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Different approaches to the study of stress and performance in sport

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Summary

This thesis examined stress and anxiety in sport from a number of different perspectives. It is written as a series of research papers (chapters). Before the research papers, a critical review chapter is presented on the research and theory relevant to stress and anxiety in sport. One of the issues to arise from the review chapter was the relative merit of multidimensional anxiety theory and catastrophe models. In multidimensional anxiety theory, it is unclear whether cognitive anxiety and self-confidence are viewed as being conceptually independent or conceptually co-dependent. In higher-order catastrophe models, self-confidence is viewed as being conceptually independent of cognitive anxiety and is expected to moderate the interactive effects of cognitive anxiety and physiological arousal upon performance. One of the aims of Chapter 3 was to clarify whether cognitive anxiety and self-confidence were conceptually independent. This was done by means of a meta-analysis that explored the relationships between cognitive anxiety and performance, and self-confidence and performance. The magnitude of the (positive) self-confidence mean effect size was significantly larger than the magnitude of the (negative) cognitive anxiety mean effect size. This offers evidence for the relatively strong influence of self-confidence upon performance. It also provides support for the conceptual independence of cognitive anxiety and self-confidence. In Chapter 4, the role of self-confidence was explored within a higher-order catastrophe model framework. This involved an exploratory segmental analysis designed specifically for exploring bias factors in higher-order catastrophe models. This analysis supported the moderating role of self-confidence within this framework. More specifically, the maximum cognitive anxiety x somatic anxiety interaction effect size was at a higher level of somatic anxiety for the high self-confidence condition, when compared to the low self-confidence condition. Another of the findings from the meta-analysis was the dearth of studies conducted with elite performers. The final research paper was an investigation of organizational stress within an elite environment. In view of its exploratory nature, this study was conducted within a qualitative framework. The major sources of organizational stress to emerge from the interviews with elite athletes were: selection, training environment, finances, nutrition, goals and expectations, coaches and coaching styles, team atmosphere, roles, support network,

and communication. A general discussion chapter follows the research papers. In this chapter, implications for future research and applied practice are discussed in relation to the project as a whole.

Chapter 1

Introduction

Competitive athletes often have to cope with a great deal of pressure and stress. This is particularly true of athletes at the highest level. However, despite these seemingly adverse conditions, performers frequently seem able to “rise to the occasion” and perform exceptionally well. It is perhaps this apparent paradox that has made the topics of stress and anxiety so appealing to researchers in sport psychology. Such is the popularity of these topics that it is quite rare for any given volume of a sport psychology journal to contain no research articles related to stress or anxiety.

However, the rate at which journal articles are published on this subject seems rather greater than the rate at which our understanding has evolved.

Previous stress and performance research has been partly hampered by the ambiguous and interchangeable use of terms such as arousal, activation, stress, and anxiety. Furthermore, at times, researchers have adopted seemingly diametrically opposed theoretical standpoints. Consequently, some fundamental issues remain to be satisfactorily resolved. For example, do worry (i.e., cognitive anxiety) and self-confidence represent opposite extremes of a single continuum (cf. Martens, Burton, Vealey, Bump, & Smith, 1990) or do they represent independent constructs (cf. Hardy, 1996a)? Does anxiety sometimes help a performer’s performance (cf. Jones, 1995) or does a “negative” emotion always hinder performance (cf. Burton & Naylor, 1997)? When a competitor’s performance suffers a drop, is the nature of this drop always smooth and gradual (cf. Martens et al., 1990) or is it sometimes large and sudden (cf. Hardy, 1996b)? These questions remain to be satisfactorily addressed. Finally, past research with elite athletes (e.g., Gould, Jackson, & Finch, 1993a; Scanlan, Stein, & Ravizza, 1991) has revealed a number of sources of stress that are not related to the stress engendered by the competition itself. Thus, an important question remains: what are the organizational stressors to which elite athletes are exposed?

Purpose of the Research Project

The purpose of the present research project is to address some of the above questions. More specifically, the purpose of the project is to investigate the relationship between stress and sport performance from two major theoretical paradigms. The first is an attempt to elucidate the relationship between cognitive anxiety, self-confidence, and competitive performance. The second is an attempt to investigate elite performers' sources of stress from an organizational perspective. These approaches are discussed in more detail in the next section.

Structure of the thesis

After a detailed review and critical appraisal of stress and anxiety research, this project will attempt to answer the following questions:

- 1) What is the relative impact of cognitive anxiety and self-confidence upon performance?
- 2) Is self-confidence a bias factor within a butterfly catastrophe model framework?
- 3) What are the sources of organizational stress in elite sport?

Chapter 2 of the thesis is a review of the literature in the area of stress and anxiety in sport. This chapter provides working definitions of the main concepts of interest in the thesis. Also, the chapter provides a detailed and critical overview of the research conducted to date. The chapter critically appraises theories and models that have been proposed in the area. As this chapter was written for publication in the Handbook of Sport Psychology, it concludes with future research directions and applied implications for best practice.

Chapter 3 reports a meta-analysis of two relationships: state cognitive anxiety and competitive sport performance, and state self-confidence and competitive sport performance. The main purpose of this study was to investigate the relative importance of cognitive anxiety and self-confidence effects upon performance. Another purpose of this meta-analysis was to determine whether cognitive anxiety and self-confidence reflected independent or interdependent constructs.

Chapter 4 reports an innovative investigation of Hardy's (1996a) butterfly catastrophe model. The main purpose of this study was to determine whether self-confidence might act as a bias factor within a butterfly catastrophe model framework.

Chapter 5 reports a qualitative case study of organizational stress in elite sport. The purpose of this study was to explore organizational stress within an elite environment in order to better understand the real-life stress to which elite athletes can be exposed during their preparation for major international competitions.

Chapter 6 provides a summary and discussion of the thesis findings. In particular, this chapter discusses the implications of the findings from both applied and theoretical perspectives. Finally, future directions are offered for research in the area of stress and anxiety in competitive sport.

The methodological approaches used in this thesis are varied, including a meta-analysis, an innovative test of higher-order catastrophe models, and a qualitative study. This variety has the benefit of training the candidate to conduct research in a number of different ways. Also, the thesis is written as a collection of research papers. Writing a thesis as a series of research papers serves two important functions. First, it trains the candidate for an essential part of an academic career, namely to conduct research with a view to publication. The second function is related to the first. That is, writing a thesis in this way encourages the development of self-contained chapters that are easier both to write and read than a magnum opus. Furthermore, whereas a magnum opus is likely to be read only by the thesis committee, the papers comprising a thesis will directly serve the scientific community. It is for these reasons that the School of Sport, Health, and Exercise Sciences encourages candidates to submit doctoral theses as a series of research papers.

Chapter 2

Stress and Anxiety¹

It doesn't take much technique to roll a 1.68-inch ball along a smooth, level surface into, or in the immediate vicinity of, a 4.5 inch hole. With no pressure on you, you can do it one-handed most of the time. But there is always pressure on the shorter putts... 90 percent of the rounds I play in major championships, I play with a bit of a shake... (Jack Nicklaus on golf putting; Patmore, 1986, p. 75).

As illustrated in the quote above, athletes who participate in competitive sport invariably have to deal with a great deal of pressure. This pressure is most often associated with elevated levels of stress and anxiety, which form an integral part of high-level sport (Gould, Eklund, & Jackson, 1992a, 1992b; Gould, Jackson, & Finch, 1993a, 1993b; Patmore, 1986; Scanlan, Ravizza, & Stein, 1989; Scanlan, Stein, & Ravizza, 1991). This chapter will review the current state of research in stress and anxiety in sport and offer some guidelines for future research in this area.

One of the problems that has plagued stress and anxiety research has been a lack of clarity between terms such as stress, anxiety, arousal, and activation. It is important to be clear about what these terms mean with regard to theory, research methodology, and conclusions. Consequently, a clarification of these terms forms the basis of the first section of this chapter. The second section comprises a brief review of the measurement of anxiety in sport. The third section focuses on research that has investigated the sources of stress and anxiety. The fourth section discusses theories, hypotheses, and models of anxiety and sports performance. In the fifth section, measurement issues in competitive anxiety research are revisited in light of the research reviewed in section four, while in the sixth section, the mechanisms via which anxiety might affect performance are explored using theories from mainstream psychology. In the seventh section, the applied implications of the research to date are discussed and future research directions and questions are offered.

¹ Based upon Woodman, T., & Hardy, L. (2001a). Stress and Anxiety. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology* (pp. 290-318). New York: Wiley.

Defining Terms

Arousal

Arousal has typically been used by researchers to refer to the intensity of behaviour as a unitary construct encompassing both psychological and physiological aspects of behaviour. For example, Duffy (1962) defined arousal as “the extent of release of potential energy, stored in the tissues of the organism, as this is shown in activity or response” (p. 179). Although this definition will be accepted here as a working hypothesis, it will be criticized and revised later in the chapter.

Stress

Jones (1990) defined stress as a state in which some demand is placed on the individual, who is then required to react in some way in order to be able to cope with the situation. This definition implies that stress may or may not place a ‘strain’ upon the individual (Jick & Payne, 1980; Lazarus, 1966); it will depend upon one’s perceived ability to cope with the stressor. Thus, it is the individual’s cognitive appraisal of the situation that is central to the stress process (Cox, 1978; Lazarus, 1966; Sanders, 1983; Welford, 1973). If people doubt their ability to cope with the stressor, then feelings of anxiety will likely ensue.

Anxiety

Anxiety is generally accepted as being an unpleasant emotion. There are two rather discordant views on the role of cognition in the generation of emotions. Some researchers (e.g., Zajonc, 1980, 1984) argue that the affective evaluation of stimuli involves basic processes that do not always require the involvement of the cognitive system. Other researchers (e.g., Eysenck, 1992; Lazarus, 1982) propose that an emotional reaction will be triggered only in the presence of cognitive processing, even though such processing might be at differing levels of accessibility to consciousness. Espousing such a view, Lazarus (1982) stated, “Cognitive appraisal (of meaning or significance) underlies and is an integral feature of all emotional states” (p. 1021). If one accepts that anxiety is an emotion, and that some level of cognitive processing necessarily precedes emotions, then it is necessary to consider cognitive processes to fully understand the mechanisms underlying anxiety.

State and Trait Anxiety

Spielberger (1966) defined *state anxiety* as “subjective, consciously perceived feelings of tension and apprehension, associated with... arousal of the autonomic nervous system” (Spielberger, 1966, p. 17). Such feelings of apprehension are normally relatively transitory and relate to a particular event. As such, state anxiety is the individual’s response to a *specific* threatening situation. *Trait anxiety* is a *general* disposition to respond to a variety of situations with high levels of state anxiety.

Although early researchers investigated anxiety from a unidimensional perspective, with no differentiation being made between different components of anxiety (e.g., Lowe & McGrath, 1971; Scanlan & Passer, 1978; Simon & Martens, 1977), research in mainstream psychology has suggested that anxiety might have at least two distinguishable components (e.g., Davidson & Schwartz, 1976; Liebert & Morris, 1967): a mental component normally termed *cognitive anxiety* or *worry*; and a physiological component normally termed *somatic anxiety* or *physiological arousal*.

In their development of the Competitive State Anxiety Inventory-2 (CSAI-2), Martens, Burton, Vealey, Bump, and Smith (1990) used Morris, Davis, and Hutchings’ (1981) definition of cognitive anxiety. Morris et al. (1981) defined cognitive anxiety as “negative expectations and cognitive concerns about oneself, the situation at hand, and potential consequences” (p. 541). Morris et al. (1981) defined somatic anxiety as “one’s perception of the physiological-affective elements of the anxiety experience, that is, indications of autonomic arousal and unpleasant feeling states such as nervousness and tension.” (p. 541). In their definition of state somatic anxiety (somatic A-state), Martens et al. (1990) stated:

Somatic A-state refers to the physiological and affective elements of the anxiety experience that develop directly from autonomic arousal. Somatic A-state is reflected in such responses as rapid heart rate, shortness of breath, clammy hands, butterflies in the stomach, and tense muscles. (p. 121)

There appears to be ambiguity as to whether somatic anxiety refers to one’s perception of one’s physiological symptoms (cf. Morris et al., 1981) or whether somatic anxiety refers directly to these physiological symptoms (cf. Martens et al.,

1990). It is assumed here that somatic anxiety refers to the perception of one's physiological arousal symptoms (Morris et al., 1981). As such, levels of somatic anxiety can be determined with the use of a self-report measure, whereas if Martens and associates' (1990) definition were adopted, somatic anxiety could not be directly assessed by self-report measures.

The Measurement of Anxiety

Since Spielberger's (1966) distinction between trait anxiety and state anxiety, researchers have constructed scales to measure these two constructs separately (e.g., Spielberger, Gorsuch, & Lushene, 1970). Following the lead of researchers who developed measures specific to particular settings (e.g., Sarason, Davidson, Lighthall, Waite, & Ruebush, 1960; Watson & Friend, 1969), Martens (1977) constructed the Sport Competition Anxiety Test (SCAT), a sport-specific measure of trait anxiety. Also, Martens and associates developed the Competitive State Anxiety Inventory (CSAI; Martens, Burton, Rivkin, & Simon, 1980), a sport-specific measure of state anxiety.

