three. Game number six resulted in an alpha coefficient of -2.72 for somatic state anxiety. This is theorized to relate to the low number of participants who completed the CSAI-2 at this time point (*n*=4), and the lack of variation provided in responses. It was decided that game six would be removed from further analysis, based on its poor reliability. Upon removal of this game from further analysis, alpha coefficients for cognitive state anxiety scores ranged from 0.55 to 0.95 and alpha coefficients for somatic state anxiety ranged from 0.56 to 0.92.

Table 3

Reliabilities of CSAI-2 scores

Game	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Cognitive Anxiety	.86	.89	.63	.91	.55	.89	.87	.92	.95	.92	.89	.86	.90	.91	.90	.89	.79
Somatic Anxiety	.56	.68	.73	.83	.75	-2.72	.92	.83	.92	.79	.83	.85	.92	.97	.89	.85	.96
N	13	14	15	9	10	4	12	15	12	11	11	14	15	12	14	8	9

4.4 Descriptive Statistics

Descriptive statistics for each of the nineteen participants can be viewed in Appendix B. Means and standard deviations for cognitive anxiety, somatic anxiety, and the interpretation/direction of both are listed in table four.

Table 4

Descriptive Statistics for Entire Sample (n = 19)

Variable	N	Mean	Standard Deviation
Performance	183	2.39	0.78
Cognitive Anxiety	189	16.41	5.70
Somatic Anxiety	190	16.08	5.45
Directional Modification: Cognitive Anxiety	180	11.98	8.83
Directional Modification: Somatic Anxiety	177	9.86	8.50

Note. The cognitive and somatic anxiety scores can range from 9 to 36. Directional modification scores can range from -27 to +27. n values represent the total number of player-games.

4.5 Analysis of Between Groups Differences

4.5.1 Primary Results

Data analysis consisted of a series of four independent t-tests. T-tests were the selected method of data analysis as they test to see if observations come from two different "populations", which is a tenet of IZOF theory. That is, are those who are "in-zone" quantitatively different from those who are "out of zone"? When computing t-tests in SPSS, the file was split into in-zone and out-of-zone, and then entered into the t-test. The first set of independent t-tests was run for the dependent variable of performance, for both in versus outside of somatic anxiety zone, and in versus outside of cognitive anxiety zone. The second set of independent t-tests was run for the dependent variable of interpretation (direction) and independent variables of in versus out of zone, for both somatic and cognitive anxiety.

The independent t-test for in/out of zone cognitive anxiety produced no significant difference in performance when athlete's were either inside or outside of their cognitive zone, $t(38)=0.94$, $p>.025$. The same analysis testing somatic zone showed no significant differences, $t(30)=0.99$, $p>.025$, equal variances were not assumed for this calculation. It is important to note that a Bonferroni adjustment was conducted, as the same data set was used for multiple statistical analyses (Vincent,

1995). The Bonferroni adjustment consisted of dividing the desired alpha level of .05 by the number of statistical tests conducted (2). Although this does guard against committing type I error, chance of committing type II error is inflated. Means and standard deviations for this hypothesis are presented in table five.

Table 5

Performance In and Out of Zone

	In Zone		Out of Zone	
	n	M(SD)	n	M(SD)
Somatic Zone	20	2.65(1.18)	20	2.35(0.67)
Cognitive Zone	3	3.00(1.00)	37	2.46(0.96)

Note. Scores for performance are ranked on a four-point Likert scale, from 1 (poor) performance, 2 (below average performance), 3 (above average performance), to 4 (one of the best players on the ice).

4.5.2 Secondary Results

The independent t-tests run for direction, athlete's interpretation of anxiety intensity, as either facilitative or debilitative, while in or outside of cognitive zone, revealed no significant results, $t(41)=0.81$, $p>.05$. The same analysis testing interpretation while inside or outside of somatic zone revealed no significant differences, $t(41)=1.38$, $p>.05$. It was not appropriate to conduct a Bonferroni adjustment with this data, as two separate sets of data were used for the statistical analysis. Means and standard deviations for this hypothesis are presented in table six.

Table 6

Interpretation In and Out of Zone

Variable	In Zone		Out of Zone	
	n	M(SD)	N	M(SD)
Somatic Zone	20	6.70(7.12)	23	3.74(6.91)
Cognitive Zone	4	8.75(6.65)	39	5.89(6.71)

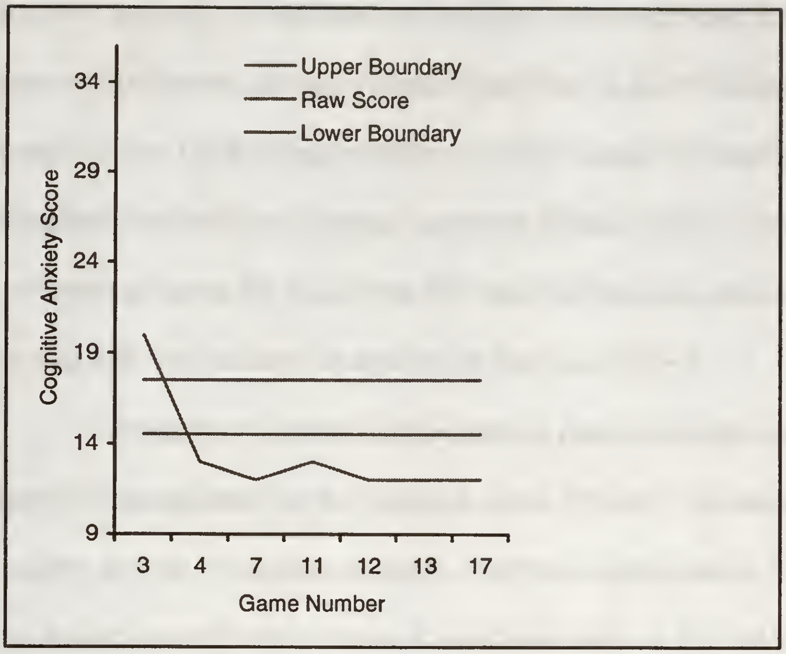
Note. Directionality/interpretation are rated on a scale ranging from -7 (very debilitative to +7 (very facilitative). Scores can range from -21 to +21.

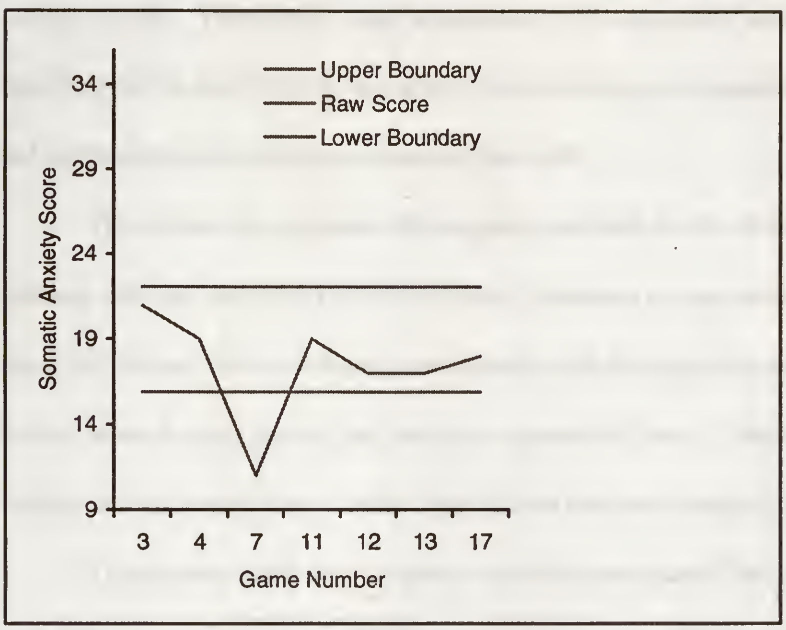
4.6 Analysis of Within Participants Variation

4.6.1 Primary Results

Intra-individual analysis was completed by plotting data points in a series of graphs, as well as by using tables to analyze performance in and out of zone. Figures one through six graphically display the in versus out of both cognitive anxiety zone, and somatic anxiety zone for each participant. These graphs were completed on an individual basis. Note that the number of games per participant ranges from 6 to 8. Further details surrounding the number of games played and games missed can be viewed in appendix C. Also note the y-axis of each graph represents the total raw score for either the somatic or cognitive anxiety subscale on the CSAI-2. These scores can range from 9 to 36. The x-axis of each graph represents the game number in which each athlete completed the corresponding CSAI-2 scores. Two of the figures show optimal zones, which fall below the minimum score of 9, this is due to the use of individual's standard deviation, versus the typical four points used by Hanin (1980). The upper and lower boundaries are identified by two horizontal lines. Refer to figures 1 through 6.

Figure 1. Cognitive and somatic anxiety in versus out of zone, for player one.





Player one is a goalie and is a first year player with the current team. His cognitive anxiety zone was relatively narrow, ranging from 14.5 to 17.5. None of his anxiety intensity score across the seven games fell within this “optimal” zone, yet he achieved optimal performances at scores of 17 and 21. This is a limitation of utilizing the top two performance scores to form the zone, as well as the individual’s own

standard deviation. If the standard deviation for an individual is relatively small, the zone will be narrow, leaving a greater possibility of scores falling outside of the zone versus inside. IZOF theory postulates that individuals with narrower zones cannot adequately deal with wide ranges in anxiety (Hanin, 1980). However, the top two performance scores for this athlete fall outside of his zone, indicating that not only can he deal with this variation in anxiety, he may excel with it.

Upon further inspection of the graph a peak in anxiety intensity during the first game of measurement for this athlete is noted. This early season peak in cognitive anxiety, amount of negative thoughts, worry and apprehension, may be in response to the desire for consistent ice time. It could also relate to the first year status of playing varsity hockey. This player may be unaware of his opponent's skill level, and the matching of his skill level to the level of competition, increasing the amount of worry and apprehension he enters the competition with.

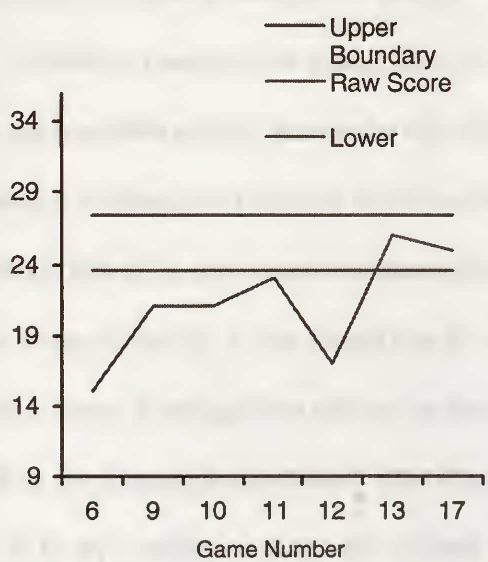
The following six games the cognitive anxiety levels of this athlete appear to plateau, with the remainder of scores nearly identical to one another. This may be the result of roles on the team being established, with this player understanding the role of first or second string goalie, and what is expected of him. It has been shown that role clarity, and understanding of role expectations decreases anxiety in individuals.

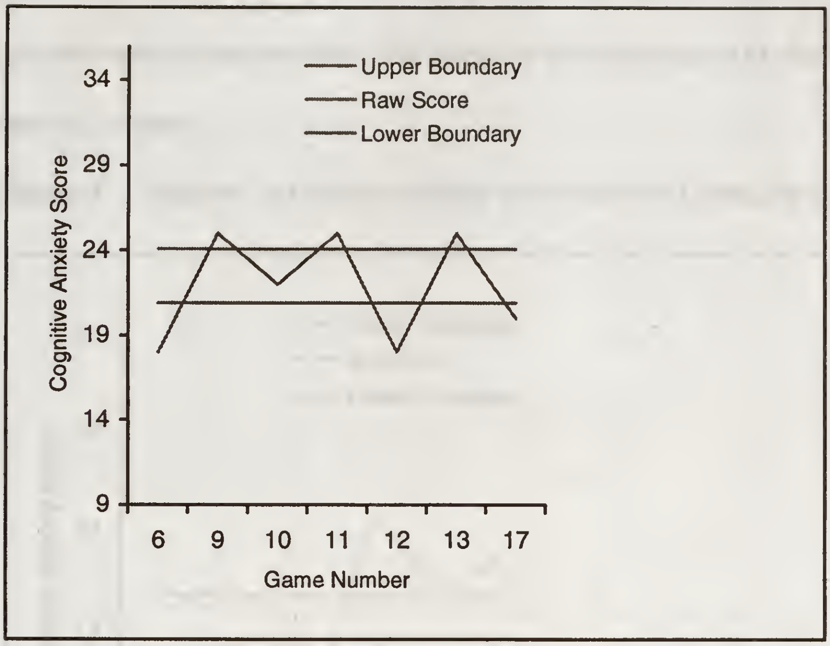
The somatic zone for this player is wider than that of his cognitive anxiety, with all but one anxiety score falling within this zone. IZOF would postulate that this athlete therefore is more capable of dealing with changes in the non-evaluative cues in the environment, such as his pre-game warm up routine, than he is with the evaluative cues, or cognitive anxiety. This makes logical sense, as the non-evaluative cues would remain consistent throughout level of competition, and are not related to the likelihood of success or failure.