Following the distinction between cognitive anxiety and somatic anxiety (e.g. Davidson & Schwartz, 1976), sport psychology researchers developed sport-specific multidimensional measures of trait and state anxiety. For example, Smith, Smoll, and Schutz (1990) constructed the Sport Anxiety Scale (SAS), which contains three trait measures: worry, somatic anxiety, and concentration disruption. Also, Martens et al. (1990) developed the CSAI-2, which contains three relatively independent state subscales: cognitive anxiety, somatic anxiety, and self-confidence. The CSAI-2 has become almost the *sine qua non* for researchers undertaking research in pre-competition state anxiety.

Sources of Stress and Anxiety

Sources of Stress

Many studies on stress and anxiety have included participants from a wide range of ability levels. As non-elite populations are typically more accessible for researchers, this is not surprising. However, in order to further our understanding of elite performance, information must be gleaned from top-level performers. Studies

with such individuals are fairly limited. In an attempt to unveil some of the pertinent sources of stress and anxiety experienced by elite performers, researchers have begun to employ interview methods (Gould, Eklund, & Jackson, 1991; Gould et al., 1993a, 1993b; Scanlan et al., 1989; Scanlan, et al., 1991; Woodman & Hardy, 2001b).

Scanlan et al. (1991) interviewed 26 former national-championship figure skaters in order to identify the stressors encountered during the most competitive phase of their career. The interviews were analysed for content and the sources of stress were categorized under five headings. These were: negative aspects of competition (e.g., experiencing competition worries); negative significant-other relationships (e.g., not getting along with others); demands/costs of skating (e.g., dealing with family's financial sacrifice); personal struggles (e.g., experiencing the consequences of having an injury); and traumatic experiences (e.g., having significant others die). Gould et al. (1993a) extended Scanlan et al.'s (1991) research by interviewing 17 current and former US national champion figure skaters. The sample of figure skaters interviewed by Gould et al. included 3 skaters who had won a World Championship and 7 skaters who had won a medal either at the World Championships or at the Olympic Games. The sources of stress revealed in Gould et al.'s (1993a) study were similar to those revealed by Scanlan and her colleagues (1991). An example of some of the pressure with which elite performers can be confronted is illustrated below:

He could not handle the frustration, and he would really freak out and blame me for my injury. That was a really hard thing to deal with. It's like, "Yes, of course I know we are supposed to be training hard, and yes, I want to defend the title too, but I don't need you putting more stress on me." (United States pairs ice-skating champion; Gould et al., 1993a, pp. 140-141).

Interview studies dealing with sources of stress in top-level performers have begun to unearth some of the organizational issues that they face. Interviews also formed the basis of Woodman and Hardy's (2001b) study of organizational stress in 15 elite performers. Their findings, taken together with those of Gould et al. (1993a, 1993b) and Scanlan et al. (1991) suggest that organizational stress might be an important issue in preparing for major international competitions. For example, coach and team-mate problems, selection procedures, and financial issues that are poorly

managed will likely result in competition preparation that is far from ideal. To date, there is no research directly investigating the effects of organizational stress on subsequent performance. Although a challenging area, organizational stress in high-level sport is likely to be a fruitful area of research in the future.

The research outlined above suggests that top-level performers can face a wide spectrum of stressors. These include: interpersonal problems (with team-mates or coaches); financial concerns; injury problems; issues arising from selection procedures; lack of social support; traumatic experiences; and other personal issues. In view of the vast array of stressful issues that the athlete may face in preparation for a major competition, it is likely that sport psychology consultants working with elite performers will need to possess skills that go beyond the application of mental skills training. Indeed the array of psychological skills that currently form the typical sport psychologist's arsenal are not likely to prove particularly useful for addressing such issues as a lack of social support, problematic selection criteria, or traumatic experiences.

Antecedents of Anxiety

Gould, Petlichkoff, and Weinberg (1984) argued that if the causes of debilitating anxiety in a competitive setting could be identified, then sport psychologists would be well equipped to help athletes avoid the sources of their anxiety. Clearly, research in this area is seriously constrained by the ethical dilemma of manipulating variables that are thought to cause anxiety. Researchers have typically circumvented this issue by investigating the correlation between factors that are thought to cause anxiety and the intensity of the anxiety response. These factors have typically been called *antecedents* of state anxiety.

In an attempt to identify some of the antecedents of anxiety, most researchers in earlier years did not differentiate between the cognitive and somatic components of anxiety. Also, many of these earlier investigations included only young samples. For example, Scanlan and Passer (1978) reported that trait anxiety, self-esteem, and performance expectancies were all significant predictors of state anxiety in a sample of competitive female youth soccer players between 10 and 12 years old.

Furthermore, Lowe and McGrath (1971) found the importance of a game within a season to be significant predictor of physiological arousal. More specifically, the critical and important games were associated with higher levels of physiological arousal. Finally, Hanson's (1967) study revealed that, when they were at bat, young baseball players' physiological arousal was significantly higher than at any other phase of the game.

Investigations of the differential antecedents of cognitive and somatic anxiety in a sport setting were first conducted by Gould et al. (1984) in their study with wrestlers. Gould et al. reported "years of experience" to be the strongest (negative) predictor of cognitive anxiety. Furthermore, they found trait anxiety to be the only antecedent of somatic anxiety. Jones, Swain, and Cale (1990) conducted a similar, albeit more in-depth, study with male middle-distance runners. In Jones et al.'s study, the major predictors of cognitive anxiety were: performers' perceptions of readiness; their attitude towards previous performances; and their use of outcome goals. However, somatic anxiety was not related to any of the variables considered in their study. In a follow-up study, Jones, Swain, and Cale (1991) found evidence for different cognitive anxiety antecedents between men and women. More specifically, they observed that the cognitive anxiety of the women was mainly predicted by their readiness to perform and the importance of doing well. However, the cognitive anxiety of the men was predicted by their opponents' ability in relation to themselves and their perceived probability of winning.

In determining different antecedents for the different anxiety components, researchers have provided further evidence for the need to distinguish between cognitive and somatic anxiety. Indeed, if the antecedents of cognitive and somatic anxiety are sometimes different, then this would seem to indicate that they are, at least partially, independent constructs.

Investigations of how cognitive and somatic anxiety change over time have typically shown that the components of anxiety fluctuate differently prior to a competition (Gould et al., 1984; Jones & Cale, 1989; Krane & Williams, 1987; Parfitt & Hardy, 1987). More precisely, these studies have typically indicated that cognitive anxiety

remains fairly high and stable prior to a competition whereas somatic anxiety remains fairly low up to one or two days before a competition and then increases steadily up to the competition (e.g., Gould et al., 1984). Researchers who have used physiological arousal as well as somatic anxiety have determined that these two variables follow similar temporal patterns (e.g., Parfitt, Jones, & Hardy, 1990). Jones and his colleagues (Jones & Cale, 1989; Jones et al., 1991) concluded that women's pre-competition anxiety differed from that of the men in a variety of team sports. Whereas men's cognitive anxiety remained stable prior to a competition, women's cognitive anxiety increased steadily up to the competition. Furthermore, women's somatic anxiety increased earlier than did that of the men.

In summary, although most early research identified antecedents of unidimensional anxiety in youth participants, more recent research has identified differences between the antecedents of cognitive and somatic anxiety in wrestlers and middle-distance runners. Furthermore, the research just presented shows that the antecedents of cognitive and somatic anxiety can be different for male and female middle-distance runners.

State Anxiety and Performance

In mainstream psychology, Broadhurst (1957) and Hebb (1955) proposed that the relationship between arousal and performance would best be explained by the inverted-U hypothesis (Yerkes & Dodson, 1908). The inverted-U hypothesis proposes that the relationship between arousal and performance will be in the form of a symmetrical inverted-U, such that increases in arousal will result in increases in performance up to a point (optimal arousal) beyond which further increases in arousal will result in a gradual decrement in performance (see Figure 1). Sport psychology researchers (Anshel, 1990; Cox, 1990; Gill, 1986; Landers, 1994; Landers & Boutcher, 1986) adopted the inverted-U as the dominant explanation of arousal-performance relationships in sport. Subsequently, many researchers (e.g., Gill, 1986) have used the inverted-U as an explanation of the relationship between: arousal and performance; stress and performance; and anxiety and performance. However, many researchers (e.g., Hardy, 1990; Hockey & Hamilton, 1983; Jones,

1990; Krane, 1992; Neiss, 1988) have extensively and severely criticized the use of the inverted-U as an explanation of such relationships.

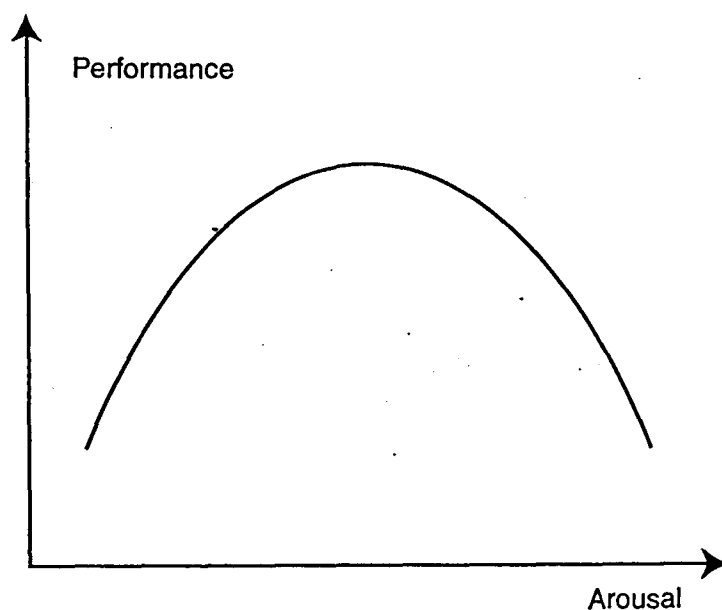


Figure 1. The inverted-U hypothesis.

One major problem with the inverted-U hypothesis as an explanation of arousal-performance relationships lies in the operationalisation of arousal and activation. Following Duffy's (1962) definition (see the start of this chapter), arousal has been regarded as a unidimensional activation response that prepares the organism for action. This response has been viewed as lying on a continuum from deep sleep to extreme excitement (Malmö, 1959). Thus, according to this view, arousal is conceptualised as a simple unitary construct accounting for behavioural, physiological, and cognitive factors. However, many researchers have argued that this is a simplistic conceptualisation of more complex relationships (Hardy, 1990; Hockey & Hamilton, 1983; Jones & Hardy, 1989; Lacey, 1967; Neiss, 1988). Also, research conducted by Lacey (1967) presented strong evidence for three distinct forms of activation (arousal): electrocortical (electric activity in the cortex measured by EEG); autonomic (physiological activity measured by skin conductance, heart rate, etc.); and behavioural (overt activity).

A number of researchers (e.g., Hockey & Hamilton, 1983; Näätänen, 1973; Neiss, 1988; Parfitt et al., 1990) have suggested that it is necessary to view arousal in a more detailed fashion by investigating the systems that are involved in different aspects of performance. According to this position, arousal is best viewed as a patterning of various physiological parameters. If this patterning is appropriate for

the task at hand, then performance will likely be maintained; if the patterning is not appropriate, then performance will likely be impaired (cf. Neiss, 1988). Other researchers (e.g., Hardy, Jones, & Gould, 1996a; Pribram & McGuinness, 1975) have advocated a clearer distinction between arousal and activation. For example, Pribram and McGuinness (1975) proposed that activation is the cognitive and physiological activity that is geared towards preparing a planned response that is appropriate to the task; arousal is defined as the cognitive and physiological activity that occurs in response to some new and external input to the system. Hardy et al. (1996a) provided the example of a gymnast immediately before performing a beam routine in an important international competition. If the gymnast has prepared well, having performed the routine over 100 times in training and various competitions, she probably has the appropriate activation state for performing this routine. However, if a balloon bursts loudly the very moment she is about to land on the springboard for a complex mount, the gymnast may experience an involuntary startle (arousal) response, leading to a disruption of her activation pattern. With this different activation pattern, she misses her mount. Thus, *activation* (e.g., the appropriate state for performing a beam routine) refers to the cognitive and physiological activity that is geared towards the preparation of a *planned response* to an anticipated situation. *Arousal* (e.g., an involuntary startle) refers to the cognitive and physiological activity that takes place *in response to some new input* (Pribram & McGuinness, 1975).

The utilization of the inverted-U hypothesis as an explanation of complex relationships between, arousal, anxiety, stress, and sport performance has been criticized on a number of other points. Perhaps the most salient criticism of the inverted-U hypothesis is that it offers no explanation of *how* arousal affects performance. The inverted-U hypothesis has received further criticism, including: it does not allow for an individual's cognitive appraisal of the situation and is consequently "... an impediment to the understanding of individual differences" (Neiss, 1988, p. 353); and its symmetrical shape is not realistic of a competitive sport situation when a performer who has gone "over the top" is unlikely to be able to regain an optimal level of performance with only a slight reduction in physiological arousal (Hardy, 1990).

In summary, the application of the inverted-U hypothesis to sport is a description of the relationship between unidimensional arousal and performance. Given that arousal and anxiety are distinct constructs, this relationship is unlikely to be useful as a description, let alone as an *explanation*, of the effects of anxiety upon performance. In an attempt to address the shortcomings of the inverted-U hypothesis, various theorists have formulated alternative hypotheses, theories, and models. These will be elaborated upon in the following section.