Consistent with the cognitive anxiety scores, anxiety peaks in game one for this player. This again may be related to the early season "jitters" encountered by freshman team members. These are typically associated with fitting in with a team, understanding the unwritten rules of conduct, and again understanding your own role expectations as a member of the team. However, contrary to the plateau witnessed in cognitive anxiety scores, we see a large drop in somatic anxiety scores at game three. This may reflect the acceptance and understanding of the player's role on the team, the understanding of the unwritten rules of conduct of the team, as well as overall comfort with pre-game warm-ups and competition levels.

It is interesting to note that for this player's somatic zone, both his best and worst performance fall within the upper and lower boundaries. Previous research does not report a strong relationship between performance and somatic anxiety. Typically it is theorized that cognitive anxiety impacts performance to a greater extent then somatic anxiety does. This, and the wide range of optimal zone for somatic anxiety, could explain why we find both sets of performances within zone.

Figure 2. Cognitive and somatic anxiety in versus out of zone, for player five.



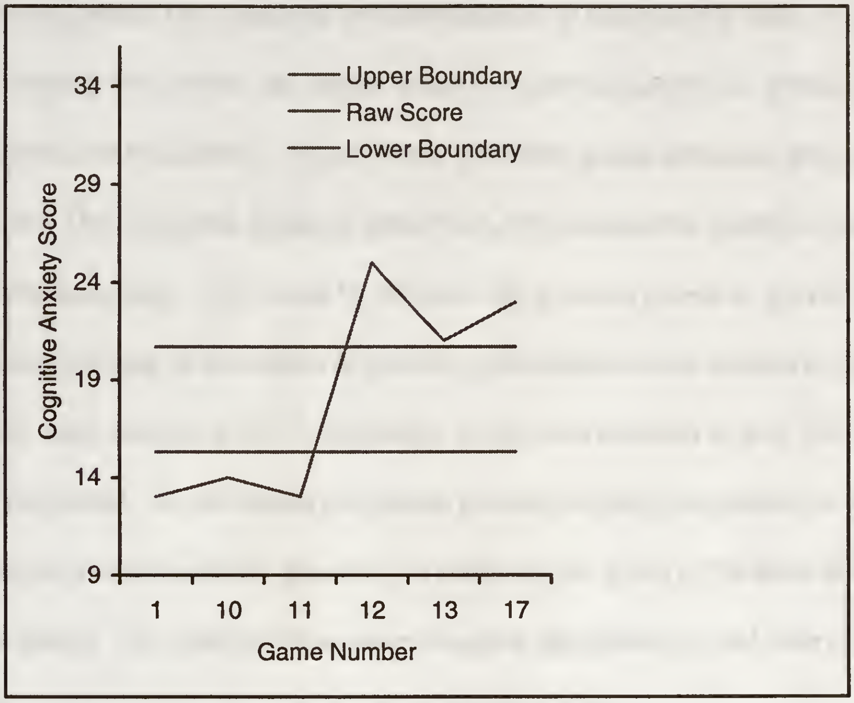


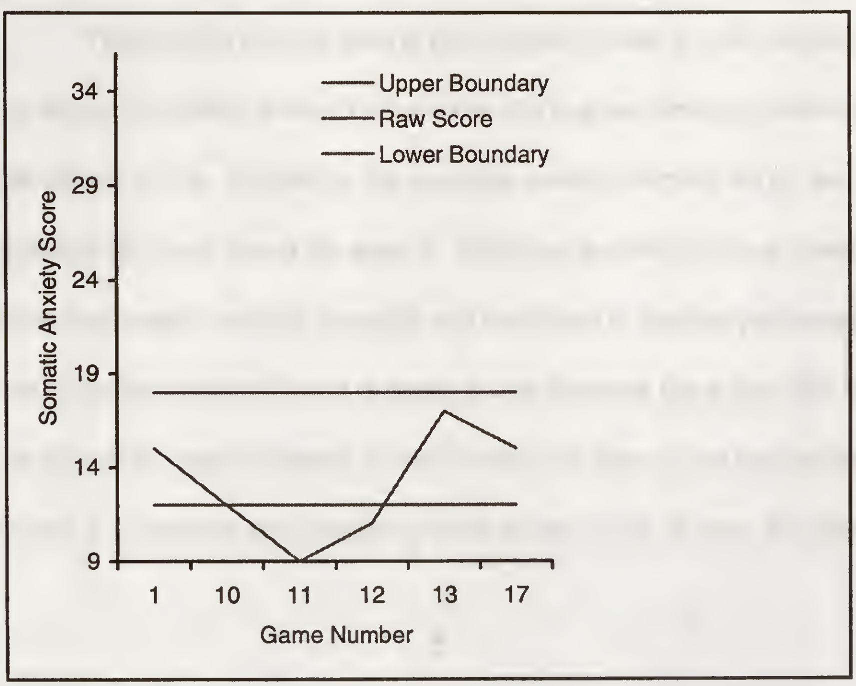
Player five is a defenseman in his first year with the team. His optimal cognitive anxiety zone is relatively narrow. Supporting the notion of the IZOF model, the only two scores which fall within this zone are the athlete's two best performance scores of the season. These two performances occur late in the season. Prior to this we see two large dips in scores, occurring at game one and five. This is in contrast to player one. Player five enters the first game (measured) of the season with relatively low quantity of negative thoughts or worries.

Similar to the cognitive zone, player five's somatic zone is narrow. However, unlike the cognitive anxiety scores, the two somatic anxiety scores corresponding to the best two performances fall just above and below this athlete's zone. Player five's zone relays that he is only capable of small changes in both cognitive and somatic anxiety intensity levels. It also seems that he is better able to deal with changes in somatic anxiety, then cognitive anxiety, as his best two performances scores fall outside of the somatic anxiety zone. This finding is similar to player one. There also seems to be no consistency in somatic anxiety throughout the games measured, as

peaks and valleys are noted across the games. Again, indicating that changes in somatic anxiety may not affect this player to the same degree as changes in cognitive anxiety intensity.

Figure 3. Cognitive and somatic anxiety in versus out of zone, for player seventeen.





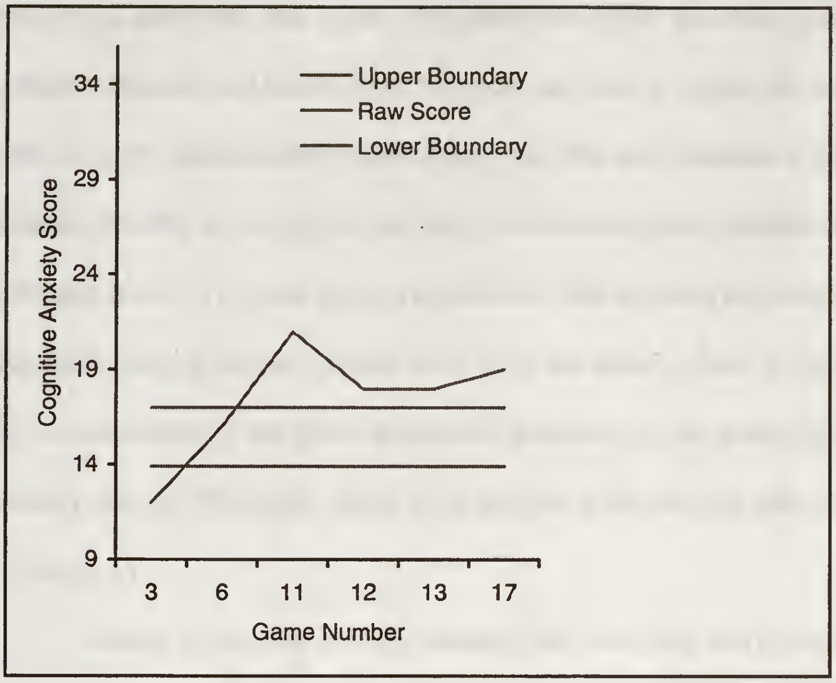
Player seventeen is a center forward in his first year with the team. His cognitive anxiety zone is relatively wide, meaning it is assumed he can sufficiently deal with wide ranges of cognitive anxiety intensity. Again limited by the use of the individual's standard deviation and top two performance scores we see no scores falling within the upper and lower boundaries of this player's zone. In contrast to the previous two players, the largest peaks in cognitive anxiety are seen at the end of the season for this athlete. Scores for the first three games measured are consistent, and low. The large peak begins at game four, with subsequent cognitive anxiety scores remaining high. This could be related to the position played by player 17. Pressure at the beginning of the season is typically placed more on the defensive roles amongst the team, such as goalie or defenders, as the team attempts to gain role clarity and role acceptance. As the season progresses pressure begins to be placed on the goal scorers, as roles acceptance has generally be achieved, the focus of the team then turns to winning. The quantity of negative thoughts, apprehension, and worry, in relation to success or failure, for a centerman will then surface.

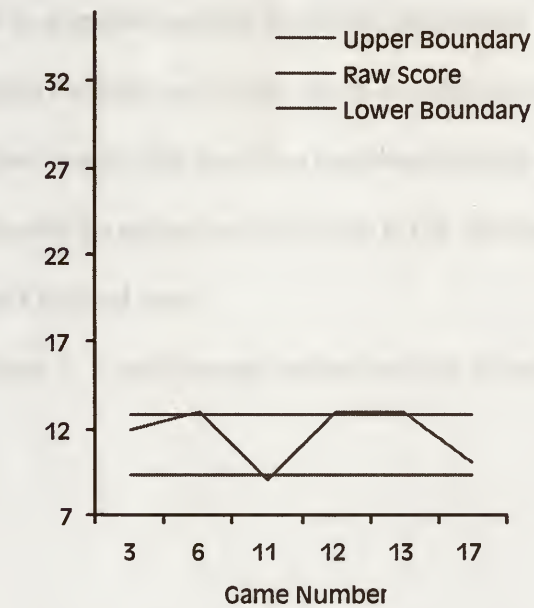
The somatic anxiety zone is also relatively wide for this athlete. Contrary to the cognitive anxiety scores, we have the two best performance scores falling within this player's zone. Parallel to the cognitive scores however, we do see considerable variation in scores across the season. This does support previous research, which notes that somatic anxiety intensity will be related to optimal performance, with best performances being achieved in zone. It also supports the notion that larger variations can be had in somatic anxiety intensity with little impacts on performance.

Figure 4. Cognitive and somatic anxiety in versus out of zone, for player twenty-one.

[illegible]

[illegible]



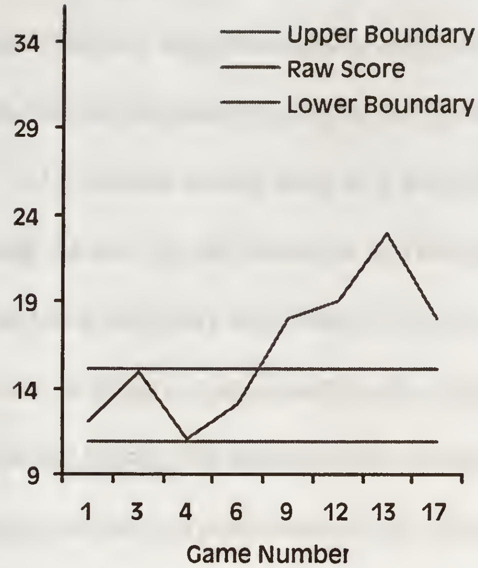


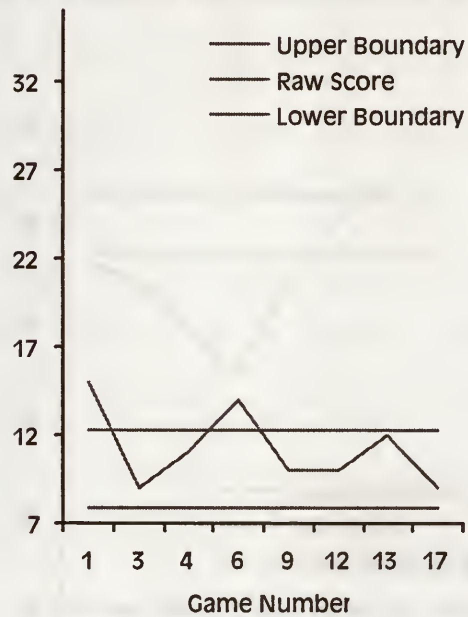
Player twenty-one is a center forward in his second year with the team. He had the highest overall performance rankings consistently across the season, with four performances being rated as 3s and his two best performances at ratings of 4. Both cognitive and somatic anxiety intensity zones were relatively narrow. Only one game, a performance of 3, fell within the cognitive zone. The two best performances fell

below and above the zone limits. This does not support the notion that best performances are had when inside the zone, nor does it support the notion that a player with a narrow optimal zone cannot efficiently deal with changes in cognitive or somatic anxiety, as this player had high performance scores despite changes in intensity levels. Previous playing experience with the team may explain the lower cognitive anxiety intensity scores early on in the season. Prior to the third game, and for the remainder of the games measured, however, we see much higher cognitive anxiety scores. This again, could be in relation to the position played, similar to that of player 17.