Individualized Zones of Optimal Functioning

The individualized zones of optimal functioning (IZOFs) hypothesis was developed by Yuri Hanin in the seventies and published in the English language in the eighties (1980, 1986). The central tenet of the IZOF hypothesis is that each athlete has his/her own optimal zone of pre-performance anxiety within which he/she is more likely to attain optimal performance. If the anxiety level lies outside of this zone, performance will be impaired. Contrary to earlier attempts at classifying optimal levels of anxiety based upon task characteristics and experience (e.g., Oxendine, 1970, 1984), the IZOF approach simply purports that a person's optimal level of anxiety is specific to that particular individual.

Hanin (1986) has claimed that IZOFs can be derived either by direct and repeated measurement of anxiety levels and subsequent performance, or by recall of anxiety levels prior to a past peak performance. There is some evidence that IZOFs can be determined by recall of past optimal levels of anxiety (Hanin, 1986; Morgan, O'Connor, Sparling, & Pate, 1987; Raglin & Morgan, 1988). Also, research generally supports the contention that anxiety levels that are within individualized zones correspond to higher levels of performance (Gould, Tuffey, Hardy, & Lochbaum, 1993c; Hanin & Kopysov, 1977, cited in Hanin, 1980; Krane, 1993; Randle & Weinberg, 1997; Turner & Raglin, 1991; Woodman, Albinson, & Hardy, 1997). For example, Turner and Raglin (1991) found that track and field athletes who competed with anxiety levels within their estimated IZOF performed significantly better than those who competed with anxiety levels outside their estimated IZOF. Also, in an investigation employing a multidimensional framework, Woodman et al.

(1997) observed that 10-pin bowling performance was better when bowlers' combined cognitive anxiety and somatic anxiety scores were within their IZOF compared to when they were outside this multidimensional IZOF.

Gould and Udry (1994) proposed that anxiety is unlikely to be the only emotion that affects performance and that researchers would do well to consider other emotions (e.g., anger, disappointment, frustration, excitement, joy, etc.). Gould and Udry suggested that a recipe of emotions for a performer is likely to account for larger proportions of variance than anxiety alone. Certainly, preliminary investigations that have included other emotions to derive IZOFs have supported the applicability of the IZOF concept to a wider range of emotions (Hanin & Syrjä, 1995a, 1995b).

From a more theoretical perspective, Gould and Tuffey (1996), and Hardy et al. (1996a), noted that Hanin's IZOF hypothesis lies on barren ground for two reasons. First, Hanin's (1980) original hypothesis was based on a unidimensional conceptualisation of anxiety. However, this shortcoming has recently been overcome by research that has investigated IZOFs within a multidimensional framework (Gould et al., 1993c; Krane, 1993; Randle & Weinberg, 1997; Thelwell & Maynard, 1998; Woodman et al., 1997). Second, and more seriously, Hanin's IZOFs comprise what is essentially an individual difference "theory" without any individual difference variables (Gould & Tuffey, 1996; Hardy et al., 1996a). Gould and Tuffey (1996) offered two possible explanations for accounting for the effects of state anxiety upon performance. First, based on Easterbrook's (1959) cue-utilization theory, a number of researchers have stated that an athlete's perceptual field will narrow as a result of increased anxiety (e.g., Eysenck, 1992; Landers & Boutcher, 1993). In essence, Easterbrook's theory states that an athlete will perform optimally when he/she is attending to all those cues that are relevant to the task at hand, and to those cues only. Any deviation from this optimal focus (i.e., a focus that either takes in too many cues or too few cues) will result in sub-optimal performance. Second, Gould and Tuffey (1996) cited research that has shown that increases in anxiety can be accompanied by increased muscular tension and co-contraction, which are associated with inferior performance (Weinberg & Hunt, 1976). Although both of these explanations are fairly tenable, they do not account for the *individual*

differences revealed in various IZOF studies. Consequently, despite encouraging applied data, IZOF remains an intuitive applied tool, which, as yet, has little theoretical value.

In summary, the IZOF hypothesis has received some encouraging support. However, its theoretical value is limited by a lack of explanation as to why there are differences between individuals' IZOFs.

Multidimensional Anxiety Theory

Multidimensional anxiety theory hypothesizes that the antecedents of cognitive and somatic anxiety are different and that these anxiety components are differentially related to performance. More specifically, cognitive anxiety is hypothesized to have a negative linear relationship with performance. This hypothesis is largely based on early theories of attention (e.g., Wine, 1971, 1980). The premise is that cognitive resources are taken up by worrying thoughts and so are not available for the task at hand. Consequently, the more athletes are worried, the less well they will perform. Somatic anxiety is hypothesized to have a quadratic (inverted-U shaped) relationship with performance, whereby performance is expected to be optimal at moderate levels of somatic anxiety. The rationale for this hypothesized relationship between somatic anxiety and performance is unclear. It appears that it is largely an extension of the hypothesized inverted-U shaped relationship between arousal and performance (Broadhurst, 1957). In attempting to explain why somatic anxiety might affect performance in this fashion, Martens et al. (1990) cited the research of Weinberg (1978) suggesting that too much muscular tension might lead to a deterioration in performance. If this is the case, it is unclear why somatic anxiety, and not physiological arousal, was used in Martens et al.'s (1990) theory of multidimensional anxiety. Indeed, if physiological arousal is expected to directly affect motor performance, then measuring a performer's *perception* of this physiological arousal might not be the most effective manner in which to test for such effects. Certainly, in light of the research that has found no significant relationships between perceived physiological arousal and indicators of physiological arousal (e.g., Kareroliotis & Gill, 1987; Yan Lan & Gill, 1984), it appears that somatic anxiety might well be, at best, only a very crude indicator of the

physiological component of anxiety. Clearly, a *theory* that offers a relationship between somatic anxiety and performance, and yet does not offer an *explanation* of this relationship, remains a weak theory.

Multidimensional anxiety theory also proposes that self-confidence will have a positive linear relationship with performance. It is worth explaining here how self-confidence became part of a theory on multidimensional *anxiety*. In the factor analysis of the items comprising the CSAI-2, Martens et al. (1990) found that cognitive anxiety effectively separated into two factors, one that included negatively phrased items and one that included positively phrased items. These factors were subsequently labelled cognitive anxiety and self-confidence respectively. Therefore, what was originally intended to be an anxiety scale comprising the two subscales of cognitive anxiety and somatic anxiety ended up also including a self-confidence subscale. Given that self-confidence and cognitive anxiety emerged as orthogonal (i.e., independent) factors, it is rather surprising that Martens et al. (1990) should appear to view them as interdependent. In the discussion of their factor analyses, Martens et al. stated:

These findings suggest that cognitive A-state and state self-confidence represent opposite ends of a cognitive evaluation continuum, state self-confidence being viewed as the absence of cognitive A-state, or conversely, cognitive A-state being the lack of state self-confidence. (Martens et al., 1990, p. 129)

This conclusion has been supported neither in independent research (Gould et al., 1984; Jones & Cale, 1989; Hardy, 1996a) nor in Martens et al.'s (1990) own analyses, both of which have demonstrated the relative independence of cognitive anxiety and self-confidence. Also, the research conducted by Jones and associates (Jones et al., 1990, 1991) on the antecedents and temporal patterning of cognitive anxiety and self-confidence provided additional evidence for their relative independence. Finally, Hardy's (1996a) study of golfers revealed that self-confidence accounted for performance variance over and above the performance variance accounted for by cognitive and somatic anxiety. In light of these findings, it follows that cognitive anxiety and self-confidence do not lie at opposite ends of the same continuum.

Empirical support for multidimensional anxiety theory has been somewhat equivocal. Burton's (1988) study with swimmers yielded support for all three multidimensional anxiety theory predictions. That is, the relationship between cognitive anxiety and swimming performance was negative and linear, the relationship between somatic anxiety and performance was in the form of an inverted-U, and the relationship between self-confidence and performance was positive and linear. However, in Raglin's (1992) review of eight studies reporting relationships between CSAI-2 subscales and sport performance, Burton's (1988) was the only study that supported all of the predictions of multidimensional anxiety theory. Of the seven remaining studies reviewed by Raglin, three provided partial support and four provided no support for any of the hypothesized relationships between the CSAI-2 components and performance. In a more recent review, Burton (1998) classified studies based on the level of support (strong, moderate, or weak) that they provided for the predictions of the CSAI-2. Of the 16 studies reviewed, 2 provided strong support², 6 provided moderate support, and 8 provided weak support for the CSAI-2 predictions. The inconsistencies in these findings might be attributable to a number of factors, notably inappropriate performance measures and individual differences.

In order to control for individual differences, Gould, Petlichkoff, Simons, and Vevera (1987) and Burton (1988) standardized all anxiety and performance scores within subjects, such that each individual's anxiety and performance scores were expressed relative to his/her mean scores. When utilizing this procedure, Gould et al. identified no significant relationship between cognitive anxiety and pistol shooting performance, and a negative linear relationship between self-confidence and pistol shooting performance. As already stated, Burton (1988) found support for all three relationships proposed in multidimensional anxiety theory. In both studies, a significant inverted-U shaped relationship between somatic anxiety and performance was revealed. In his critique of these intra-individual procedures, Raglin (1992) correctly pointed out that median or mean scores do not necessarily reflect moderate

² In Burton (1998), presumably due to a typographical error, Burton's (1988) study was not classified. It is assumed here that Burton (1998) would have classified his 1988 study as providing strong support for the CSAI-2 predictions.

scores. Therefore, when transforming raw scores to standardized scores, a high score simply reflects a score that is *higher than normal* for that individual rather than a score that is *high* in absolute terms. The fact that both Gould et al. (1987) and Burton (1988) found a significant quadratic relationship between somatic anxiety and performance, *despite* this potential confound, adds support for the hypothesized inverted-U shaped relationship between somatic anxiety and performance in these instances.

Another possible reason for the inconsistent support for multidimensional anxiety theory might be the terminology used in the CSAI-2. This is particularly the case for cognitive anxiety. Indeed, in an effort to reduce potential social desirability, Martens et al. (1990) replaced cognitive anxiety statements starting with “I am worried” with statements starting with “I am concerned.” The verb “concern” is clearly less evaluative than “worry”, and as such, might well be more open to divergent interpretation by different performers. This point is not semantic pedantry. Rather, it is central to a number of issues that have recently been debated in the competitive state anxiety literature (cf. Burton & Naylor, 1997; Hardy, 1997; Jones, Hanton, & Swain, 1994). These points will be elaborated upon later in the chapter.

In summary, multidimensional anxiety theory has allowed researchers to move anxiety research beyond the inverted-U arousal-performance hypothesis.

Multidimensional anxiety theory hypothesizes that athletes will perform their best at low levels of cognitive anxiety, high levels of self-confidence, and at moderate levels of somatic anxiety. Research in support of these hypothesized relationships has been equivocal or, at best, mildly supportive. Furthermore, no theoretical reason has been offered for why somatic anxiety should affect performance in the manner hypothesized by multidimensional anxiety theory. Finally, the proposition that cognitive anxiety and self-confidence are co-dependent has been refuted in a number of studies (for a more detailed discussion of this issue, the reader is referred to Hardy et al., 1996a).

Catastrophe Models of Anxiety and Performance

One of the major shortcomings of multidimensional anxiety theory identified by Hardy and his colleagues (Hardy, 1990; Hardy & Fazey, 1987; Hardy & Parfitt, 1991) was that it attempts to explain the potentially complex four-dimensional relationship between cognitive anxiety, somatic anxiety, self-confidence, and performance in a series of *independent* two-dimensional relationships. The cusp catastrophe model of anxiety and performance was developed and proposed by Hardy and associates as a result of their dissatisfaction with such explanations of anxiety-performance relationships. As catastrophe models are at least three-dimensional in nature, they allow for the illustration of *interactions* between the anxiety components and performance.

The cusp catastrophe model originally proposed by Hardy and Fazey (1987) illustrated a three-dimensional relationship between cognitive anxiety, physiological arousal, and performance (see Figure 2). In this model, cognitive anxiety is termed the splitting factor, and physiological arousal is termed the asymmetry (or normal) factor. The splitting factor (i.e., cognitive anxiety) determines whether the effect of the asymmetry factor (i.e., physiological arousal) will be smooth and small, large and catastrophic, or somewhere in between these two extremes.

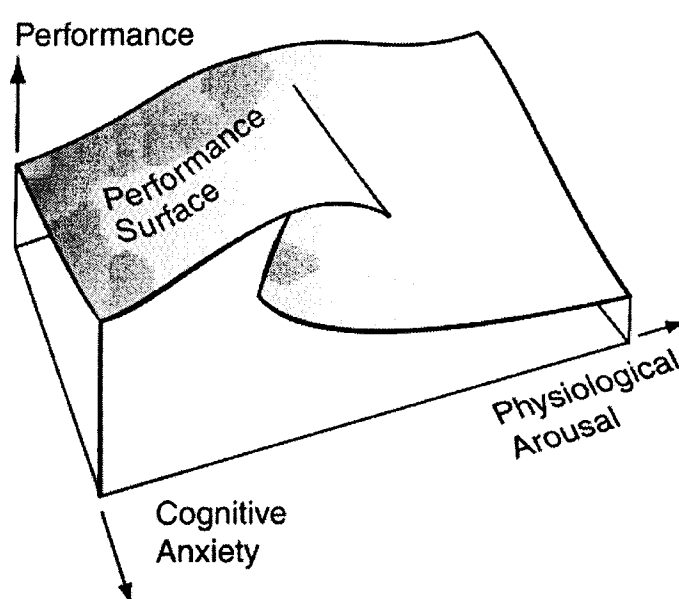


Figure 2. The Cusp Catastrophe Model.