Scores for somatic anxiety intensity also vary with two decreases, one at game three and the other at the final game. This is an interesting contrast to the increase we see in cognitive anxiety during the same game. Despite this all scores either fall within the zone, or slightly above or below zone. Contrary to the cognitive anxiety scores, we see that both best performances fall within the athlete's zone. This finding supports the notion posited by the IZOF, that best performance occurs when within one's optimal zone.

Figure 5. Cognitive and somatic anxiety in versus out of zone, for player twenty-five.



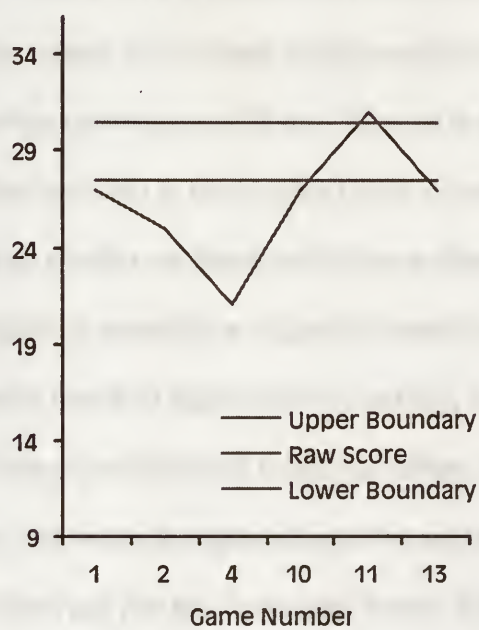


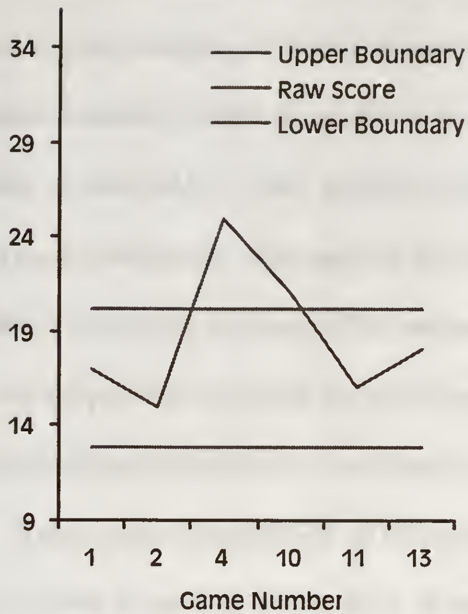
Player twenty-five is a forward in his first year with the team. His cognitive anxiety intensity scores varied across the season. The first four games measured show relatively low cognitive anxiety intensity scores, in contrast to the high scores reported in the last four games measured. Both top performances fall within this athlete's zone, and are at the lower range of scores. This supports the IZOF notion that best

performance occurs when within the cognitive anxiety zone. Similar to the other offensive players, cognitive anxiety levels are relatively low at the beginning of the season, and get progressively higher as the season goes on.

The somatic anxiety zone is in the lower range of scores and is narrow. Utilizing the two top performances and the athlete's own standard deviation, we see that the lower boundary falls below the lowest possible score on the CSAI-2, a limitation of using the participant's own standard deviation. Only two performances, the first and fourth, fall outside of the optimal zone. All other performances, including the two top performances fall within zone. This supports the IZOFs contention that best performances occur when inside of the zone.

Figure 6. Cognitive and somatic anxiety in versus out of zone, for player thirty.





Player 30 is a goalie in his second year with the team. Unlike the other 5 players, player 30's optimal cognitive anxiety zone is high on the scale, with the lower boundary approximating 27 on a 36-point scale. This reflects the position he plays. Goalies are noted to have higher levels of anxiety, then other players on the playing surface. Goalies are heavily relied upon during competition. This high optimal zone is intuitively appealing as a goalie is consistently under higher levels of stress, which typically results in higher levels of anxiety, especially so, cognitive anxiety in response to probability of success or failure. However, similar to other analyses, no scores fall within the optimal cognitive anxiety zone. The top two performances fall just above and just below the zone limits. This shows that this athlete can deal with slight variations in cognitive anxiety levels, which does not support the notions posited by the IZOF model. There is no overall consistency in the intensity scores, as peaks and valleys are noted across the games measured.

Scores on somatic anxiety intensity are similar to the cognitive anxiety scores, as there is great variation, with several peaks and valleys evident across the games measured. However, unlike the cognitive zone, this zone falls in the low to mid range of scores on the CSAI-2. Also, unlike the cognitive scores both top performances fall within the somatic zone. This supports the IZOF contentions. Interestingly however, this athlete's worst performance of the season also falls within the somatic zone. This may also support the previously noted research findings that changes in somatic anxiety are not as detrimental to performance, as are changes in cognitive anxiety.

Tables were completed on an individual basis, meaning the data from each player is listed in separate tables. Each of these tables includes the players mean performance scores, for both in their cognitive and somatic optimal zone and outside of their optimal zones. Note optimal zones were formed from their two best performances of the season, plus and minus half of their individual standard deviation. Refer to tables 7 through 12.

Table 7

Performance In and Out of Zone, player one.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	6	2.00(0.89)	1	2.00(0)
Cognitive Anxiety	0		7	2.00(0.82)

Table 8

Performance In and Out of Zone, player five.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)

Somatic Anxiety	1	1.00(0)	6	2.00(0.89)
Cognitive Anxiety	2	3.00(0)	5	1.40(0.55)

Table 9

Performance In and Out of Zone, player seventeen.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	4	2.50(0.58)	2	2.00(0)
Cognitive Anxiety	0		6	2.33(0.52)

Table 10

Performance In and Out of Zone, player twenty-one.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	2	4.00(0)	4	3.00(0)
Cognitive Anxiety	1	3.00(0)	5	3.40(0.55)

Table 11

Performance In and Out of Zone, player twenty-five.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	6	2.83(1.17)	2	2.50(0.71)
Cognitive Anxiety	4	3.25(0.96)	4	2.25(0.96)

Table 12

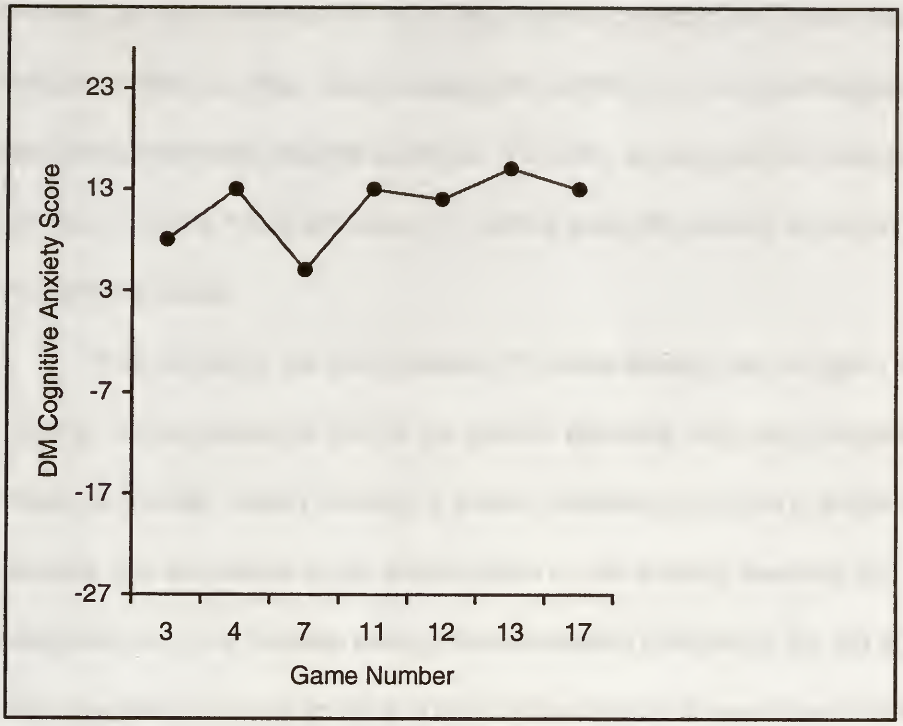
Performance In and Out of Zone, player thirty.

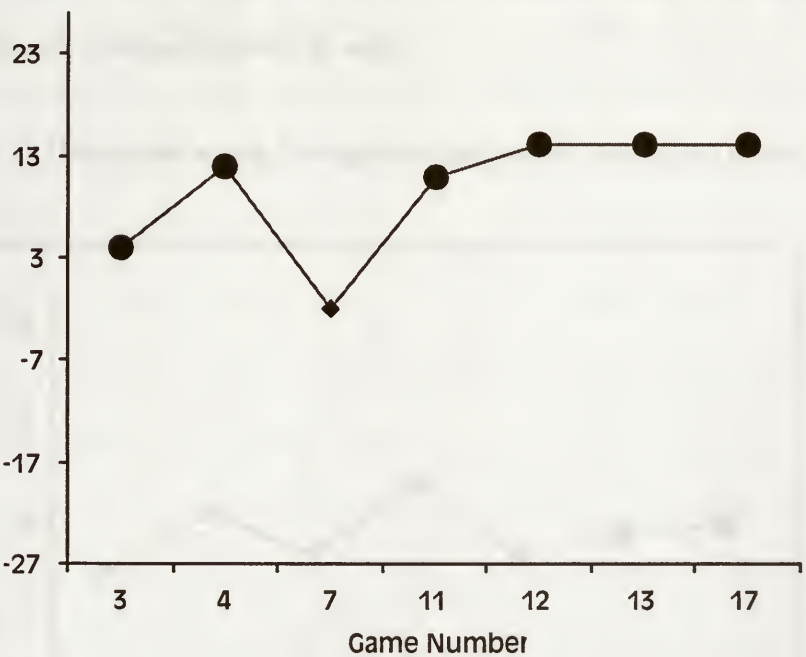
Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	4	3.00(1.41)	2	2.50(0.71)
Cognitive Anxiety	0		6	2.83(1.17)

4.6.2 Secondary Results

Figures 7 through 11 graphically display the directional scores for both somatic and cognitive anxiety. When an athlete was within their optimal cognitive or somatic anxiety zone (score wise on the CSAI-2), the corresponding directional score was highlighted on the graphs, using a large circle. Note the y-axis of each graph represents the total raw score for either the somatic or cognitive anxiety subscale on the directional portion of the DM-CSAI-2. These scores can range from -27 to +27. The x-axis of each graph represents the game number in which each athlete completed the corresponding DM scores. These game numbers range, reflecting such obstacles as injury, absenteeism, and incomplete questionnaires. Also note, only four players were utilized in this analysis. Player 21 only completed one DM portion, on the DM-CSAI-2 throughout the season, therefore his data could not be used for this analysis.

Figure 7. Directional scores for cognitive and somatic anxiety for player one.



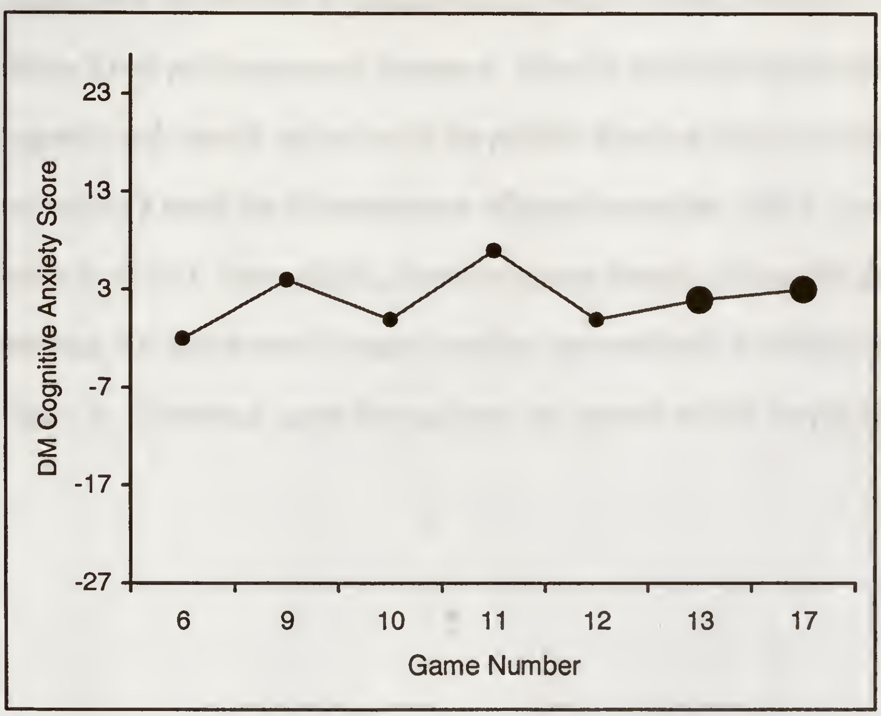


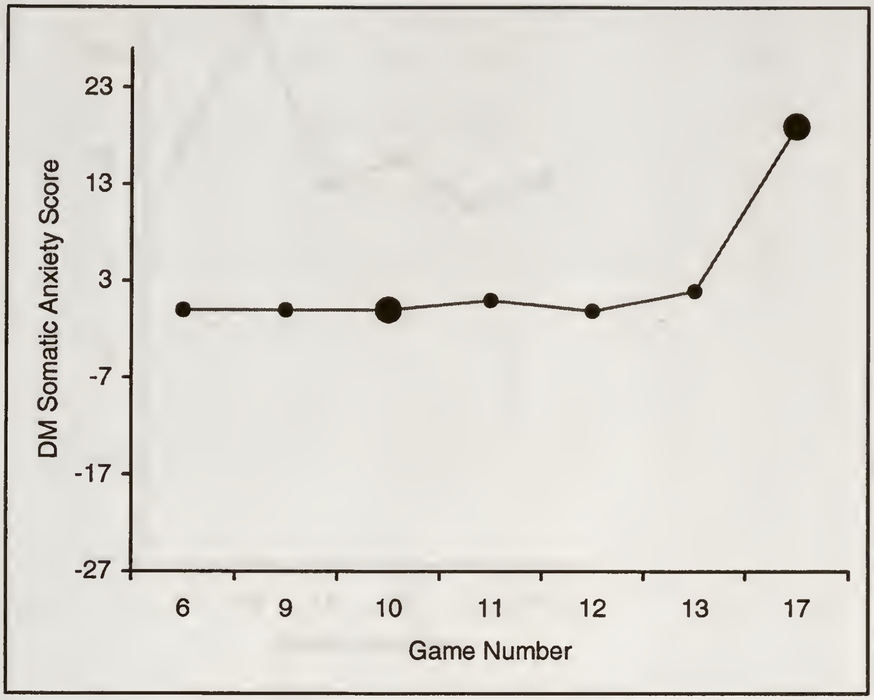
For player one when analyzing the direction/interpretation aspect of anxiety, all interpretations with respect to cognitive anxiety are in the positive direction. This means that's despite the levels of cognitive anxiety intensity athlete one incurred, all were interpreted as facilitative to his performance. There is no mirrored relationship

between the interpretations of the two best scores, meaning one is rated more facilitative then the other. Interestingly, this athlete's two worst performances were also interpreted in the positive direction. This does not support the claims made by previous research, which says that if an athlete interprets anxiety as facilitative they will perform better.

With respect to the interpretation of somatic anxiety, we see again that the majority of interpretations were in the positive direction, with one exception. With respect to somatic anxiety intensity a drastic decrease was shown at game three, this decrease was also shown in the interpretation of that anxiety; meaning the interpretation of low somatic anxiety was considered debilitative for this athlete. After this game we see a leveling off of interpretation in the positive direction, with all remaining games relatively similar in scores. This is consistent with the leveling off the intensity of somatic anxiety as well.

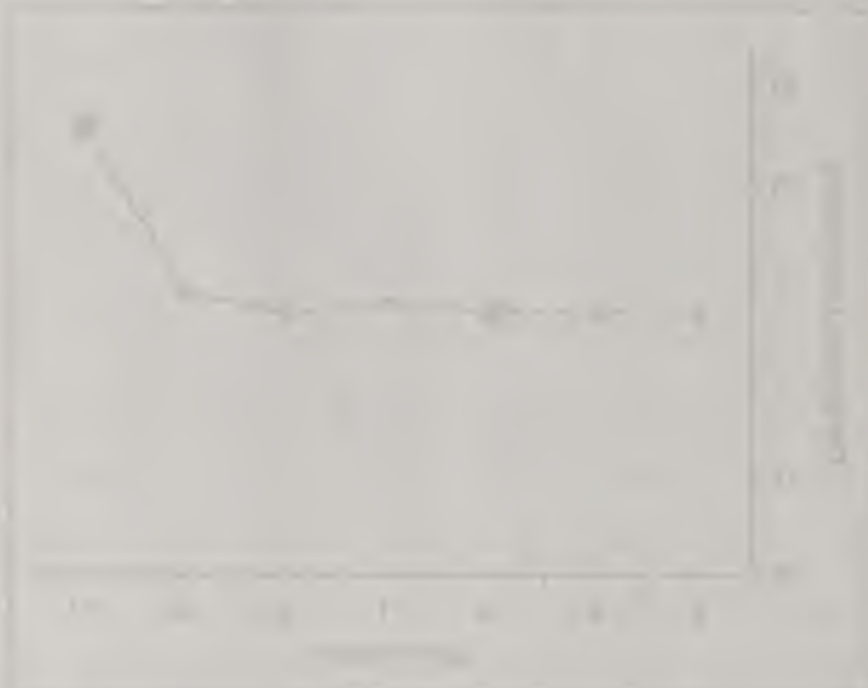
Figure 8. Directional scores for cognitive and somatic anxiety for player five.

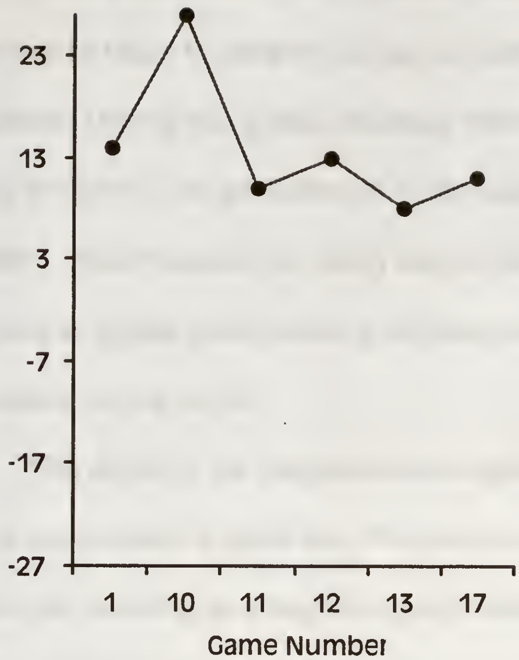


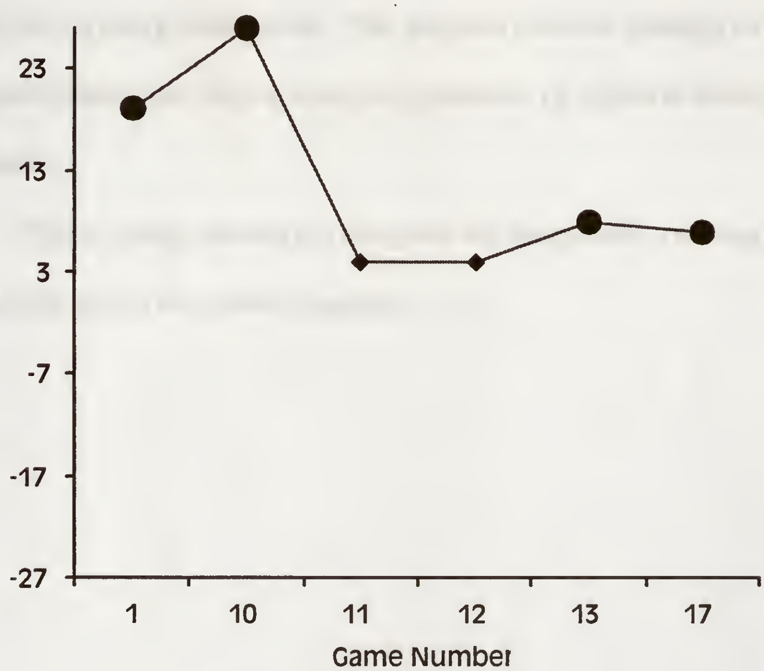


Unlike the intensity scores for player five, the interpretation scores appear consistent over time, with one exception. The last game measured for this athlete has a large peak in the interpretation of somatic anxiety. Meaning the athlete interprets this anxiety intensity level as very facilitative to performance. In support of the claims made surrounding the interpretation aspect of anxiety, this game is one of the athlete's best performances of the season. Also, all scores for interpretation of both cognitive and somatic anxiety are in the positive direction, with one exception. Game one we see a small dip in interpretation of cognitive anxiety, with a score falling just below 0 at -2.00. Interestingly, cognitive anxiety intensity during this game is low, inferring that low levels of cognitive anxiety are considered detrimental to this player.

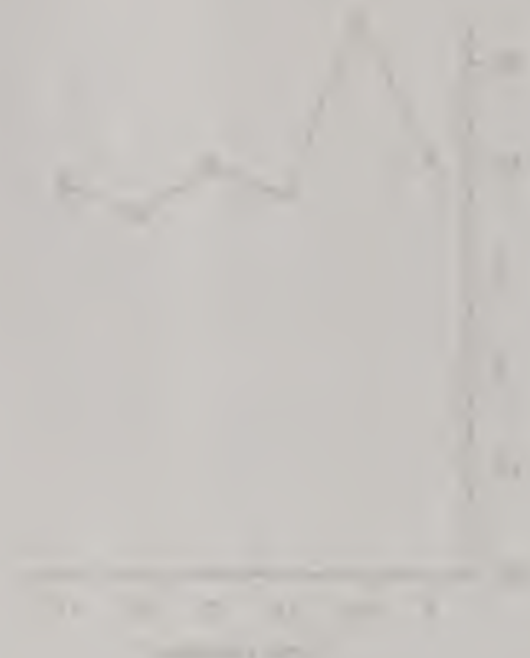
Figure 9. Directional scores for cognitive and somatic anxiety for player seventeen.







In regards to player seventeen's interpretations, all interpretations for both cognitive and somatic anxiety are in the positive direction, however there is great variability in scores. We see large drops in interpretation scores between the first two games, and the following games for somatic anxiety. These changes infer that early

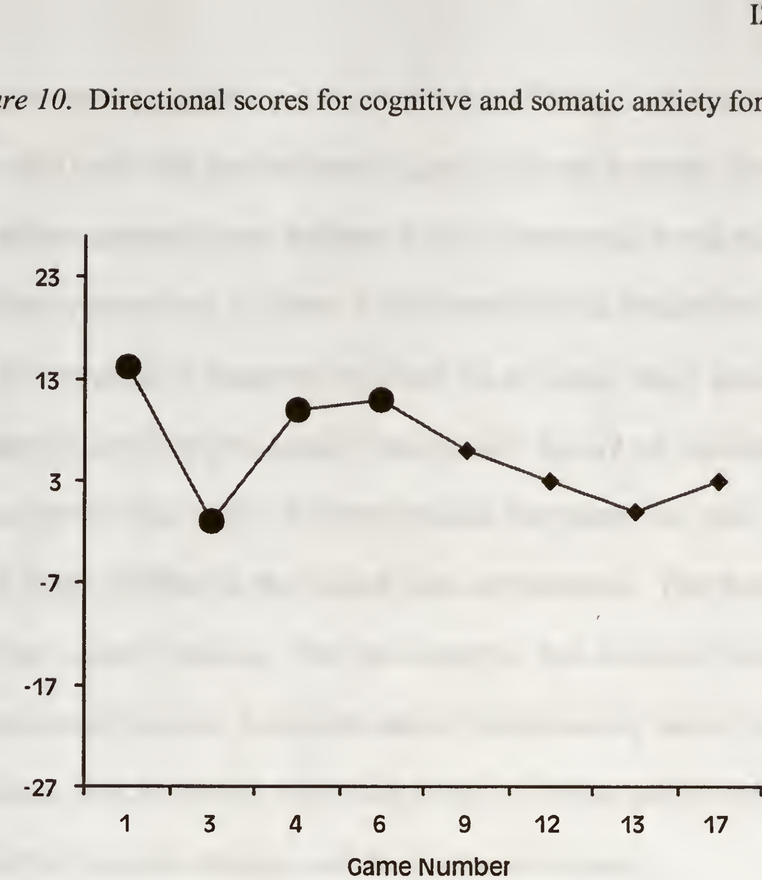


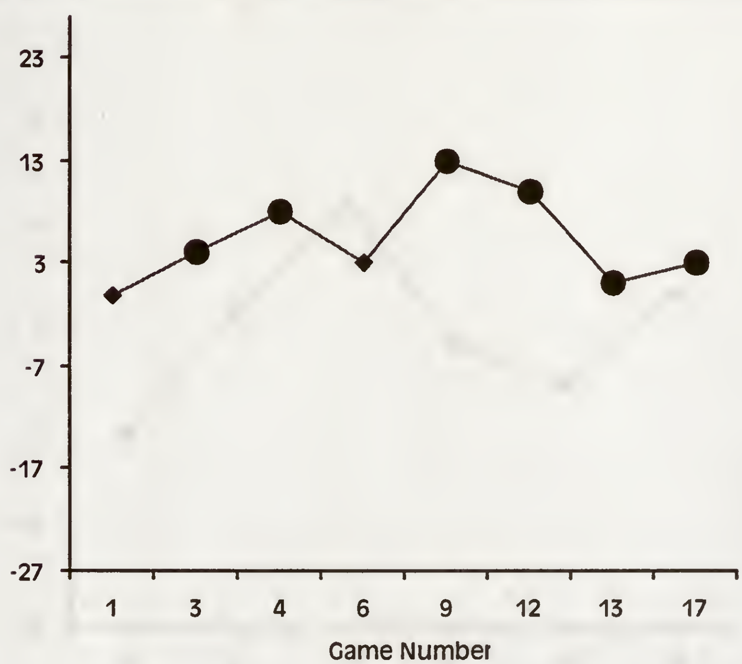
on in the season this athlete viewed somatic anxiety as facilitative and as the season progressed he began to interpret it as less facilitative, but still not completely debilitative. There is also a large difference between the interpretation of somatic anxiety for the two best performances of the season with one being fairly higher then the other. These results do not clearly support the notion that facilitative interpretation will result in optimal performance, as all interpretations were positive, and performance scores varied.