The cusp catastrophe model predicts that increases in cognitive anxiety will be beneficial to performance under conditions of low physiological arousal (see the left edge of Figure 2), but will be detrimental to performance under conditions of high physiological arousal (see the right edge of Figure 2). Also, under conditions of low cognitive anxiety, changes in physiological arousal should result in small and continuous changes in performance in the form of a mild inverted-U (see the back face of Figure 2). Under conditions of high cognitive anxiety, physiological arousal can either be facilitating or debilitating to performance, depending on the level of physiological arousal experienced (see the front face of Figure 2). Furthermore, under conditions of high cognitive anxiety, changes in physiological arousal can result in large and discontinuous changes in performance in the form of hysteresis. That is to say, the path that performance follows is different depending upon whether physiological arousal is increasing or decreasing (see Figure 3). Under these elevated levels of cognitive anxiety, when physiological arousal increases continually from a fairly low level, performance will also increase up to a point. However, if physiological arousal increases beyond this point, performance will suffer a large drop (i.e., a catastrophe). Once a catastrophe has occurred, a considerable reduction in physiological arousal is required before the upper performance surface can be regained.

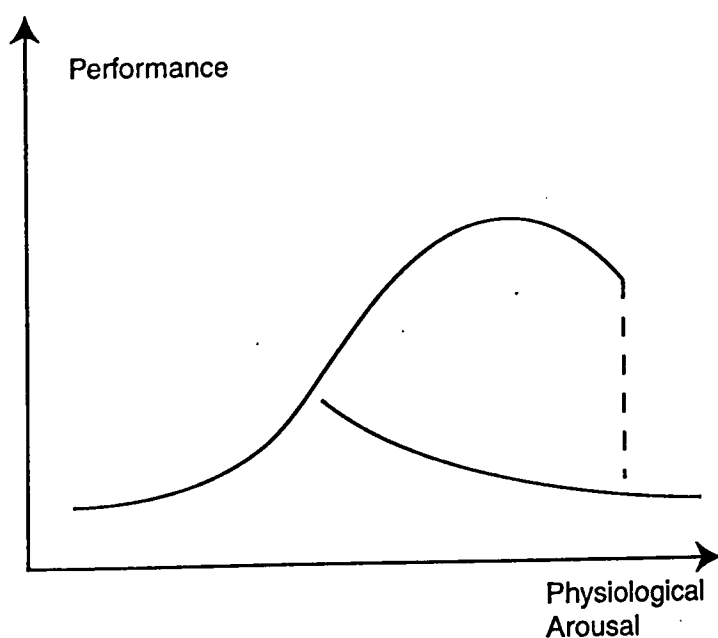


Figure 3. Hysteresis

To date, apart from Hardy and his associates, researchers appear to have been fairly reticent in testing the catastrophe model of cognitive anxiety, physiological arousal, and performance. This may well be due to the perceived complexity of the model (Gill, 1994). However, as Hardy (1996b) stated, “complexity is an insufficient reason for rejecting any theory or model” (p. 140). Indeed, research in anxiety would not have advanced beyond the inverted-U hypothesis had it not been for theorists’ challenging of simplistic conceptualisations of anxiety (Lacey, 1967; Martens et al., 1990; Neiss, 1988). In order to render research on the catastrophe model more readily accessible, Hardy (1996b) provided a number of ways of testing the various aspects of the model, notably: (a) methods that explore the interactive effects between cognitive anxiety and physiological arousal; (b) methods that explore the facilitative versus the debilitating effects of cognitive anxiety; (c) surface-fitting procedures; and (d) the examination of the frequency distributions of raw data. It is beyond the scope of this chapter to explore each of these predictions in full and the interested reader is referred directly to Hardy (1996b).

The research that has been conducted to date has generally provided some support for the cusp catastrophe model (e.g., Edwards & Hardy, 1996; Hardy, 1996a; Hardy & Parfitt, 1991; Hardy, Parfitt, & Pates, 1994; Krane, 1990; Woodman et al., 1997). For example, Hardy and Parfitt (1991) found evidence for a hysteresis effect with a sample of basketball players. More specifically, they found that the relationship between physiological arousal (as measured by heart rate) and performance followed a mild inverted-U path under conditions of low cognitive anxiety (during training), but a hysteresis path under conditions of high cognitive anxiety (prior to an important match). Also, there is some fairly conclusive evidence for interactive effects between cognitive anxiety and somatic anxiety/physiological arousal (Deffenbacher, 1977; Edwards & Hardy, 1996; Hardy et al., 1994; Woodman et al., 1997). However, the interactions revealed in these studies generally have not been in precisely the form predicted by the cusp catastrophe model originally proposed by Hardy and his colleagues. Furthermore, those studies that tested the hysteresis effect using direct physiological arousal measures (e.g., Hardy & Parfitt, 1991; Hardy et al., 1994) manipulated heart rate by means of physical exercise rather than anxiety. To date there have been no studies that have investigated the catastrophe model by

manipulating anxiety-induced physiological arousal. This could be a serious limitation in the studies that have tested the hysteresis effect, as the mechanisms underlying exercise-induced physiological arousal could be quite different to those underlying anxiety-induced physiological symptoms. For example, in a study conducted by Williams, Taggart, and Carruthers (1978), rock climbers' levels of adrenaline were significantly higher after their climb than before. In contrast, there were no significant differences in noradrenaline levels before and after the climb. In the Williams et al. (1978) study, the climbs "required minimal physical effort, but they engendered considerable anxiety owing to the steepness of the rock face and its slippery nature caused by rain which continued all day" (p. 126). Considering that noradrenaline levels rise as a function of exercise (Wilmore & Costill, 1994), these results suggest that noradrenaline secretion differs depending upon whether the physiological response is triggered by anxiety or exercise. Thus, although anxiety-induced physiological arousal might be similar to exercise-induced physiological arousal when measured by heart rate, the two states will likely differ when measured using other physiological indicators.

There are two additional points about catastrophe models that are worth mentioning at this juncture. First, Hardy and associates' cusp catastrophe model of cognitive anxiety, physiological arousal, and performance is a model; it is not a theory. This distinction is important because the mechanisms via which cognitive anxiety and physiological arousal might interact in their effects upon performance are not *explained* in the model. Theories that might explain the mechanisms underlying anxiety-performance relationships and catastrophe models are discussed later (see section on Possible Explanations of how Anxiety Affects Performance). Second, the nature of catastrophe models is such that they can be rotated, stretched, or bent (although not torn) into a variety of different shapes and positions (Zeeman, 1976). It follows that the cusp catastrophe model originally presented by Hardy and Fazey (1987) reflects only one of a plethora of subtly different forms and shapes that a cusp catastrophe model might take. Consequently, it is unlikely to be the only catastrophe model of cognitive anxiety, physiological arousal and performance. For example, Hardy et al. (1994) suggested that, under certain conditions, the original model should be tilted either about the cognitive anxiety axis or the physiological arousal

axis. Also, Hardy (1996b) surmised that the performance surface might be tilted forward about the physiological arousal axis for tasks that require more fine motor control and touch (e.g., golf putting), but not so for tasks that require more anaerobic power (e.g., slam dunking in basketball). Of course, it is likely that individual differences will further moderate these models. If the model were tilted far enough forward, cognitive anxiety would be detrimental to performance regardless of the level of physiological arousal. However, the crucial prediction of the models is that this debilitating effect should be greater under high levels of physiological arousal when compared to low levels of physiological arousal.

As Hardy (1996b) has indicated, physiological arousal (rather than somatic anxiety) was an astute choice for the asymmetry factor in the catastrophe model. The rationale for this choice was that physiological arousal could exert both direct and indirect effects upon performance, whereas somatic anxiety can exert only indirect effects. This is because somatic anxiety is simply the *perception* of one's physiological symptoms (cf. Morris et al., 1981). Physiological arousal, on the other hand, can affect performance both indirectly (i.e., through one's perception) and directly through changes in one's activation state (Hockey & Hamilton, 1983; Humphreys & Revelle, 1984; Parfitt et al., 1990). For example, a gymnast might perceive himself to be fairly relaxed physically even though his muscular tension reflects a high level of physiological arousal. In such a case, the gymnast's pommel horse routine might suffer because of tight shoulders, even though, in terms of somatic anxiety, he was not aware of this tightness, and thus might have reported a low level of somatic anxiety. Conversely, if somatic anxiety were used as the asymmetry factor then the underlying assumption would be that physiological arousal exerts no direct effects upon performance. Only its perception is important. This does not fit at all well with our received view of the experiences of high-level performers.

In support of the differentiation between somatic anxiety and physiological arousal, Yan Lan and Gill (1984) and Karteroliotis and Gill (1987) found no relationship between somatic anxiety and physiological arousal as measured by heart rate and blood pressure. Furthermore, Parfitt, Hardy, and Pates (1995) found performance on an anaerobic task to be more strongly related to physiological arousal than to somatic

anxiety. Finally, research on individuals' perceptions of their bodily symptoms has shown that, unless trained to do so, people can be fairly poor at reading their own physiological symptoms to any degree of accuracy (e.g., Yamaji, Yokota, & Shephard, 1992). Consequently, it is important to consider both the potential direct and indirect effects of physiological arousal upon performance.

Higher-order Catastrophe Models

Although the cusp catastrophe model is the most often cited, there exist higher-order catastrophe models of anxiety and performance. The most commonly used higher-order catastrophe model is the butterfly catastrophe (cf. Hardy, 1990; Zeeman, 1976). This higher-order catastrophe model allows for the incorporation of two further control dimensions: a bias factor and a butterfly factor. A detailed discussion of higher-order catastrophe models is beyond the scope of this chapter and the interested reader is referred directly to Hardy (1990) and Zeeman (1976).

However, in essence, the addition of a bias factor to a cusp catastrophe model has the effect of swinging the front face of the model either to the right or to the left. Fazy and Hardy (1988) proposed that task difficulty might act as a bias factor. However, Hardy (1990) largely dismissed this proposal and proposed that self-confidence would form a better bias factor in a catastrophe model of anxiety and performance. According to this proposal, under high levels of cognitive anxiety, highly self-confident performers might withstand higher levels of physiological arousal before suffering a sudden drop in performance than their less self-confident counterparts. Using Guastello's (1982) method of dynamic differences to test the catastrophe model's fit to putting performance data from eight golfers over 18 holes, Hardy (1996a) offered some empirical support for self-confidence acting as a bias factor. However, there is a clear need for further research that tests the proposition that self-confidence might moderate the interactive effects of cognitive anxiety and physiological arousal upon performance.

Although the cusp catastrophe model proposed by Hardy and his associates accounts for some of the inconsistencies in the research, it does not offer any theoretical explanation for the interactive effects of cognitive anxiety and physiological arousal on performance. For example, why does cognitive anxiety sometimes have a positive

effect upon performance? Why do performers sometimes suffer dramatic drops in performance when they are cognitively anxious? It is important for researchers to address such questions if further understanding is to be achieved with respect to the mechanisms underlying anxiety-performance relationships.

In summary, research to date generally provides support for an interaction between cognitive anxiety and somatic anxiety (or physiological arousal). Also, there is encouraging support for the notion of hysteresis under high levels of cognitive anxiety. However, there are a number of issues that need addressing with regard to catastrophe models of anxiety and performance. These include clarifications of: (a) the interaction between cognitive anxiety and physiological arousal; (b) the possible mediating and moderating variables within catastrophe models; and (c) the importance of differentiating between anxiety-induced physiological arousal and exercise-induced physiological arousal in tests of the hysteresis effect. Despite these limitations, at present, Hardy and associates' catastrophe models are the only models of anxiety and performance that predict an interaction between cognitive anxiety and physiological arousal and, as such, appear worthy of further investigation.

Reversal Theory

Multidimensional anxiety theory (Martens et al., 1990) proposes that the relationship between somatic anxiety and performance is in the form of an inverted-U. As such, high levels of perceived physiological arousal are always associated with poor performance. Other theories suggest that high somatic anxiety might not always be perceived as detrimental. Reversal theory (Apter, 1982; Kerr, 1990) is one such theory. Reversal theory is based upon the concept of "metamotivational states." A metamotivational state is a "phenomenological state which is characterized by a certain way of interpreting some aspect(s) of one's own motivation." (Kerr, 1990, p. 129). Reversal theory postulates that there are four possible pairs of "metamotivational states." These are telic-paratelic, negativism-conformity, autic-alloic, and sympathy-mastery. The telic-paratelic pair has received the most attention within a sporting context. In a telic state (i.e., a state in which individuals are goal-oriented and express purpose), individuals tend to be fairly serious with a preference for low arousal. Conversely, in a paratelic state (i.e., a state in which individuals are

oriented toward the sensations associated with their behaviour), individuals tend to be fairly spontaneous with a preference for high arousal. According to reversal theory (e.g., Kerr, 1990), if performers are in a telic state, they will interpret high physiological arousal as anxiety; if they are in a paratelic state, they will experience high physiological arousal as excitement.