With respect to the interpretation of cognitive anxiety, there is also a large peak in interpretation at game two. There is no clear conclusion for this interpretation, as there was relatively no change in cognitive anxiety intensity levels between games one, two and three. Interestingly, we see a parallel between the two interpretation scores for the best performances. This supports previous findings of interpretation, as best performance was shown when interpretations of cognitive anxiety were the most facilitative.

Player twenty-one did not complete the interpretation section of the DM-CSAI-2 for any of the games measured.

Figure 10. Directional scores for cognitive and somatic anxiety for player twenty-five.

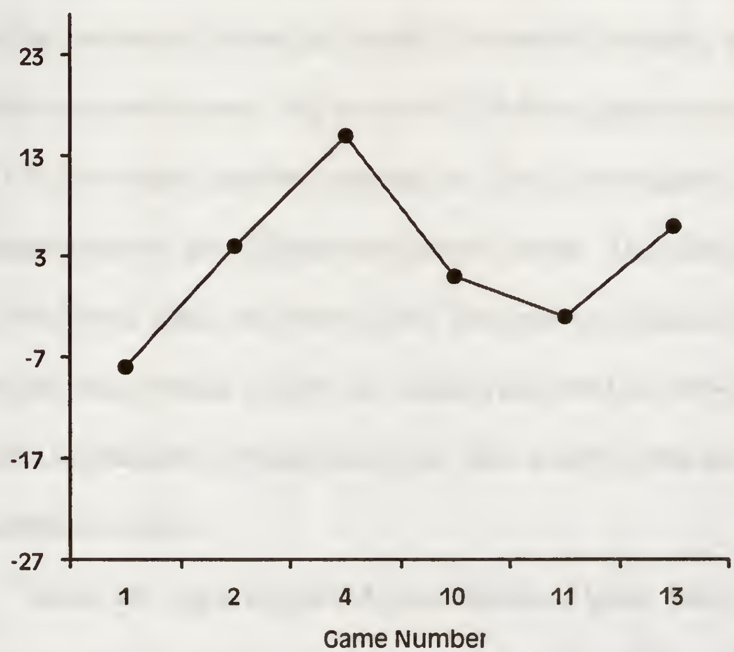


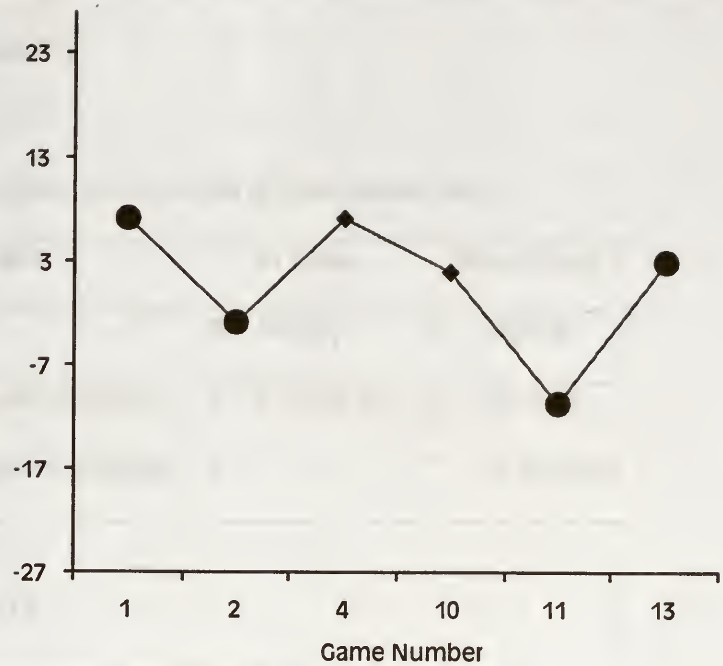


Interpretations of both cognitive and somatic anxiety for player twenty-five are in the positive direction, with one exception. Game two we see a small dip in the

interpretation of cognitive anxiety, with a score falling just below zero, at -1.00. This is parallel to the first peak we see in cognitive anxiety intensity levels, meaning when this athlete incurred greater feelings of worry, apprehension and negative thoughts concerning his success or failure, he interpreted this as debilitative to his performance. For the remainder of interpretation scores we see a large dip at game two, for the interpretation of cognitive anxiety, interestingly this is a top performance score. This means that for this athlete's best performance they interpreted their anxiety intensity levels as less facilitative, then during other performances. This does not support previous research findings. This lack of support was also noted in the interpretation of somatic anxiety scores. Interpretations of somatic anxiety are varied across the games measured, with no distinct differences being shown between the interpretation scores of the two best performances, and the other performances.

Figure 11. Directional scores for cognitive and somatic anxiety for player thirty.





For player thirty we see variation across scores for both cognitive and somatic anxiety interpretations. One of the top performance scores is associated with a negative interpretation of cognitive anxiety and somatic anxiety, meaning that when this athlete performed his best, he actually interpreted his anxiety intensity to be debilitative to performance, with scores of -3.00 for cognitive anxiety interpretation, and -11.00 for somatic anxiety interpretation. This is in complete contrast to the hypotheses made by the facilitative-debilitative model. The other interpretation scores vary, with several peaks and valley noted. This may be a product of the sub-elite performers being studied, as previous research has noted that sub-elite performers may be unable to adequately interpret and report their anxiety levels and subsequent interpretations of such.

Tables were again completed on an individual basis. Each of these tables includes the players mean interpretation score for both cognitive and somatic anxiety,

for both in their optimal zone and outside of their optimal zone. Refer to tables 13 through 17.

Table 13

Interpretation In and Out of Zone, player one.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	6	11.50(3.89)	1	-2.00(0)
Cognitive Anxiety	0		7	11.29(3.50)

Table 14

Interpretation In and Out of Zone, player five.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	1	0(0)	6	7.33(10.12)
Cognitive Anxiety	2	2.50(0.71)	5	3.00(4.58)

Table 15

Interpretation In and Out of Zone, player seventeen.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	4	15.25(9.54)	2	4.00(0)
Cognitive Anxiety	0		6	13.83(6.79)

Table 16

Interpretation In and Out of Zone, player twenty-five.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	6	6.50(4.59)	2	1.50(2.12)
Cognitive Anxiety	4	8.50(6.56)	4	3.00(2.45)

Table 17

Interpretation In and Out of Zone, player thirty.

Variable	In Zone		Out of Zone	
	N	M(SD)	N	M(SD)
Somatic Anxiety	4	0.50(7.89)	2	4.50(3.54)
Cognitive Anxiety	0		6	2.50(7.92)

V. Discussion

5.1 Summary of Results

The aim of this study was to test the IZOF model in team sport, utilizing the directional modification of the competitive state anxiety inventory-2 (DM-CSAI-2). It was hypothesized that athletes who were inside their optimal zone, for either somatic state anxiety or cognitive state anxiety, would perform better than when outside of either zone. It was also hypothesized that when athletes were inside of either zone they would interpret anxiety as more facilitative, than when outside of their zone. Statistically neither hypothesis was supported by this study.

The first set of independent t-tests was done comparing the dependent variable of performance with the independent variable of being either in or out of players' developed cognitive anxiety intensity zone. Findings reported no significant (p>.025) differences between performance and being in or out of zone. No significant (p>.025) findings were found for the comparison of in and out of somatic anxiety intensity zone either. These findings imply that athletes performed the same independent of being at their "optimal" anxiety levels. These two findings do not provide support for the IZOF model, the second tenet of which states that player's perform better when their anxiety levels are inside of their optimal zone, as compared to outside of their zone.

The second set of independent t-tests completed in this study compared athlete's interpretations of anxiety, facilitative or debilitative, and being in or out of their optimal zone. When athletes were inside of their zone they did not significantly (p>.05) differ in their interpretation of arousal, from when outside of their zone. Thus, athletes did not interpret anxiety as more or less facilitative when inside of their optimal zone, as compared to outside of their zone. These findings do not support the hypothesis that those inside of their zone interpret anxiety as more facilitative, than

when outside of zones. Overall no support was found for either hypothesis offered in this research study.

Although no support was found for the in versus out of zone tenet posited by the IZOF model, support was found for the first tenet of the model. The first tenet states that there will be considerable variation in anxiety scores between individual athletes. Variability in optimal anxiety scores between individual athletes has been noted by Jokela and Hanin (1999) in their meta-analysis, “It is remarkable that we were unable to identify a single study that demonstrated that different athletes had the same (or similar) optimal anxiety,” (p.882). In the present study, cognitive anxiety scores ranged from 11 to 21 and somatic anxiety scores ranged from 12 to 20. These wide ranges support the first tenet of the IZOF model and are consistent with previous research. Table four in chapter four, includes detailed statistics for the entire sample.

5.1.1 Interpretation of Inter-individual Analysis

No significant results were found for performance in or out of zone. These finding’s are consistent with past team research (Raglin & Morris, 1994; Randle & Weinberg, 1997; Thelwell & Maynard, 1998). These findings suggest that the IZOF model may not be an appropriate model for team sport, and may be better utilized in individual sport. This makes intuitive sense as the model itself concerns the individual athlete, versus the team of athletes. One individual’s optimal performance does not necessarily reflect the performance of the team as a whole, nor does the optimal performance of all team members. Many aspects of team sport may influence one’s anxiety level, including social atmosphere and cohesion. The team atmosphere is emotionally dynamic, with interactions between teammates, and between teams and their opponents adding drama, solidarity and commitment to the mix (Botterill & Patrick, 2003).

Interestingly, no significant differences were noted in the interpretation of anxiety while in or out of optimal zone. This is also consistent with past research (Davis & Cox, 2002). This could be a function of the ability of these sub-elite athlete's to identify their interpretations of anxiety accurately. This will be further discussed shortly.

5.2 Links to Previous Research

5.2.1 Similarities with Previous Research

Although the current study does not provide support for the main tenet of the IZOF model, in versus out of zone performance, it is consistent with other previous research findings. Raglin and Morris (1994) tested the IZOF with nine female varsity volleyball players. Similar to the current study, variability amongst optimal anxiety levels were noted, with 22.2% of players falling in the low range (0.5 standard deviation below published age-group mean), 44.4% falling in the moderate range (within +/-0.5 standard deviation of the published age-group mean) and 33.3% falling in the high range (0.5 standard deviation above the published age-group mean). Raglin and Morris (1994) also reported no support for the second tenet of the IZOF, which states that athletes will perform significantly better when inside of their optimal zone versus outside of their optimal zone. No significant differences ($p>.05$) were reported between performances inside versus outside of zone.

This study was also consistent with findings presented by Randle and Weinberg (1997) who noted that no statistically significant differences were found supporting the notion that best performance occurs when inside of somatic anxiety optimal zone, for their sample of eleven softball players. They do document that analysis could not be completed analyzing in/out of zone for cognitive anxiety, as there were not sufficient performance observations made. Another study done on team

athletes, cricket players, did not find support for the in versus out of zone tenet of the IZOF model, with quality of performance being independent of athlete's "optimal" anxiety zones (Thelwell & Maynard, 1998).

Secondary to the main tenets of the IZOF model, the present research study also found support for previous research in several other areas. Previous research has noted similar results for the directionality/interpretation aspect of anxiety, as were found in the current study. Davis and Cox (2002) studied swimmers, and found that athletes did not significantly interpret anxiety as more facilitative when inside of their optimal zone, when compared to outside of their optimal zone. This is comparable to the present study, which found no significant differences between the interpretation of anxiety, while athletes were inside or outside of their optimal zone.

There are several things these studies had in common, that were also found in the present study, which may help explain the lack of support for the in versus out of zone tenet. First, the sample sizes of all four studies are similar and could impact the results. The present study used only five participants. The Raglin and Morris (1994) study of volleyball players had a sample size of nine. Randle and Weinberg (1997) used eleven softball players. Finally Thelwell and Maynard (1998) utilized twenty cricket players in their analysis. These studies all had small samples, meaning they are underpowered. None of the three studies make reference to their levels of power, or power being a limitation of their studies Power is the probability of rejecting the null hypothesis when the null hypothesis is false. As the number of subjects in a sample is reduced, the power is reduced. Therefore, a sample with too small a number of subjects increases the probability of accepting the null hypothesis, when the null hypothesis is false (Thomas & Nelson, 1996).

Second, all of these studies involve interactive team sports. The present study utilized hockey players, the previously discussed three studies involved softball players (Randle & Weinberg, 1997), cricket players (Thelwell & Maynard, 1998) and volleyball players (Raglin & Morris, 1994). As noted, variation in optimal anxiety levels may be detrimental to team performance. However, in the team cohesion and performance literature no significant differences have been found between team performance and cohesion amongst interactive or additive team sport (Carron, Colman, Wheeler & Stevens, 2002).