Reversal theory further posits that performers can rapidly change (reverse) from one metamotivational state to another. Consequently, a performer in a telic state who is experiencing a high level of arousal as unpleasant (anxiety) might suddenly change to a paratelic state and perceive this high level of arousal as pleasant (excitement). In reversal theory, this perceived pleasure is known as “hedonic tone”. Thus, one’s hedonic tone can be either pleasant (i.e., perceiving a low level of arousal as relaxation and a high level of arousal as excitement) or unpleasant (i.e., perceiving a low level of arousal as boredom and a high level of arousal as anxiety). Despite its intuitive appeal, the application of reversal theory to sport has been limited by its lack of hypothesized relationships with performance. Recent research by Kerr and associates (Kerr, Yoshida, Hirata, Takai, & Yamazaki, 1997; Males, Kerr, & Gerkovich, 1998) has started to address this limitation. For example, Kerr et al. (1997) investigated the effects of the different combinations of metamotivational states (telic or paratelic) and felt arousal (high or low) on archery performance. Kerr et al. hypothesized that the combined high hedonic tone group (telic-low, paratelic-high) would perform better than the combined low hedonic tone group (telic-low, paratelic-high). That is to say, the archers who perceived their arousal (low or high) as pleasant were hypothesized to perform better than those archers who perceived their arousal as unpleasant. Although this hypothesis was not supported, the study does offer a method for examining the effects of hedonic tone on performance. However, the question still remains: Why should hedonic tone affect performance? Indeed, there does not appear to be an obvious theoretical reason for proposing that pleasant feelings about one’s level of physiological arousal should lead to better performance.

In summary, although the notion of reversals is interesting, reversal theory has been limited by its lack of theory in relation to performance. Although recent studies have

begun to investigate the relationships between metamotivational states, hedonic tone, and performance, the theoretical rationale for this relationship remains unclear. As such, reversal theory does not offer a great deal in terms of explaining *how* and *why* anxiety might affect motor performance.

Interpretation of Anxiety States

The proposition that anxiety can be perceived as facilitating is not new. Indeed, as early as 1960 in the test anxiety literature, such effects were brought to light by Alpert and Haber. Whereas other anxiety instruments measured the debilitating component of anxiety, the Achievement Anxiety Test (AAT) introduced by Alpert and Haber (1960) measured a facilitating component of anxiety as well as a debilitating component of anxiety. This distinction resulted in two fairly simple predictions: students with high debilitating anxiety were expected to do poorly in an examination setting and students with high facilitating anxiety were expected to do well in an examination setting. Alpert and Haber (1960) provided support for this prediction with a significant negative correlation between debilitating test anxiety and grade point average (GPA) and a significant positive correlation between facilitating test anxiety and GPA. In a subsequent examination of the factor structure of Alpert and Haber's measure, Couch, Garber, and Turner (1983) found that facilitative and debilitating factors could be distinguished for both males and females. In this study, Couch et al. revealed that a combined measure of facilitating and debilitating test anxiety was a better predictor of GPA than either measure of test anxiety alone.

In the sport psychology literature, Mahoney and Avener (1977) were the first to report that performers could interpret their anxiety in different ways. In their study of gymnasts, Mahoney and Avener found that the more successful gymnasts (those who qualified for the 1976 US Olympic team) tended "to 'use' their anxiety as a stimulant to better performance." (p. 140). Conversely, those gymnasts who were less successful (those who did not qualify for the Olympic team) seemed "to arouse themselves into near-panic states" (Mahoney & Avener, 1977, p. 140).

Following research conducted in test anxiety and Mahoney and Avenier's (1977) observations with gymnasts, Jones and his colleagues (Jones, 1991; Jones & Swain, 1992) developed the notion of "directional interpretation of anxiety" in sport psychology. Jones' (1995) subsequent model of facilitative and debilitating competitive anxiety (see Figure 4) was largely based on Carver and Scheier's (1988) control model of anxiety, which predicted that perceived control over coping and goal attainment was an important mediator of anxiety interpretation. More specifically, in Jones' model, anxiety is interpreted as facilitative when expectations of control are positive, and as debilitating when expectations of control are negative.

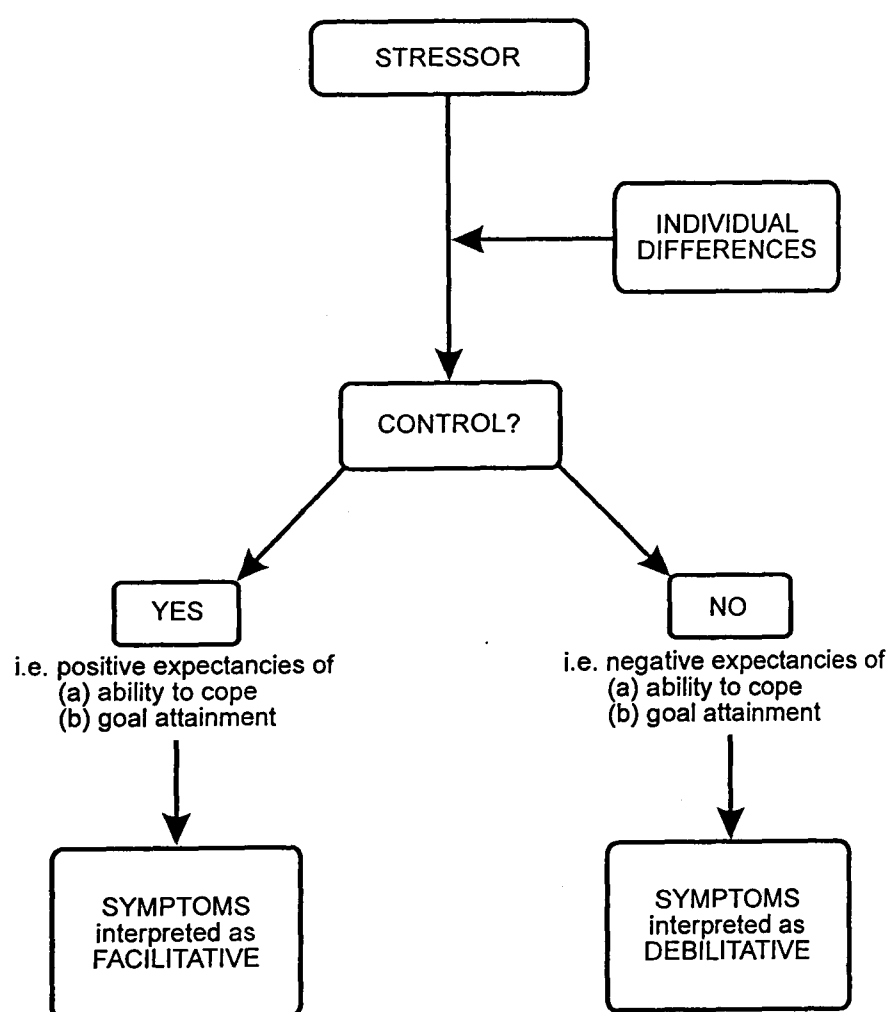


Figure 4. A model of facilitative and debilitating competitive anxiety (Jones, 1995)

In order to measure directional interpretation, Jones and Swain (1992) modified Martens et al.'s (1990) CSAI-2 to include a direction scale next to each of the 27 items. Thus, in this modified version of the CSAI-2, performers are asked to respond to their experience of each symptom in the normal fashion from 1 (*not at all*) to 4 (*very much so*). After each response, performers are asked to rate the perceived effect of this feeling on an interpretation scale from -3 (*very debilitating*) to +3 (*very*

facilitative). For example, a performer might respond with a maximum score of 4 to the statement “I am concerned about this competition”, indicating that she is very concerned about the pending competition. If this performer then rates this concern as +3 on the interpretation scale, she is essentially saying that she feels that this concern is likely to have a beneficial effect on her upcoming performance.

Using this modified scale, Jones and his colleagues have demonstrated the need to differentiate between performers’ perceived level of anxiety (“intensity”) and the concomitant interpretation of these symptoms (“direction”). For example, Jones, Swain, and Hardy (1993) reported no significant differences between high-performance and low-performance gymnasts for cognitive anxiety intensity, somatic anxiety intensity, and somatic anxiety direction scores. However, the high-performance gymnasts’ cognitive anxiety was more facilitative than their low-performance counterparts’. Similarly, although Jones et al. (1994) found no significant differences between elite and non-elite swimmers for anxiety intensity, the elite swimmers reported both their cognitive anxiety and their somatic anxiety to be more facilitative than the non-elite swimmers. This finding is similar to that of Perry and Williams (1998) who administered the modified CSAI-2 to advanced, intermediate, and novice tennis players. Consistent with Jones et al.’s (1994) results, the advanced players reported significantly more positive interpretations for cognitive and somatic anxiety than their intermediate and novice counterparts. Finally, in attempting to predict basketball performance, Swain and Jones (1996) found direction scores to be better predictors of performance than intensity scores for both anxiety components.

Other studies of the antecedents and pre-competition temporal patterning of anxiety intensity and direction have also supported the need to differentiate between intensity and direction dimensions of anxiety (e.g., Lane, Terry, & Karageorghis, 1995; Wiggins, 1998). For example, in Lane et al.’s (1995) path analysis of the antecedents of anxiety, state anxiety responses, and triathlon performance, the antecedents of anxiety intensity and anxiety direction were determined to be different. More specifically, anxiety intensity was predicted by perceived readiness and perceived

difficulty of race goals, whereas anxiety direction was predicted by perceived readiness, coach's influence, and recent form.

In addition to the interpretations of anxiety, the frequency with which performers experience anxiety symptoms has received research interest, albeit to a far lesser extent. For example, Swain and Jones (1993) observed that, although cognitive anxiety remained stable throughout the pre-competition period in accordance with past research (e.g., Jones & Cale, 1989; Parfitt & Hardy, 1987), cognitive anxiety symptoms were experienced progressively more frequently as the competition approached.

Taken together, the findings to date regarding the interpretation of anxiety imply that the intensity-alone approach to anxiety-performance relationships in sport is likely to be limiting when attempting to account for larger proportions of performance variance. It follows from this research that anxiety researchers should employ intensity, interpretation, and frequency paradigms in order to investigate the mechanisms underlying anxiety-performance relationships.

Measurement Issues

As indicated earlier, early research in competitive anxiety used unidimensional measures of pre-competitive anxiety. Such measures typically developed from Spielberger et al.'s (1970) State-Trait Anxiety Inventory (STAI). For example, from the state anxiety component of the STAI, Martens et al. (1980) developed the CSAI. However, as anxiety theorists (e.g., Davidson & Schwartz, 1976; Liebert & Morris, 1967) had already started to conceptualise anxiety as a multidimensional construct, the CSAI was soon superseded by the CSAI-2 (Martens et al., 1990). Although some researchers continue to argue that anxiety is best measured as a unidimensional construct (e.g., Landers, 1994), most theorists accept that anxiety contains at least a cognitive and a physiological component. Consequently, since 1983 (when Martens et al., 1990, originally constructed the CSAI-2), research in competitive anxiety has largely employed the CSAI-2 as a measure of cognitive and somatic anxiety. In this section the CSAI-2 will be discussed in some depth, perhaps to the partial detriment of other measures. There

are two main reasons for this. First, although other measures of competitive anxiety in sport do exist, the CSAI-2 (Martens et al., 1990) has been, and continues to be, the choice of predilection for most researchers with an interest in competitive state anxiety. Second, almost all of the issues associated with the CSAI-2 that will be discussed in this section apply equally well to other measures.

The CSAI-2 (Martens et al., 1990) was developed as a measure of cognitive anxiety, somatic anxiety, and self-confidence. As mentioned previously, Jones and Swain (1992) modified the original CSAI-2 to include a “direction” scale, whereby performers are asked to rate how debilitating or facilitating they perceive their anxiety symptoms to be. The terminology given to this debilitation-facilitation continuum has varied between “direction”, “interpretation”, and “directional interpretation”. Regardless of the terminology employed, this scale was designed to measure the extent to which an individual perceives that his/her state anxiety is either debilitating or facilitating to subsequent performance. Since the development of the modified CSAI-2, there has been an increasing interest in the concept of “facilitative anxiety” (e.g., Burton & Naylor, 1997; Hardy, 1997; Jones et al., 1994). Indeed, many studies have revealed that directional interpretation of anxiety symptoms is a better predictor of performance than measures of anxiety “intensity”. With respect to understanding the effects of anxiety upon performance, there are two fundamental questions here. First, can anxiety facilitate performance? Second, does the CSAI-2 measure cognitive anxiety or some other construct? These two questions will be addressed in the next few paragraphs.

The question “is cognitive anxiety really facilitative?” was the title of a recent article by Burton and Naylor (1997). This question formed the basis of a reaction to Hardy’s (1997) proposal that cognitive anxiety is not always detrimental to performance. In line with Jones et al. (1994), Burton and Naylor (1997) argued that “anxiety” symptoms that are perceived as being facilitative are unlikely to be labelled as anxiety at all. Indeed, it seems perfectly plausible that a performer who is experiencing facilitative anxiety might also feel self-confident for example. However, Burton and Naylor (1997) stated that:

... the challenge confronting anxiety researchers is to develop a conceptually more explicit definition of anxiety that separates negative affective states (e.g., anxiety) that have debilitating effects on performance from positive affective states (e.g., challenge, excitement or self-confidence) that facilitate performance. (p. 299)

Herein lies an assumption that seemingly has come to be accepted as self-evident. That is, a negative emotion will always have a negative effect upon performance. The question remains: Why should a negative emotion *always* have a negative effect upon performance? Also, why should a positive emotion *always* have a positive effect upon performance? In fact, Gould et al.'s (1987) study with pistol shooters revealed a significant *negative* correlation between self-confidence and pistol shooting performance, thus providing evidence that a positive emotion (i.e., self-confidence) can, in fact, be negatively related to performance. As the present chapter's focus is on anxiety, the assumption that anxiety will always have a negative effect upon on performance will be discussed in more detail here.

In justifying the hypothesized negative relationship between cognitive anxiety and performance, Martens et al. (1990) used an explanation based on reduced attentional resources (e.g., Wine, 1971). That is, a performer who is worried will use up valuable resources that would otherwise be directed towards the task at hand. Although this is a reasonable theoretical standpoint for predicting that cognitive anxiety will have a negative effect upon performance, there is empirical evidence that contradicts it. For example, Hardy and Parfitt (1991) found that basketball players' best performance was significantly better, and their worst performance significantly worse, when they were cognitively anxious than when they were not. Hardy et al. (1994) replicated this finding with crown green bowlers. These results provide evidence that a negative emotion (e.g., cognitive anxiety) can have a positive relationship with performance. In summary, it appears that a negative emotion does not, perforce, debilitate performance. In addition to the studies conducted by Hardy and associates, other theories suggest that a negative emotion (e.g., cognitive anxiety) might sometimes have a positive influence upon performance. One such theory is processing efficiency theory (Eysenck, 1992), which will be discussed later (see section entitled Processing Efficiency Theory).

A second issue that competitive anxiety researchers need to address is the measurement of pre-competition anxiety using the CSAI-2. It is fairly clear from the research discussed earlier that performers can interpret statements in the CSAI-2 quite differently. If this is the case, one has to call into question the construct validity of the CSAI-2. In other words, does the CSAI-2 measure what it purports to measure or is it possible for two different performers with different cognitive states to report the same values? To illustrate this point, let us consider two performers, Performer A and Performer B. If Performer A scores 25 (out of a possible 36) on the cognitive anxiety subscale and feels worried beyond repair, she is likely to be feeling rather differently to Performer B who also scores 25 on the cognitive anxiety subscale and yet feels excited about her upcoming event. It is interesting to note that, of the three CSAI-2 subscales, it is the cognitive anxiety subscale that has revealed the most consistent differentiation between “intensity” and “direction” (cf. Jones et al., 1993). This might well be an artefact of the terminology used for the cognitive anxiety statements in the inventory. Indeed, 8 of the 9 cognitive anxiety statements have the prefix “I am concerned” or “I’m concerned”. It could be argued that “concern” is not necessarily a reflection of worry or cognitive anxiety, but rather a perception of the importance of the upcoming event. This feature was highlighted in a study conducted by Barnes, Sime, Dienstbier, and Plake (1986). In their study of college swimmers, Barnes et al. felt obliged to remove the first item from the CSAI-2 because of the confusion it created amongst the swimmers. Indeed, the statement “I am concerned about this competition” was interpreted in one of two ways:

- 1) the swimmer thought it was asking if he was worried about the competition, or
- 2) the swimmer thought it [w]as asking if the event was important to him (Barnes et al., 1986, p. 368).

It is fairly clear that other statements in the CSAI-2 could as easily be differentially interpreted. For example, the statement “I am concerned about reaching my goal” is open to the same kind of interpretation. Indeed, Athlete A might interpret this statement as, “I am so worried that I will not achieve my goal that I cannot stop thinking about failing”. Athlete B might interpret the same statement as “I am worried about not doing very well in this competition, so I had better get myself up for it right now”. Athlete C might interpret the same statement as “I have worked

really hard to achieve this goal and it means a lot to me”. Clearly, the same statement can be interpreted quite differently.

There are two main issues here. First, it is clear that statements in the CSAI-2 can be interpreted ambiguously to the point that they might, at times, not be measuring anxiety at all. It follows that the construct validity of the inventory as one purporting to measure “anxiety” needs further investigation. Second, if one considers the interpretations of Athlete A and Athlete B, one can see that seemingly similar anxiety states can be interpreted quite differently. These interpretations are not dissimilar to those revealed by Mahoney and Avenier (1977). The first interpretation (Athlete A) is one of impending failure whereas the second interpretation (Athlete B) is one that reflects a degree of perceived readiness. In light of the latter interpretation, a possible reply to Burton and Naylor’s (1997) question “Is anxiety really facilitative?” is “Yes, for some people, sometimes”.

Furthermore, as Hardy (1997) pointed out, there is much anecdotal evidence of people performing incredible feats under extremely threatening circumstances. For example, there are accounts of mothers exhibiting extreme strength in their attempt to save their baby’s life. In a sport context, the following quote from Hemery (1976), an Olympic athlete, illustrates how performers can perform exceptionally well (i.e., breaking a World record) even when they are under extreme pressure:

Standing behind my blocks, I put my hands on my knees and tried to take as deep a breath as I could. I could not completely fill my lungs. There was a cold constriction between my stomach and my throat. My mouth and throat were dry, it was impossible to swallow... I wished I could be anywhere else. Why was I doing this anyway? I had never before felt such dreadful pressure. I walked forward to put my hands on the track in front of my blocks. Take your marks! No turning back. I kicked each leg out and placed it against the block. Still I felt weak. Did I feel ready to run the fastest quarter of my life? I was not sure... (David Hemery prior to his World Record and Olympic winning 400-metre Hurdles run at the Mexico Olympics in 1968; p. 4)

Other issues with the CSAI-2 appear to warrant further investigation. Indeed, the items that were originally chosen by Martens et al. (1990) might not reflect the most important aspects of pre-competition anxiety for some athletes. For example,

whereas the statement “I have self-doubts” might reflect a particular athlete’s worry about her upcoming competition, the statement “I am concerned about losing” might not appear relevant, particularly for some female athletes (cf. Jones et al., 1991). Similarly, whereas the statement “My heart is racing” might reflect one athlete’s somatic anxiety, the statement “I feel jittery” might not appear a relevant statement. If athletes can interpret their scores on these items as reflecting different states, then measurements of pre-competition anxiety utilizing the CSAI-2 are unlikely to account for large proportions of performance variance. For example, a 100-metre sprinter is likely to respond somewhat more calmly than a gymnast or a rock climber to a high score on the statement “My hands are clammy” because the consequences of having clammy hands are not the same for these individuals. Indeed, whereas “clammy hands” are not likely to (directly) affect a sprinter’s performance to a great extent, they might well affect a gymnast’s or a climber’s performance. Such possible differences suggest a need for the development of anxiety measures that are specific to particular sports if not particular individuals. Furthermore, in light of the fairly modest proportion of performance variance accounted for in most anxiety studies, Gould and Udry (1994) called for researchers to consider a wider range of emotions in order to better understand the relation between different emotions and performance. However, apart from IZOF studies (e.g., Hanin & Syrjä, 1995a, 1995b), research in this area has not been particularly forthcoming.

A recent confirmatory factor analysis of the CSAI-2 (Lane, Sewell, Terry, Bartram, & Nesti, 1999) has questioned its structural validity. Lane et al. split their sample of 1213 athletes into two samples. The results of Lane et al.’s analyses revealed that all fit indices for the original CSAI-2 model were below the thresholds for acceptable fit; this was the case for both samples. For example, the Robust Comparative Fit Indices (RCFI) were 0.82 and 0.84 for the two samples. As a result of this confirmatory factor analysis, Lane et al. (1999) concluded that, “... investigators of anxiety responses to sport competition cannot have faith in data obtained using the CSAI-2 until further validation studies have been completed and possible refinements to the inventory have been made” (p. 511). In light of the results obtained by Lane et al., this conclusion certainly seems reasonable.

In summary, although many researchers appear to believe that cognitive anxiety *necessarily* has a debilitating effect upon performance, research suggests that this assumption may be misleading. Also, in light of past research, the construct validity of the CSAI-2 (in particular the cognitive anxiety measure) has been questioned here. The arguments presented here have been strengthened by the results of a recent confirmatory factor analysis of the CSAI-2 revealing its relatively weak factor structure. Finally, researchers might need to investigate other emotions in order to account for larger percentages of performance variance in a sporting context.

How Anxiety Affects Performance: Possible Explanations

Humphreys and Revelle's Information Processing Model

Humphreys and Revelle's (1984) information processing model is an attempt to explain the relationship between personality, stress, and performance. More specifically, the model proposes that performance (at the level of information processing) is predicted by the combined effects of: selected personality dimensions (i.e., achievement motivation, trait anxiety, and impulsivity); situational moderators (i.e., stressors); and motivational states (i.e., approach motivation, avoidance motivation). The model integrates two systems, termed arousal and on-task effort. Humphreys and Revelle (1984) used the notion of arousal as "... a conceptual dimension defined as that factor common to various indicants of alertness" (p. 158). This is essentially a unidimensional view of arousal similar to that of Duffy (1962). Rather than simply "trying hard," on-task effort was defined by Humphreys and Revelle (1984) as the allocation of available resources to the task at hand. Although Humphreys and Revelle's definition of arousal could be viewed as simplistic, their model is included here as it was the first explicitly to include personality, motivational, situational, and cognitive variables in a single arousal model. A simplified version of Humphreys and Revelle's (1984) model is illustrated in Figure 5. A detailed discussion of this model would be beyond the scope of this chapter and only its central features are discussed here. For a more in-depth discussion of the model, the reader is referred either directly to Humphreys and Revelle (1984) or to Jones and Hardy (1989) and Jones (1990).

Humphreys and Revelle's (1984) model attempts to predict performance on two types of task: sustained information transfer (SIT) tasks and short-term memory (STM) tasks. SIT tasks involve rapid throughput of information with no attempt at retaining this information in memory (e.g., a net rally in tennis). STM tasks require information either to be maintained in an available state or to be retrieved when it has not been attended to for a short while (e.g., deciding which serve to deliver next in a tennis match). One of the major predictions of the model is that performance on these two tasks is differentially affected by arousal. Performance on SIT tasks is predicted to be a monotonically increasing function of arousal (i.e., the greater the level of arousal, the better the performance), whereas performance on STM tasks is predicted to be a monotonically decreasing function of arousal (i.e., the greater the level of arousal, the poorer the performance). In this way, performance may either be enhanced or impaired by arousal, depending on the nature of the task. For example, increased arousal might affect tennis performance in different ways depending on the demands of the task and different points in the match. If the rally were predominantly a fast exchange of volleys at the net, requiring rapid throughput of information, then increased arousal would likely help the tennis player. However, if the player were serving a second serve, she might have to recall a number of aspects from previous returns of serve. As such a task is more dependent on short-term memory, higher levels of arousal will more likely be detrimental to performance. Of course, if a task contained elements of both SIT and STM, then arousal could either enhance or impair performance, possibly accounting for an inverted-U relationship between arousal and performance (Humphreys & Revelle, 1984).

Despite Humphreys and Revelle's (1984) commendable attempt to move beyond theories that emphasize the role of worry, their model has three main limitations. First, the model adopts a unidimensional view of arousal whereas most researchers would accept that arousal comprises at least two components (e.g., Hardy et al., 1996a; Pribram & McGuinness, 1975). Second, there is no differentiation between arousal and activation (see earlier section on state anxiety and performance). Third, the database of knowledge gleaned from research is as yet insufficient to sustain such a complex model of interactions between personality variables and task characteristics (Eysenck, 1986).