In addition to supporting the variability in pre-competitive anxiety scores, the range of scores for both somatic and cognitive state anxiety reported in the current study, are consistent with past research findings. The current study reports somatic anxiety intensity scores ranging from 12 to 20, and cognitive anxiety intensity scores from 11 to 21. A similar study conducted using softball players also reported similar levels and ranges in somatic anxiety (9 to 23) and cognitive anxiety (9 to 21), (Randle & Weinberg, 1997). In comparison, Gould et al. (1993) report high levels with wide ranges for both somatic anxiety (12 to 27) and cognitive anxiety (12 to 32). The largest difference in ranges (highest scores minus lowest score) is noted for the scale of cognitive anxiety intensity, with ranges equal to 10 (current study), 12 (Randle & Weinberg, 1997) and 20 (Gould et al., 1993). All studies used the CSAI-2, which total scores for each subscale range from 9 to 36. These levels and ranges make intuitive sense. This would especially be true in relation to cognitive anxiety, which is the amount of negative thoughts and worries one has, and is related to perceptions of success or failure. Team sports may act as a social dispersion mechanism, in which anxiety is minimized by the dispersion of pressure to perform amongst several athletes, versus one individual athlete.

Another possible explanation comes from research in the area of team cohesion and success. Mullen and Copper (1994) note that in order for a team to be successful it must be cohesive and unified. This is in direct contradiction to the notion presented by the IZOF model. The variability in optimal anxiety hypothesized by the IZOF model may be detrimental to team performance, as it may decrease the homogeneity and cohesion of a team. Athletes who are reaching their optimal anxiety levels, and thusly optimal performance, may not necessarily be meshing with the team, and in turn will then not be aiding in the production of an optimal team performance. Athletes may have to adjust their anxiety levels for varying situations, such as difficulty of competition, variation in roles on team, interpersonal conflicts with other team members, as well as relationships with coaches (Carron & Hausenblas, 1998). Thusly, it may be more beneficial for a team to attain consistently good performance, rather than individuals on the team attaining sporadic optimal performance (Thelwell & Maynard, 1998).

It is imperative to note the possibility of deficiencies with the IZOF model, and not within the research conducted. It is possible that the IZOF model does not allow for applicability in team sport, as previously noted, homogeneity is beneficial in team sport, directly contradicting the notion of all athletes attaining differing levels of anxiety. Also one player's optimal performance, does not infer team optimal performance. Therefore, it may not be that the studies conducted lack validity, or power; instead it may the model itself that is irrelevant for team sport use. Hanin (1995; 1997) suggests that the IZOF model is most appropriate for use in predicting individual performance, versus team performance.

5.2.2 Discrepancies with Previous Research

Although several studies have reported similar results as the current study did,

there is a breadth of research which is inconsistent with the present study, providing support for the in versus out of zone notion of the IZOF model. The second tenet of the IZOF model which states that athletes perform better when inside of their zone versus outside of their zone has been supported in track and field athletes (Turner & Raglin, 1995), tennis players (Annesi, 1998), runners, sprinters, rhythmic gymnasts and ice skaters (Salminen et al., 1995), and track and field athletes (Imlay et al., 1995).

5.3 Limitations

5.3.1 Sample Size

Small samples sizes have also been noted in previous research. Annesi (1998) completed a study assessing the IZOF model in three elite tennis players. Using a small number of participants allowed the researcher to develop individual analysis of the relationship between zones and performance, and further develop individualized anxiety-controlling programs for two of the athletes (third moved away). Small sample sizes are also noted in the following studies: Imlay et al. (1995) utilized 16 track and field athletes for their analysis; Morgan, O'Connor, Ellickson and Bradley (1988) and Morgan, O'Connor, Sparling and Pate (1987) utilized 15 and 14 distance runners in their analysis; Gould et al. (1993) utilized 11 middle-distance runners and Randle and Weinberg (1997) utilized 11 softball players in their analysis.

The current study was limited by its small sample size. In order to accurately test the tenets of the IZOF the sample decreased from the original 19 participants to 6 participants. This was due to the identification of optimal performance scores across the season. The small sample size of this study limits the external validity of the findings. Based on our findings, using a small sample, we accepted the null hypothesis. Because we have a small sample, we have limited power. Limited power

makes it more likely that findings of a study will fail to reject the null hypothesis, when in reality it may be false. This is called type II error. Effect sizes calculated for the current study ranged from .31 to .56. Given current results the desired sample size, in order to provide enough power to guard against type II error, is 138 athletes (Cohen, 1988). Power analysis for this study was completed post-hoc, or after the study was completed. In future research this should be completed ad-hoc, before the study begins. Ad hoc should be used, rather than a priori, as previous research supplies knowledge of an assumed cause.

Raglin and Morris (1994) encountered a similar problem in attempting to test the IZOF model with a women's volleyball team, which consisted of nine players. They note that their small sample size would only have been complicated by the addition of other teams from other sports. Complications could arise from differences in team atmosphere and cohesion, as well as demands placed on athletes and teams in different sports.

5.3.2 Administration of Questionnaires

This study was limited by two distinct aspects of questionnaire administration: (1) time to competition and (2) self-administration. Thelwell and Maynard (1998) note that one of the major research limitations when attempting to test the IZOF model is the time to game administration of anxiety measures. In their study on cricket players, they note that their administration of the CSAI-2 thirty-minutes people to the competition beginning was limited in relation to the length of actual competition. Using an anxiety measure prior to lengthy competitions, some of which last up to several hours may never be able to accurately predict the anxiety experienced and subsequent performance of the athletes in those competitions. It may be more effective in these cases to have an in-game anxiety, versus a pre-game anxiety

measure (Gould & Tuffey, 1996; Jones, 1995; Krane 1994). Krane et al., (1994) who studied fluctuations of anxiety throughout a baseball game, found that both cognitive and somatic state anxiety did indeed fluctuate throughout the competition. Jokela and Hanin (1999) also suggest that it would be advantageous to measure anxiety prior to competition, during competition and after competition. This may be especially true in the current study, as the sport of hockey has unique characteristics, which may be more facilitative to throughout competition variations in anxiety levels. Hockey is a sport of quick "shifts." Players are on the ice for a short period of time; before they leave the ice and the following line of players comes on to perform. Each change in shifts demands players to be prepared to adapt to the changes in play, and enter the game with full effort, and at the speed of the game. These specific characteristics about hockey, may lead to fluctuations in anxiety levels throughout competition, as they are in a constant state of readiness.

The second limitation, specific to this study, was the self-administration of questionnaires. Athletes were taken through a familiarization session, in which they practiced completing the DM-CSAI-2 and any questions, concerns, or misunderstandings were clarified. However, in this study; athletes self-administered the questionnaires prior to competition beginning. It is this self-administration that may be responsible for the few missing data points. Athletes may have felt rushed and not completed the questionnaire prior to some games, or may have skipped questions or sections of the questionnaire, either due to confusion or lack of authority to observe the total completion of the measure. Had a research assistant been present to administer the questionnaire, any difficulties with it may have been dealt with, as well the participants may have felt some obligation to complete the questionnaire.

5.3.3 Specific Sport

The nature of sport examined, individual versus team sport, has been noted as being essential to understanding the anxiety-performance relationship (Hanton et al., 2000). As previously noted, team sports involve many other aspect including cohesion and unity, which may complicate the measure and subsequent performance of individual athlete's optimal anxiety levels. Within team sport, individual optimal performance is not valued as much as overall team performance. Differences have also been noted in contact versus non-contact sport, as well as between short-duration and long-duration sports. Those in contact sports, where fear of physical harm may be a factor, have reported higher levels of pre-competition anxiety (Dunn & Syrotuik, 2003). Hanin and Syrja (1995) noted that the IZOF model is best suited to predict performance in sports of short-duration. This may be due to fluctuations of anxiety noted in long-duration sports. The present study was limited as it only examined one sport, a contact sport of short duration.

5.3.4 Gender

The present study was limited by its inclusion of only one gender, males. Differences have been noted in the ability to identify emotional level as well as the willingness to share emotional levels with others. Salminen et al. (1995) note that females are more emotionally aware of themselves, and therefore are more accurate in reporting anxiety levels when compared to males. Contradictory to this observation, Martens (1977) states that females may be less accurate in reporting pre-competition anxiety levels as they become more highly emotional prior to competition, than do males, making it more difficult for them to anticipate and thusly report their mood accurately. The present study is limited in that it cannot offer any support or contradiction to either of these statements, as it did not include gender comparison groups.

5.3.5 Performance Measures

5.3.5.1 Subjective Performance Measure

The performance measured used in this study was also a limiting factor. The performance measure was a subjective scale created and modified by the coaching staff of the sample team. Subjective measures are limiting as they rely on individual's interpretations. It has been noted in the literature that athlete's self-ratings of performance are stronger predictors of performance when compared to coach's ratings (Jokela & Hanin, 1999). Contrary to suggestions of Hanin (1986) and Raglin and Morgan (1988), Jokela and Hanin (1999) found that self-ratings of performance produced smaller effect sizes than criterion-referenced ratings.

5.3.5.1.1 Monomethod Bias

Despite the use of both subjective and objective performance measures, mono-method bias is still a limitation of the current study. Mono-method bias is defined as, "a threat to construct validity that occurs because you use only a single method of measurement" (Trochim, 2001, p. 348). Construct validity, is the ability of your research findings to relate to theoretical concepts surrounding your research. By using only points per game, and subjective perceptions of performance, this study only measured part of "hockey performance." When creating zones for the current study, only the coach's subjective ratings of performance were used to identify optimum performances. As such, the current mono-method approach to measuring performance, did not account for objective performance measures, or differences in positions on the ice. The inability to measure the performance construct as a whole, defines monomethod bias.

5.3.5.2 Objective Performance Measure

The objective performance measure used was points per game. Points per game included total goals per game and number of assists per game. Due to the variance in positions, and roles of each player on the ice, goals and assists per game may not serve to accurately depict an individual's performance. For instance, a defenseman may complete his role of checking and preventing goals yet end the game with a 0 for points per game as he did not score or assist on a goal. This would then be an inaccurate performance measure for this player. The use of points per game as the objective performance measure is then a limitation of this study, as it may only account for a small portion of the player's accurate performances.

5.3.6 Identification of Optimal Performance

In order to accurately test the tenets of the IZOF model, an optimal performance score must be identified. It is this identifiable optimum which is used to create the athletes optimal zone. Upon completion of data collection for the current study, as previously explained, there were three individuals who had one identifiable optimum, six who had two identifiable optimal scores and two participants who had three identifiable optimal scores. By choosing to use the largest sample, six, 68% of the initial sample was unusable (n=19). This is a problem for several reasons. The first, viable and interesting information may remain uncovered as no further analysis was done on the 13 players who did not have identifiable optimal performance scores. This also raises the question, what if a player is consistently optimal, therefore produces several high performance scores, with none standing out from the rest (being identifiable)? This is of special concern to the study of team sport, where, as previously noted, consistency and homogeneity is preferred to individual optimal performances. This is a major limitation of the IZOF model.

Second, individuals agree to participate in practical research with the hope of gaining some information as to better understand themselves and their performance in sport. Being unable to test 13 of 19 athlete's who devoted time and effort to a study, leaves the researcher unable to provide such practical feedback to the unused players. This may serve to further repel individuals in sport from agreeing to participate in research studies.

5.3.7 Anxiety Measure

The validity of measuring competitive anxiety using the CSAI-2 has been called into question recently (Lane, Sewell, Terry, Bartram & Nesti, 1999). Jokela and Hanin (1999) note that the STAI is more accurate for recalling pre-competitive anxiety levels, when compared to the CSAI-2, but the CSAI-2 is more accurate for prediction of pre-competitive anxiety. One further criticism of the CSAI-2 is the psychometric weakness of the somatic anxiety subscale (Raglin & Hanin, 1999).

The CSAI-2 also utilizes a 4-point likert scale. This scale does not allow for much variation in responses. It limits responses to merely slight variation from competition to competition, without allowing for a breadth of differentiation to be shown. Also one cannot assume that each participant perceives the differences between a 3 and 4 (for example) as being the same, as the difference between a 1 and 2. This could be improved by using a 6-point likert scale. A 6-point likert scale still forces the individual to make a positive or negative decision, and also allows for greater variation between anxiety states.

Concerning the directional modification of the CSAI-2, Davis and Cox (2002) report a correlation between the intensity and direction scores on the DM-CSAI-2 as zero. They suggest two possible explanations: (1) their sample of swimmers did not understand the directions for the interpretation scale or (2) intensity and interpretation

of anxiety are not related. In attempts to eliminate option one, the authors instilled a familiarization session with the participants, clarifying the questionnaire and its instructions. As well, each athlete was given three practice trials completing the questionnaire, to ensure that instructions were understood. Despite the concerns of Davis and Cox, the present study did use a familiarization procedure, and did find significant correlations between anxiety and interpretation for both somatic, $r=.18$, $p<.05$, and cognitive $r=-.24$, $p<.001$ anxiety.

The DM scale assumes that the adjoining CSAI-2 item is neutral. However, upon inspection of the CSAI-2, it can be shown that several items, for example "I have self doubts" and "I feel nervous", are implicitly negative, and items such as, "I feel at ease" and "I feel mentally relaxed" are implicitly positive. Athletes may alter their interpretations to reflect the implicit direction of the CSAI-2 item. For example, it is more likely that an athlete will interpret "I have self doubts" as debilitative to performance, than it would be for an athlete to interpret it as facilitative to performance. These implicit directions may impact the athlete's directional scores, by not accurately reflecting their interpretation of their anxiety, but by reflecting the implied direction of each CSAI-2 item.