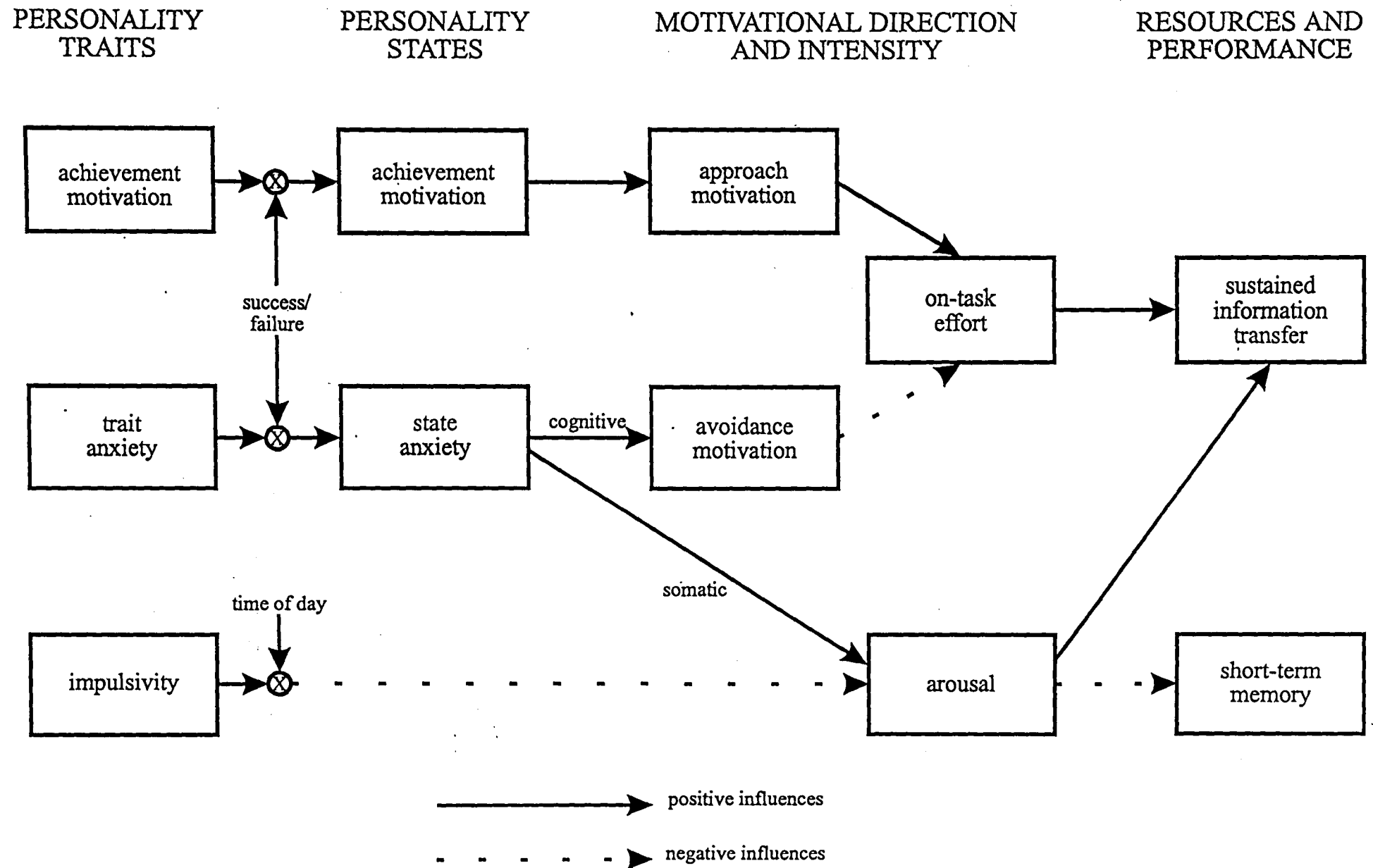


Figure 5. Conceptual structural model of the effects of personality, situational moderators, and motivational states on information processing and cognitive performance.

In summary, Humphreys and Revelle's (1984) model of information processing attempts to explain the relationship between personality, stress, and performance. Information processing performance is viewed as comprising the two components of sustained information transfer (SIT) and short-term memory (STM). Arousal and on-task effort comprise two systems within the model that differentially affect performance. Arousal is hypothesized to help performance on SIT tasks and to impair performance on STM tasks. With its dual-system approach, Humphreys and Revelle's (1984) information processing model is quite possibly an advance over theories that emphasize worry to the exclusion of other systems. However, the model has a number of limitations, particularly the limited database upon which such complex interactions might be based.

Processing Efficiency Theory

After the initial work of Eysenck (1979, 1982, 1983, 1986), Eysenck and Calvo (1992) proposed their processing efficiency theory. Although processing efficiency theory was developed in cognitive psychology, it may have important relevance for sport psychology. The theory emerged from Eysenck's dissatisfaction with theorists' simplistic conceptualisation of anxiety-performance relationships. In essence, most anxiety theories are based on anxiety-induced cognitive interference, such that anxiety uses up attentional resources. These theories typically predict that high-anxious individuals will perform less well than low-anxious individuals (e.g., Deffenbacher, 1980; Easterbrook, 1959; Mandler & Sarason, 1952; Sarason, 1984, 1988). Eysenck (1992) argued that such theories are limited because they exaggerate the effects of self-preoccupation and worry. Indeed, Eysenck cited numerous studies in which high-anxious individuals did not perform less well than low-anxious individuals (e.g., Blankstein, Flett, Boase, & Toner, 1990; Blankstein, Toner, & Flett, 1989; Calvo, Alamo, & Ramos, 1990; Calvo & Ramos, 1989). For example, Blankstein et al. (1989) found support for the notion that high-anxious individuals have more negative thoughts about themselves than low-anxious individuals. However, no differences were noted between high-anxious and low-anxious individuals in performance on an anagram task.

Eysenck (1992) argued that cognitive anxiety serves two principal functions. First, consistent with cognitive interference theories, worry will consume some of the individual's attentional resources, such that the attentional capacity for the task will be reduced. Second, worry signals the importance of the task to the individual and, as such, serves a monitoring function. In this way, anxious individuals will invest more effort if they perceive their performance to be below their expectations. However, Eysenck (1982) argued that this increase in effort would occur only when individuals perceive that they have at least a moderate probability of succeeding. In other words, if performers are reasonably confident, they will invest more effort in the task when their anxiety increases. Therefore, processing efficiency theory states that cognitive anxiety (a negative emotion) can have a negative cognitive effect (reduced attentional capacity) whilst serving *a positive motivational function* (increased effort).

In processing efficiency theory (Eysenck, 1992; Eysenck & Calvo, 1992), an important distinction is made between processing efficiency and performance effectiveness. Processing efficiency is the efficiency with which information is processed. Performance effectiveness is, in essence, the quality of performance. Consequently, increases in anxiety will likely result in a decrease in processing efficiency because of the extra effort invested in performance and the reduced attentional resources. However, performance effectiveness could be maintained or improved as a result of this extra effort, or it could be impaired despite this extra effort.

As cognitive anxiety is hypothesized to tax working memory, the effects of elevated anxiety are likely to be fairly positive if the task does not overwhelm working memory. However, if the task is cognitively demanding, then performance may be impaired by elevated anxiety due to the limited remaining resources available for the task at hand. Research on processing efficiency theory has generally been supportive of its predictions using various procedures to tax working memory. For example, Eysenck (1985) used a letter transformation task to manipulate task difficulty. In these tasks, participants are asked to transfer a series of letters into another series of letters by converting the letters by a certain amount. For example, a participant might

be asked to add 4 to the series ADG. The correct answer would then be EHK (A+4, D+4, G+4). When Eysenck (1985) increased the number of letters to be transformed, he found no differences between high-anxious and low-anxious individuals on performance when the task was fairly simple (one or two letters). However, a significant interaction indicated that the differences in performance between the two groups increased as a function of task difficulty. That is to say, the high-anxious individuals' performance was increasingly worse than their low-anxious counterparts as task difficulty increased. As processing efficiency theory predicts that performance impairment is caused by overloads to working memory, it follows that the performance of tasks that do not tax working memory to any great extent will not be affected by anxiety because performers can increase their effort to maintain or improve performance. However, if the cognitive demand is beyond a certain threshold, performers will lose confidence in being able to achieve the task, effort will likely be withdrawn, and performance will suffer.

Although processing efficiency theory emanated from cognitive psychology, its central tenets appear particularly relevant to some of the seemingly conflicting findings in competitive anxiety research, particularly the negative and positive effects of cognitive anxiety. Despite its natural extension from other theories in cognitive psychology (e.g., Wine's, 1971, theory of attention and interference), processing efficiency theory differs considerably in its dual-system approach. Indeed, rather than viewing the cognitive system as one passive mechanism (i.e., less cognitive resources = poorer performance), it allows for a positive moderating influence (i.e., effort) that might attenuate the negative effects of reduced resources. Although Martens et al.'s (1990) multidimensional anxiety theory does not allow for any such compensatory mechanisms, Hardy and associates' cusp catastrophe model (Hardy, 1990, 1996b; Hardy & Fazey, 1987; Hardy & Parfitt, 1991) appears to fit well into a processing efficiency theory framework. For example, consider the proposed hysteresis effect illustrated earlier (see Figure 3). Under conditions of high worry (cognitive anxiety), the cusp catastrophe model proposes that increases in physiological arousal will result in increases in performance up to some optimal point beyond which further increases in physiological arousal will result in a dramatic drop in performance. In processing efficiency theory, individuals are

predicted to monitor their performance and when performers are anxious they are expected to respond to the possibility of unsatisfactory performance with increases in effort in order to maintain performance effectiveness (at the cost of processing efficiency). However, if the performance demands are beyond a certain threshold, the anxious individual will likely perceive the task demands to be too great, lose confidence, and withdraw effort. A withdrawal of effort is likely to be accompanied by a significant drop in performance as reflected in the cusp catastrophe model under conditions of high cognitive anxiety.

It is worth giving further consideration to the role that self-confidence and expectancies of success might play in processing efficiency theory. For example, Carver and Scheier (1988) suggested that anxiety would enhance performance when people are able to maintain a favourable expectancy regarding goal attainment. Also, Hardy (1990, 1996b) suggested that self-confidence might play a buffering role in protecting performers against the potential debilitating effects of elevated cognitive anxiety. For example, Hardy (1996b) postulated that high self-confidence might result in the front face of the catastrophe model shifting toward the right. The result of such a shift would result in higher levels of physiological arousal being tolerated before a dramatic drop in performance occurred. Similarly, Hardy (1996b) proposed that low levels of self-confidence would result in the front face of the model shifting toward the left, such that only fairly low levels of physiological arousal could be tolerated before a dramatic drop in performance occurred. If these propositions, in the context of processing efficiency theory, are combined, it is quite conceivable that anxious performers who are self-confident (and therefore have favourable goal attainment expectancies) will increase their effort for a longer period of time in their attempt at achieving their goal. This proposition seems to concord with anecdotal reports of athletes performing exceptionally well under conditions of extreme pressure (e.g., breaking world records at major international events). Conversely, anxious performers with relatively low levels of self-confidence are more likely to withdraw their effort and “give up”. If such a proposition were supported, then one would expect highly self-confident performers to exert more effort under conditions of elevated cognitive anxiety. This would result in enhanced performance under conditions of high (i.e., “higher than normal”) cognitive anxiety, but impaired

performance if performers lost their self-confidence because task conditions changed (cf. Hardy & Parfitt, 1991; Hardy et al., 1994). Based on these propositions, exploration of the interaction between cognitive anxiety, effort, and self-confidence appears likely to be a fruitful area for future research.

The majority of research on processing efficiency theory has been conducted in laboratory settings using test anxiety measures such as Spielberger et al.'s (1970) STAI. As such, it would be crude to suggest that findings from test anxiety research could be applied *en bloc* to a competitive sport context. However, more recent research within a sport environment has also lent credence to processing efficiency theory. Hardy and Jackson's (1996) examination of rock climbers is one such example. In this study, experienced rock climbers led and seconded high and low anxiety rock climbs³. Climbers performed better and exerted more cognitive and physiological effort when they were cognitively anxious (leading) compared to when they were not cognitively anxious (seconding). In another study, with golfers, Mullen, Hardy, and Tattersall (1999) also found more effort was exerted when performers were anxious in a golf-putting task. Interestingly, Mullen et al.'s study did not reveal any significant changes in golf putting performance. Golf putting differs from rock climbing in that a golfer is not required to react to a changing environment, whereas a rock climber constantly has to make important decisions with respect to the changing nature of the climb as it evolves, including the risk of injury. In view of the likely different demands on working memory, it is possible that a contrived golf putting task will not tax working memory as much as rock climbing. Consequently, the stakes might have to be perceived as very high before anxiety significantly affects performance. Australian golfer Greg Norman's demise⁴ at the 1996 Masters is a case where such conditions might apply.

In summary, processing efficiency theory overcomes the shortcomings of many previous theories of anxiety and performance by incorporating a monitoring system, whereby anxious individuals will invest more effort if they perceive their

³ When rock climbers lead a climb, they run the risk of serious injury. When climbers second a climb, the technical difficulty remains the same but the risk is largely removed.

⁴ Greg Norman had a 6-shot lead going into the final round of the 1996 Masters; he eventually lost by 5.

performance to be threatened and they are reasonably confident of achieving their goal. A distinction is made between processing efficiency and performance effectiveness, such that an increase in effort will allow an individual to maintain performance effectiveness albeit at a cost in terms of processing efficiency. Processing efficiency theory has received support in test anxiety. Also, recent research within a sporting environment suggests that processing efficiency theory may be applicable in competitive anxiety research, particularly in those sports that tax working memory. However, because of the obvious differences between test anxiety and competitive anxiety in sport, further research examining the theory within a sporting context is much needed. Processing efficiency theory appears to dovetail rather well with catastrophe models, particularly with respect to the role that self-confidence might play in buffering the debilitating effects of elevated cognitive anxiety. As such, self-confidence might allow anxious individuals to invest more effort in their performance due to their elevated anxiety. Consequently, performers who enjoy high levels of self-confidence might well be expected to perform better under conditions when they feel more anxious. Research investigating the interaction between cognitive anxiety, physiological arousal, effort, and sport performance will undoubtedly clarify the applicability of processing efficiency theory to a sport environment.

Conscious Processing Hypothesis

The conscious processing hypothesis (Masters, 1992) states that performers who are experiencing increased anxiety attempt to control their performance by consciously controlling their movements using explicit “rules” to perform the task, rather than simply “doing it automatically” as they would normally. Baumeister (1984) suggested that performers have a tendency to focus on the process of performing in competitive situations because they are highly motivated to do well. Thus, performers who are normally capable of executing a task “without thinking about it” will lapse into a conscious monitoring and control of their performance under conditions of stress. As conscious control is relatively crude compared to automatic control (Keele, 1973; Langer & Imber, 1979), performance should suffer when conscious control is exerted over a skill that is normally executed automatically.