The directional modification of the CSAI-2 also assumes that those completing the questionnaire are self-aware. If an athlete cannot identify, or interpret his or her anxiety levels, they cannot accurately relay that information onto a questionnaire. This notion, in part, may explain the variability in interpretation scores we see in each athlete, as well as why we see optimal performances being attained when the athlete reports interpreting their anxiety as debilitative to performance.

5.3.8 Sub-Elite Performers

cognitive strategies, which alter their interpretations of anxiety, interpreting multiple differing levels of anxiety intensity as facilitative. No significant findings may be a by-product of the samples inability to identify and report true anxiety levels.

5.3.9 Separation of Anxiety Zones

Several researchers have noted that it may only be when cognitive anxiety is above one's zone that performance will decrease (Butt et al., 2003; Jones & Swain, 1995; Thomas et al., 2004). Butt et al. (2003) found that cognitive anxiety had a significant negative correlation with performance at four points during a field hockey competition (-.43, $p<.01$ pre-game; -.57, $p<.01$ first half; -.48, $p<.01$ second half; -.37, $p<.01$ post game). Davis and Cox (2003) also noted that their sample of swimmers performed significantly better when inside of their cognitive zone, versus outside of the zone. They did not however, find significant differences when comparing in versus out of zone for somatic anxiety. The present study is limited as it did not measure above or below zone. Simplification of in versus out of zone was followed, in order to test the basic tenets of the IZOF. Due to the already apparent lack of power, it was thought best to refrain from doing any further analysis.

5.3.10 Difficulty of Competition

Differences have been found between athlete's pre-competition anxiety levels, in relation to the upcoming competition difficulty. Raglin and Morris (1994) note that more women volleyball players were inside of their optimal zone more often prior to difficult matches when compared to easy matches. Salminen et al. (1995) found that accuracy of reporting anxiety was dependent on the difficulty of match, with more accurate reports made prior to difficult matches. Krane (1993) also notes that it may be important to measure the skill levels of the opposing players, as they may impact each athlete's performance across games. These differences may impact overall

anxiety scores prior to competition as well. There are many variables when looking into the possible moderator of difficulty of match or competition. One limitation of the present study is that it did not take into account difficulty of match, or skill level of opposing players.

5.3.11 Inclusion of Other Emotions

Motivation, excitement and competitiveness, to list a few, have all been identified as emotional components, which may be involved in the anxiety-performance relationship. Jokela and Hanin (1999) suggest the inclusion of relevant emotions, in order to make predictions of pre-competitive anxiety more accurate. Several researchers have suggested that the anxiety measures currently used in testing the IZOF may lack sensitivity to other emotions such as these (Gould & Udry, 1994; Gould & Tuffey, 1996). Burton and Naylor (1997) have suggested that these emotions are triggered by the variation in interpretation of anxiety, either being facilitative or debilitative. Positive and negative affect has been identified as influencing interpretations of anxiety (Watson & Clark, 1984; Watson & Tellgen, 1985). Several studies have been done assessing the role of positive and negative affect in pre-competitive anxiety (Hanin & Syrja, 1995; Jones & Swain, 1995). Findings indicate that those who have a predisposition for positive affect interpret anxiety as more facilitative, in comparison to those with a predisposition for negative affect. The current study is limited by its exclusion of other emotions, which may be involved in the pre-competitive anxiety-performance relationship. It was simply beyond the breadth of this study to be completed at the present time.

5.3.12 Student Athletes

The current study is limited in that it did not take into account the student-profile held by these varsity athletes. At various times of year a student-athlete may

face conflicting demands, or role conflict. This role conflict, student versus athlete, may increase stress and anxiety levels. Typically stress has been found to increase during exam periods. This may be linked to increases in anxiety reports at the end of each semester of academics. However, it is important to note, that for hockey specifically, the season runs the entire school year, therefore we would, if this notion was true, witness two peaks in anxiety, one at the middle of the season and one at the end of the season. However, of the six athletes utilized in this analysis, we do not see this.

5.4 Future Directions

5.4.1 Larger Sample

In order to accurately test the IZOF model in team sport, studies need to utilize larger samples. As noted previously, studies that have been completed in team sport, have had low sample sizes. In order for results to be statistically powerful and externally valid, sample sizes should be increased.

5.4.2 Performance Measures

In congruence with recommendations of past literature, when possible both subjective and objective measures of performance should continue to be utilized (Salminen et al., 1995). These measures should be position-specific, as to not inaccurately measure an athlete's performance, such as a goal tender's performance measured on points scored during a game. It has also been suggested that individual characteristics, such as health status, or perceptions of goal attainment be included in the analysis (Jones & Hanton, 1996; Raglin & Morris, 1994).

As noted previously, it may be advantageous for researchers to begin testing overall team performance versus individual performance (Raglin & Morris, 1994). This suggestion is intuitively appealing, as in team sport it is not the performance of

individuals that win games, it is the performance of a team as a whole. However, performance measures must be created which accurately assess team performance, in order for this notion to be useful.

5.4.3 Optimal versus Consistent Performance

It has been argued that for coaches and athletes it may be more advantageous to measure consistently good performance rather than sporadic optimal performance (Thelwell & Maynard, 1998). Sonstroem and Bernardo (1982) argue that optimal anxiety is best represented by the typical pattern of anxiety experienced by an individual prior to competition, rather than a single performance. Attaining sporting success is generally done over the course of season, which involves numerous performances. Consistently good performance across a season is more likely to result in success, than one or two optimal performances throughout a season. With this being said, measuring consistently good performance in athletes should be the next step taken in anxiety performance theory, especially at the sub-elite level. This can be done by creating athlete's optimal zones around several top performance scores, versus a single point as recommended by Hanin (1980).

5.4.4 Anxiety-Controlling Programs

Numerous studies have shown that it is the interpretation of anxiety, which is most significantly related to performance, not intensity (Butt et al., 2003; Jones & Swain, 1995; Hanton et al., 2000). Research has also noted that athletes who develop cognitive restructuring programs are better able to cope with anxiety intensity, by viewing it as facilitative (Hanton et al., 2000). It would therefore be valuable to develop and instill cognitive restructuring programs, teaching athletes how to view previously debilitating anxiety as facilitating, rather than temporarily dealing with the intensity of anxiety. One such program was completed and assessed by Annesi in

1998. Annesi developed a psychological skills grid, in which athletes could self-score their anxiety intensity levels, find the score on the grid and then self-administer the appropriate psychological skill. Skills such as thought stopping and positive self-talk were used. He found that post-treatment performances significantly increased ($p<.05$) when compared to pre-treatment performances. This study provides a basis on which to develop further anxiety-controlling programs.

5.4.5 Self-awareness

In future research done utilizing the directional modification aspect of the CSAI-2, it is imperative that athletes also be assessed on their self-awareness. Findings may suggest that the athlete is not self-aware, therefore the responses attained on the DM section of the questionnaire may not be of use. It may also be noted that the athletes are very self-aware, and therefore the researchers may be able to conclude that their findings are accurate, as the athletes have proven to be self-aware, therefore reflecting their true interpretation of anxiety.

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Appendix A

Directional Modification of the Competitive State Anxiety Inventory-2

DM-CSAI-2

IMPORTANT INSTRUCTIONS.

experience about competition. 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 **right now**. Please complete the inventory as honestly as you can. Sometimes athletes feel they should not admit to any nervousness, anxiety or worry they **currently** experience before competition because this is undesirable. Actually, these feelings are common, and to help us understand them we want you to share your feelings with us candidly. If you **are** worried about competition or have butterflies or other feelings that you know are signs of anxiety, please indicate these feeling accurately on the inventory. Equally, if you **currently** feel calm and relaxed indicate those feelings as accurately as you can. Your answers will be not be shared with anyone. We will be looking only at group responses.

The inventory is divided into 2 sections. Section **1** asks you to rate the level (amount) of symptoms that you **currently** experience, and section **2** asks you to rate whether you **currently** view these symptoms as positive (facilitative) or negative (debilitative) towards performance. Please read each statement carefully and circle the appropriate number in each section before moving onto the next statement.

	SECTION 1				SECTION 2						
	Not at all	Some-what	Mode rately	Very much	Very negative		Unimportant			Very positive	
I am concerned about this	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel nervous	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel at ease	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I have self doubts	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel jittery	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel comfortable	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned that I may	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My body feels tense	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel self-confident	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned about	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel tense in my stomach	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel secure	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned about	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My body feels relaxed	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am confident I can meet	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned about	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My heart is racing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm confident about	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm worried about	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel my stomach sinking	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel mentally relaxed	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm concerned that others	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My hands are clammy	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm confident because I	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm concerned I won't be	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My body feels tight	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm confident at coming	1	2	3	4	-3	-2	-1	0	+1	+2	+3

Appendix B

Raw Data

	Game#	PERF	savepercentage	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	4.00	.934	27.00	17.00	26.00	-8.00	7.00	18.00
2	2	3.00	.938	25.00	15.00	29.00	4.00	-3.00	12.00
3	3	3.00	.933	21.00	25.00	27.00	15.00	7.00	6.00
4	8	2.00	.911	27.00	21.00	25.00	1.00	2.00	16.00
5	9	4.00	.924	31.00	16.00	19.00	-3.00	-11.00	-3.00
6	10	.	.	28.00	26.00	24.00	11.00	8.00	15.00
7	11	1.00	.914	27.00	18.00	30.00	6.00	3.00	19.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	1.00	.	19.00	33.00	.	3.00	24.00
2	2	2.00	.00	26.00	22.00	30.00	11.00	9.00	20.00
3	7	3.00	2.00	25.00	29.00	29.00	17.00	18.00	17.00
4	8	2.00	.00	28.00	29.00	28.00	20.00	20.00	23.00
5	9	2.00	.00	31.00	34.00	23.00	25.00	26.00	25.00
6	12	2.00	1.00	28.00	27.00	28.00	18.00	19.00	20.00
7	13	3.00	2.00	28.00	29.00	24.00	22.00	22.00	25.00
8	14	3.00	1.00	29.00	26.00	24.00	19.00	18.00	19.00
9	15	3.00	1.00	28.00	32.00	28.00	20.00	19.00	22.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	3.00	1.00	12.00	15.00	28.00	14.00	.00	10.00
2	3	4.00	2.00	15.00	11.00	27.00	-1.00	4.00	15.00
3	4	4.00	3.00	11.00	9.00	20.00	10.00	8.00	17.00
4	5	2.00	2.00	13.00	14.00	29.00	11.00	3.00	17.00
5	7	3.00	3.00	18.00	10.00	31.00	6.00	13.00	20.00
6	8	1.00	.00	19.00	10.00	31.00	3.00	10.00	19.00
7	10	3.00	1.00	23.00	12.00	20.00	.00	1.00	2.00
8	11	2.00	.00	18.00	9.00	33.00	3.00	3.00	24.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	12	3.00	.	25.00	20.00	28.00	10.00	11.00	17.00
2	13	3.00	.	22.00	20.00	28.00	15.00	16.00	20.00
3	14	2.00	.	23.00	19.00	34.00	18.00	21.00	21.00
4	15	3.00	.	24.00	17.00	25.00	.	.	.
5	16	3.00	.	25.00	15.00	26.00	.	.	.
6	17	4.00	.	24.00	16.00	25.00	14.00	14.00	17.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.	19.00	18.00	27.00	21.00	9.00	22.00
2	2	2.00	.00	11.00	14.00	33.00	9.00	5.00	13.00
3	3	3.00	1.00	15.00	14.00	34.00	14.00	4.00	15.00
4	4	3.00	.00	11.00	15.00	35.00	13.00	7.00	16.00
5	5	1.00	.00	9.00	14.00	35.00	11.00	.	14.00
6	6	3.00	.00	11.00	.	29.00	10.00	.	13.00
7	7	2.00	2.00	.	16.00	33.00	.	8.00	14.00
8	8	1.00	.00	10.00	17.00	30.00	12.00	9.00	14.00
9	9	3.00	2.00	11.00	18.00	32.00	12.00	8.00	13.00
10	10	2.00	.00	11.00	18.00	28.00	14.00	11.00	16.00
11	11	1.00	.00	10.00	17.00	31.00	16.00	10.00	15.00
12	12	3.00	1.00	11.00	18.00	31.00	9.00	6.00	11.00
13	13	3.00	1.00	12.00	20.00	30.00	11.00	8.00	10.00
14	14	2.00	.00	12.00	18.00	30.00	12.00	8.00	9.00
15	15	3.00	1.00	12.00	20.00	30.00	10.00	8.00	13.00
16	16	2.00	.00	10.00	18.00	33.00	12.00	11.00	14.00
17	17	2.00	.00	11.00	19.00	30.00	14.00	10.00	14.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	3	4.00	3.00	12.00	12.00	27.00	8.00	6.00	11.00
2	12	3.00	1.00	16.00	13.00	26.00	.	.	.
3	13	3.00	2.00	21.00	13.00	25.00	.	.	.
4	14	3.00	2.00	18.00	9.00	26.00	.	.	.
5	15	3.00	1.00	18.00	15.00	29.00	.	.	.
6	17	4.00	2.00	19.00	10.00	28.00	.	.	.

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.00	12.00	17.00	24.00	15.00	19.00	18.00
2	2	2.00	.00	11.00	16.00	25.00	17.00	12.00	18.00
3	3	2.00	.00	14.00	13.00	25.00	8.00	13.00	17.00
4	4	3.00	.00	10.00	14.00	26.00	22.00	16.00	19.00
5	5	2.00	.00	12.00	16.00	.	18.00	13.00	.
6	6	3.00	.00	11.00	15.00	27.00	15.00	12.00	19.00
7	7	2.00	.00	11.00	14.00	25.00	.	18.00	18.00
8	8	1.00	.00	12.00	13.00	24.00	6.00	8.00	14.00
9	12	1.00	.00	13.00	12.00	24.00	3.00	8.00	16.00
10	13	3.00	.00	11.00	12.00	23.00	15.00	13.00	13.00
11	15	2.00	.00	20.00	18.00	22.00	15.00	16.00	16.00
12	17	2.00	1.00	18.00	19.00	18.00	.00	.00	.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	2	3.00	.00	13.00	15.00	29.00	14.00	19.00	19.00
2	8	2.00	.00	14.00	12.00	24.00	27.00	27.00	27.00
3	9	2.00	.00	13.00	9.00	35.00	10.00	4.00	14.00
4	12	2.00	.00	25.00	11.00	25.00	13.00	4.00	8.00
5	13	2.00	.00	21.00	17.00	26.00	8.00	8.00	20.00
6	15	3.00	.00	23.00	15.00	30.00	11.00	7.00	21.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	2	3.00	1.00	13.00	12.00	24.00	19.00	20.00	20.00
2	3	2.00	.00	12.00	14.00	25.00	18.00	19.00	23.00
3	5	2.00	.00	11.00	14.00	27.00	18.00	19.00	23.00
4	7	2.00	2.00	16.00	16.00	21.00	18.00	18.00	19.00
5	8	1.00	.00	13.00	14.00	23.00	22.00	18.00	23.00
6	9	3.00	.00	13.00	12.00	22.00	21.00	18.00	21.00
7	10	2.00	.00	13.00	12.00	21.00	20.00	18.00	22.00
8	11	1.00	.00	12.00	15.00	26.00	18.00	18.00	23.00
9	12	3.00	.00	12.00	15.00	27.00	18.00	18.00	21.00
10	13	4.00	.00	13.00	13.00	25.00	18.00	18.00	23.00
11	14	3.00	.00	11.00	14.00	25.00	18.00	18.00	24.00
12	15	2.00	.00	11.00	12.00	24.00	19.00	18.00	23.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.00	22.00	16.00	31.00	6.00	5.00	15.00
2	2	3.00	.00	14.00	10.00	29.00	10.00	8.00	14.00
3	3	3.00	.00	17.00	12.00	33.00	15.00	18.00	23.00
4	4	3.00	3.00	11.00	9.00	36.00	26.00	26.00	27.00
5	5	2.00	.00	23.00	9.00	36.00	27.00	23.00	26.00
6	7	2.00	.00	13.00	11.00	34.00	24.00	25.00	25.00
7	8	1.00	.00	13.00	12.00	32.00	15.00	7.00	23.00
8	9	2.00	.00	23.00	18.00	23.00	4.00	.	6.00
9	10	2.00	.00	12.00	12.00	34.00	18.00	6.00	24.00
10	11	1.00	.00	18.00	14.00	25.00	8.00	2.00	15.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	2	2.00	2.00	16.00	16.00	23.00	3.00	1.00	12.00
2	3	2.00	.00	18.00	17.00	23.00	7.00	-3.00	11.00
3	4	2.00	.00	18.00	15.00	23.00	.00	.00	10.00
4	5	1.00	.00	20.00	20.00	19.00	2.00	-3.00	6.00
5	6	2.00	.00	19.00	16.00	21.00	9.00	-4.00	8.00
6	15	3.00	.00	17.00	16.00	24.00	9.00	3.00	10.00
7	16	2.00	.00	18.00	17.00	23.00	1.00	3.00	9.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	3	3.00	2.00	19.00	12.00	28.00	15.00	26.00	19.00
2	9	3.00	2.00	18.00	11.00	26.00	14.00	.	16.00
3	10	3.00	1.00	18.00	11.00	23.00	19.00	25.00	17.00
4	12	2.00	.00	19.00	12.00	24.00	14.00	17.00	14.00
5	13	3.00	.00	20.00	12.00	19.00	14.00	19.00	16.00
6	14	2.00	.00	21.00	14.00	19.00	10.00	13.00	9.00
7	15	3.00	1.00	23.00	15.00	20.00	11.00	16.00	13.00
8	17	3.00	1.00	19.00	13.00	25.00	20.00	21.00	19.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.00	14.00	18.00	28.00	3.00	-3.00	15.00
2	2	3.00	1.00	16.00	19.00	25.00	-2.00	-4.00	8.00
3	3	3.00	.00	14.00	16.00	26.00	2.00	.00	8.00
4	5	2.00	.00	20.00	14.00	21.00	-5.00	3.00	2.00
5	6	3.00	.00	12.00	17.00	28.00	8.00	.00	11.00
6	7	3.00	2.00	20.00	14.00	19.00	-5.00	8.00	.00
7	8	2.00	.00	17.00	17.00	22.00	1.00	.00	9.00
8	9	2.00	.00	16.00	18.00	25.00	-3.00	.00	9.00
9	10	1.00	.00	.	17.00	25.00	.	-1.00	9.00
10	11	1.00	.00	17.00	13.00	26.00	-2.00	.	6.00
11	12	3.00	.00	17.00	13.00	27.00	-5.00	2.00	10.00
12	13	4.00	.00	19.00	13.00	25.00	-5.00	2.00	7.00
13	14	3.00	.00	17.00	10.00	26.00	.	7.00	9.00
14	15	3.00	.00	19.00	14.00	26.00	-7.00	2.00	10.00
15	16	3.00	1.00	16.00	12.00	27.00	-3.00	6.00	9.00
16	17	3.00	.00	19.00	12.00	27.00	-6.00	5.00	9.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.00	20.00	20.00	32.00	3.00	5.00	8.00
2	2	2.00	.00	24.00	16.00	31.00	8.00	1.00	12.00
3	3	2.00	1.00	20.00	17.00	29.00	4.00	-1.00	6.00
4	4	3.00	.00	24.00	21.00	24.00	2.00	1.00	4.00
5	7	3.00	1.00	23.00	33.00	25.00	18.00	18.00	18.00
6	8	1.00	.00	20.00	19.00	27.00	15.00	16.00	16.00
7	9	2.00	1.00	22.00	28.00	24.00	18.00	18.00	18.00
8	10	3.00	2.00	22.00	14.00	32.00	9.00	.	9.00
9	11	2.00	.00	25.00	26.00	24.00	14.00	14.00	14.00
10	13	2.00	.00	23.00	31.00	26.00	27.00	27.00	27.00
11	14	2.00	.00	26.00	35.00	27.00	27.00	27.00	27.00
12	15	3.00	.00	24.00	33.00	29.00	27.00	27.00	27.00
13	16	1.00	.00	23.00	23.00	29.00	18.00	18.00	18.00
14	17	2.00	.00	24.00	34.00	27.00	17.00	27.00	27.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	5	1.00	.00	15.00	18.00	25.00	-2.00	.00	15.00
2	7	2.00	1.00	21.00	25.00	22.00	4.00	.00	3.00
3	8	1.00	.00	21.00	22.00	19.00	.00	.00	.00
4	11	1.00	.00	23.00	25.00	22.00	7.00	1.00	.00
5	12	2.00	.00	17.00	18.00	18.00	.00	.00	.00
6	13	3.00	.00	26.00	25.00	23.00	2.00	2.00	.00
7	17	3.00	.00	25.00	20.00	20.00	3.00	19.00	.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	12	3.00	.00	17.00	11.00	30.00	24.00	19.00	21.00
2	13	.	.00	12.00	10.00	27.00	20.00	8.00	23.00
3	14	3.00	.00	13.00	9.00	32.00	21.00	15.00	19.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.00	16.00	.	28.00	14.00	.	14.00
2	2	2.00	.00	13.00	13.00	30.00	14.00	-1.00	16.00
3	3	3.00	.00	13.00	10.00	32.00	15.00	1.00	14.00
4	4	3.00	1.00	12.00	10.00	32.00	17.00	1.00	15.00
5	7	3.00	.00	11.00	14.00	31.00	18.00	3.00	17.00
6	8	3.00	.00	11.00	13.00	30.00	18.00	1.00	18.00
7	9	3.00	.00	11.00	14.00	26.00	20.00	2.00	17.00
8	10	3.00	.00	12.00	11.00	.	22.00	.	21.00
9	12	3.00	1.00	14.00	15.00	31.00	18.00	1.00	18.00
10	13	3.00	.00	13.00	12.00	31.00	21.00	5.00	16.00
11	14	3.00	.00	13.00	11.00	33.00	23.00	3.00	21.00
12	15	3.00	.00	13.00	10.00	36.00	24.00	23.00	26.00
13	16	3.00	.00	14.00	9.00	35.00	24.00	24.00	27.00
14	17	3.00	.00	13.00	10.00	34.00	24.00	19.00	23.00

	Game#	PERF	points	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	2.00	.00	11.00	14.00	31.00	15.00	4.00	19.00
2	2	2.00	.00	10.00	14.00	31.00	7.00	9.00	21.00
3	3	3.00	.00	9.00	15.00	34.00	6.00	6.00	24.00
4	4	3.00	.00	10.00	14.00	34.00	7.00	7.00	24.00
5	5	2.00	.00	9.00	14.00	34.00	20.00	10.00	25.00
6	7	2.00	.00	9.00	15.00	35.00	26.00	15.00	25.00
7	8	3.00	.00	9.00	15.00	36.00	25.00	17.00	26.00
8	9	3.00	.00	9.00	12.00	34.00	25.00	17.00	25.00
9	10	2.00	.00	9.00	15.00	36.00	25.00	18.00	26.00
10	11	1.00	.00	9.00	15.00	36.00	27.00	20.00	27.00
11	12	1.00	.00	9.00	17.00	34.00	25.00	14.00	25.00
12	13	2.00	.00	9.00	17.00	34.00	25.00	18.00	26.00
13	14	2.00	.00	9.00	14.00	34.00	21.00	18.00	26.00
14	15	2.00	.00	9.00	17.00	36.00	27.00	16.00	26.00
15	16	1.00	.00	9.00	14.00	36.00	27.00	24.00	27.00

	Game#	PERF	savepercentage	coganx	somanx	conf	dmcoganx	dmsomanx	dmconf
1	1	.	.	11.00	10.00	36.00	2.00	.00	.00
2	2	.	.	11.00	9.00	36.00	.00	.00	.00
3	3	.	.	14.00	9.00	35.00	1.00	.00	1.00
4	4	3.00	.964	20.00	21.00	30.00	8.00	4.00	13.00
5	5	.	.	9.00	9.00	36.00	.00	.00	.00
6	7	.	.	10.00	16.00	30.00	.00	-4.00	3.00
7	8	.	.972	10.00	17.00	28.00	-2.00	-1.00	2.00
8	10	2.00	.952	13.00	19.00	34.00	13.00	12.00	13.00
9	11	2.00	.958	12.00	11.00	33.00	5.00	-2.00	-3.00
10	12	1.00	.943	13.00	19.00	35.00	13.00	11.00	18.00
11	13	.	.	9.00	12.00	32.00	8.00	6.00	10.00
12	14	1.00	.929	12.00	17.00	35.00	12.00	14.00	5.00
13	15	3.00	.909	12.00	17.00	31.00	15.00	14.00	13.00
14	16	2.00	.910	12.00	18.00	32.00	13.00	14.00	13.00

Appendix C

Missing Data

Game	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Player																	
1	DNP	DNP	*	*	-	DNP	*	-	DNP	DNP	*	*	*	-	-	-	*
2	*	*	*	*	-	*		-	*	*	*	*	*	-	-	-	*
3	*	*	*	*	-			-	*	*	*	*		-	-	-	*
4					-			-						-	-	-	*
5					-	*		-	*	*	*	*	*	-	-	-	*
7	*	*	*	*	-			-	*	*	*	*	*	-	-	-	
10	*	*	*		-	*	*	-	*	*	*	*	*	-	-	-	*
11			*		-			-			*	*		-	-	-	*
14	*	*	*	*	-	*	*	-						-	-	-	
15	*	*	*	*	-	*		-	*	*	*	*	*	-	-	-	
16		*	*		-	*		-	*	*	*	*	*	-	-	-	*
17	*				-			-		*	*	*	*	-	-	-	*
19	*	*	*	*	-	*	*	-	*	*				-	-	-	*
21			*		-	*		-			*	*	*	-	-	-	*
22	*	*	*	*	-	*	*	-	*	*	*	*	*	-	-	-	*
24					-			-						-	-	-	*
25	*		*	*	-	*		-	*			*	*	-	-	-	*
27	*	*			-			-	*	*	*			-	-	-	*
30	*	*		*	-			-		*	*		*	-	-	-	

Note: DNP: did not play, but DM-CSAI-2 was completed. * played and completed DM-CSAI-2. – no data collected for this game.