Masters (1992) tested the conscious processing hypothesis with a sample of novice golfers. These novices were taught a golf-putting task either under explicit learning conditions or under implicit learning conditions. Golfers in the explicit learning group were given instructions on the correct method of putting, and they were asked to use this technical information during their practice sessions. The implicit learning golfers were asked to perform a random letter generation task during their practice sessions in order to prevent them from forming or using any explicit rules on how to putt a golf ball. After an extended practice period, both groups were asked to perform the putting task under high stress conditions. These conditions were induced by using both social evaluation and financial incentive. Under stressful conditions, the implicit learning group continued to improve, whereas the explicit learning group did not.

Hardy, Mullen, and Jones (1996b) argued that Masters' (1992) results did not necessarily support the conscious processing hypothesis because the implicit learning group was not asked to continue their random letter generation task in the high stress condition. As such, the continued improvement in the implicit learning group could be attributable to a decrease in task difficulty. However, when Hardy et al. (1996b) controlled for this possible confound, their results also supported the conscious processing hypothesis. Bright and Freedman (1998) partially replicated Masters' study but failed to produce the same results as Masters (1992) and Hardy et al. (1996b). However, Bright and Freedman introduced their stress intervention after only 160 putting trials as opposed to Masters and Hardy et al. who made their intervention after 400 trials. As such, the lack of significance in Bright and Freedman's (1998) study could be attributable to the participants' earlier stage of learning. That is to say, the participants in Bright and Freedman's explicit learning group were likely still at the cognitive stage of learning when performance is normally controlled by conscious processes (cf. Schneider, Dumais, & Shiffrin, 1984) and so did not experience any decrement in performance when they performed under conscious control.

These investigations in support of the conscious processing hypothesis have important practical implications. At present, many practitioners and researchers

advocate the use of process goals as important methods of retaining or regaining focus during performance (Bull, Albinson, & Shambrook, 1996; Kingston & Hardy, 1994a, 1997; Kingston, Hardy, & Markland, 1992). It could be argued that process goals encourage the use of explicit knowledge to control movements and should therefore increase the likelihood of a breakdown in automatic processing. Based on our current knowledge, it is plausible that holistic process goals, which encourage a focus on global aspects of performance, will be beneficial because they encourage automaticity rather than a de-chunking of the skill into parts (Kingston & Hardy, 1994b, 1997).

The conscious processing hypothesis could dovetail rather well with Hardy and colleagues' cusp catastrophe model, particularly if the basic tenets of processing efficiency theory were also included. For example, when performers are cognitively anxious, Eysenck (1992) argued that they are likely to invest more effort in the task at hand provided that they perceive that they have at least a moderate chance of succeeding. Under these conditions of high cognitive anxiety, performance is likely to be fairly good. However, if performers increase their effort to such a degree that they lapse into conscious processing (cf. Masters, 1992), then their performance will likely suffer dramatically. Hence, a performance catastrophe (cf. Hardy, 1990) could be explained either by a withdrawal of effort or by an effort-induced lapse into conscious processing, or both. Thus, under elevated cognitive anxiety, an increase in effort might be beneficial to performance up to a point beyond which a further increase in effort will lead to a catastrophic drop in performance due to a lapse into conscious processing.

At an applied level, this suggests that any effort invested under conditions of elevated cognitive anxiety will be best directed through the use of holistic process goals rather than through the de-chunking of an otherwise automatic skill. There is some evidence to suggest that some elite performers do tend to use such holistic process goals (Jones & Hardy, 1990; Orlick & Partington, 1988). The following quote, from an Olympic pairs kayaker, and reported by Orlick and Partington (1988), exemplifies such an approach:

My focus was very concentrated throughout the race. We have a start plan, and in it I concentrate only on the first few strokes... Then I concentrate on the next little bit of the race... Then it's getting to the end, we have to really push. Almost every 3 seconds or so towards the end I'd have to say, "Relax", and I'd let my shoulders and my head relax, and I'd think about putting on the power, and then I'd feel the tension creeping up again so I'd think about relaxing again, then power, then relax... (p. 116)

In summary, the conscious processing hypothesis predicts that performers whose cognitive anxiety is elevated are more likely to lapse into the conscious controlling of a normally automatic skill. Although there is a need for more corroborating evidence for the conscious processing hypothesis within sport settings, the research to date has generally supported its central features both in laboratory and sport settings. At an applied level, the hypothesis implies that process goals should be used wisely so as not to encourage the breakdown of a normally automated skill.

Theory of Ironic Processes of Mental Control

Wegner (1989, 1994, 1997) developed the theory of ironic processes of mental control from the observation that it is difficult not to think about something when this is one's explicit desire. For example, if one explicitly tries not to think of a white horse, one will have difficulty not bringing the image of a white horse to mind. Wegner postulated that mental control is accomplished by the interaction of two processes: an intentional operating process and an ironic monitoring process. The *operating process* is one that is conscious, effortful, and interruptible. The *monitoring process* is one that is unconscious, less effortful, and uninterruptible. The operating process consciously seeks mental components that are consistent with the intended state of mind, whereas the monitoring process searches for those mental components that signal a failure to create the intended state of mind. Wegner (1997) suggested that the operating process and the monitoring process function together as a feedback unit in an attempt to produce mental control. For example, prior to a tennis player's second serve, the operating process might look for any signs that will allow the player successfully to execute the second serve. Such signs might include: picking a target spot on the court; reminding oneself of the opponent's weak backhand return; or remembering the last successful second serve. At the same time, the monitoring process might look for signs that will result in a double fault. These

might include: recalling where the ball went on one's previous double fault; remembering the opponent's powerful forehand return; focusing on the point of impact of the first serve.

When working in an adaptive fashion, the monitoring process will ensure that threats to the operating process are registered and dealt with accordingly. In the example above, the monitoring process might register the opponent's strong forehand return and, under normal circumstances, the tennis player should be able to concentrate on delivering an appropriate serve to the opponent's backhand. However, the monitoring process is called an *ironic* monitoring process because it increases the accessibility of those thoughts that are the most undesirable. Under normal conditions, the operating process outweighs the monitoring in its consumption of processing capacity (Wegner, 1989, 1994, 1997). However, when mental load increases (e.g., under various types of pressure including high levels of stress or anxiety), the monitoring process begins to outweigh the operating process and mental control backfires by attending to those thoughts that are precisely those that are the most undesirable. In the case of the tennis player, the place on the net where the last double fault was made becomes the fixated thought. The thought, "Whatever you do, do not put the ball in the net", results in the player hitting the ball into the net and committing a double-fault. As Wegner, Schneider, Carter, and White (1987) suggested, suppression of a thought induces the monitoring process to search for that very thought that is to be ignored. Thus, if the reader is instructed not to pay attention to the full stop at the end of this sentence (something one would normally not pay attention to), the monitoring process will be primed to attend to it (Wegner, 1989).

Research that has directly tested the theory of ironic effects has received limited attention in sport psychology. However, there is some evidence that supports its central thesis. For example, Wegner, Broome, and Blumberg (1997) found that people who attempted to relax under conditions of mental load demonstrated an increase in symptoms of anxiety and physiological arousal. Also, in their study of auto-race simulation, Janelle, Singer, and Williams (1999) found that when participants were more anxious, they were more inclined to focus on and process irrelevant internal and external information. Finally, in Wegner, Ansfield, and

Pilloff's (1998) golf-putting experiment investigating ironic effects, players were instructed not to hit the ball past the hole. However, when players were under mental load, the propensity to hit the ball past the hole increased significantly.

Interestingly, it appears rather difficult to discriminate between the theory of ironic effects and the conscious processing hypothesis (Masters, 1992), particularly in terms of the hypothesized effects of stress upon performance. Indeed, under increased levels of stress, both the theory of ironic effects and the conscious processing hypothesis predict that individuals will focus upon thoughts that will be detrimental to their performance. One difference between the two predictions may be in the precise way in which these breakdowns in performance occur. For example, according to the conscious processing hypothesis, performance might break down in a number of ways (i.e., by consciously processing information that is normally processed automatically), whereas according to the theory of ironic effects, performance will break down in precisely the way that is to be avoided (i.e., by focusing on the cues to be avoided).

At an applied level, there are likely countless instances where ironic processes might be responsible for poor performance. For example, a golfer might think, "whatever you do, don't hit the ball in the lake," and subsequently proceed to hit the ball into the centre of the lake (Janelle, 1999). Despite initial research in support of the theory, there has been little encouragement with respect to changing or preventing ironic processes (Shoham & Rohrbaugh, 1997). Janelle (1999) suggested that one way to interrupt ironic processes would be to render the functioning of the monitoring process useless or irrelevant through paradoxical interventions. Such interventions encourage a person to focus upon the threatening situation thus rendering the monitoring process less debilitating. For example, an athlete who is experiencing debilitating pre-competition anxiety might choose to focus upon these feelings. As a consequence of focusing on these negative feelings, the monitoring system would search for cues that are incompatible with the anxious state, and the athlete should be able to reduce the level of debilitating anxiety through the identification of anxiety-reducing cues. Of course, as Janelle (1999) and Hall, Hardy, and Gammage (1999) pointed out, such paradoxical interventions should probably be viewed with great

caution in view of their counterintuitive quality and the lack of research that supports them. If such interventions were revealed as sometimes being helpful, the question remains: When should an athlete abandon attempts at mental control in favor of the ironic monitoring process? Indeed, presumably such a threshold exists (Wegner, 1997). If this were the case, then the skilful intervention would be in deciding whether this threshold had been crossed: If so, then the athlete should probably abandon attempts at mental control in favour of the ironic monitoring process; if not, then the athlete should attempt to redeem mental control with astute rebuilding of the operating process. However, these points remain conjectural until further research has been conducted on the theory of ironic processes.

In summary, the theory of ironic processes of mental control (Wegner, 1989, 1994, 1997) suggests that mental control is achieved via the interaction of an intentional operating process and an ironic monitoring process. When mental load is elevated, the monitoring process outweighs the operating process and leads the individual to focus upon that aspect of behaviour that he/she precisely intended to avoid. Although initial research on the theory of ironic processes has been encouraging, the implications for applied interventions are yet to be elucidated.

Applied Implications

Antecedents of Stress and Anxiety

The sources of stress and anxiety revealed in the research include: readiness and performance problems; interpersonal problems with team-mates and coaches; financial and time constraints; selection procedures; lack of social support; injury struggles; traumatic experiences; and other personal issues. The coach can influence many of these areas. For example, if coaches encourage athletes to have attainable goals, and to prepare sufficiently well to perceive these goals as attainable, these athletes are likely to maintain a reasonably positive pre-competition affective state. Conversely, if coaches try to pressure them to goals that are not really attainable, then negative pre-competition affective states might well follow.

Useful strategies will likely be those that encourage automatic responses with respect to mental and physical preparation for competition. One such strategy that is widely used, particularly in team situations, is to have athletes generate “What if...” scenarios (e.g., “What if my sports bag is stolen?”). In such cases, the coach, sport psychologist, and athlete can work together to come up with contingency plans when the competition does not run as smoothly as planned. Personal experience and discussions with coaches, athletes, and practicing sport psychologists suggest a competition rarely runs as smoothly as planned. Consequently, strategies that prepare one for numerous (not necessarily positive) eventualities will likely be beneficial.

State Anxiety and Performance

The relationship between state anxiety and performance arguably has been one area in sport psychology that has received a great deal of attention. However, the research to date allows only for informed speculations to be made about how state anxiety might affect performance. Consequently, any implications for best practice can only reflect this relatively limited state of knowledge.

Based on the evidence presented in this chapter, there appears to be fairly sound evidence that cognitive anxiety can be either detrimental or beneficial to performance. If physiological arousal is not too high, and if performers perceive that they have a fairly reasonable chance of achieving their goal, then cognitive anxiety is

likely to act as a motivator before and during performance. Conversely, if physiological arousal is elevated, and if athletes perceive that they have little chance of achieving their goal, then cognitive anxiety is likely to be detrimental to performance. Furthermore, when athletes suffer a decrement in performance under high levels of cognitive anxiety, this is likely to be large, sudden, and difficult to recover from. Ideally, performers will not suffer such a drop. One way to reduce the chance of such occurrences is by establishing truly attainable goals in conjunction with the coach. However, if a large drop in performance occurs, and if athletes are competing in a sport where recovery time is possible, then a combination of physical relaxation and cognitive restructuring might be helpful. More specifically, in relation to the cusp catastrophe model, athletes could physically relax and then cognitively restructure in order to regain the upper performance surface. Only then would recommencing one's pre-performance routine (e.g., mental rehearsal) be recommended. Of course, in view of the relatively limited amount of research directly investigating catastrophe models of anxiety and performance, these recommendations remain fairly speculative.

In summary, from the research to date, the applied implications for coaches and athletes are:

- 1) "Psyching up" strategies should be employed with great caution, as it is difficult for athletes to recover from a large drop in performance.
- 2) Stress management strategies that enable athletes to target cognitive anxiety and physiological arousal separately should be learned and practiced.
- 3) Truly attainable goals should be agreed between the coach and the athletes. If the goal is unrealistic (regardless of perceptions), then the athletes will start to fail sooner or later. Once this failure has occurred, the impact upon self-efficacy will likely be disastrous because they were previously convinced that the goal *was* attainable.
- 4) Athletes should have well-practiced and effective self-talk and cognitive restructuring strategies. For athletes who typically experience anxiety as debilitating, such cognitive restructuring strategies might include changing

their cognitive appraisal to a more facilitating state such as excitement or challenge.

Summary and Future Directions

This chapter has included a review of research on: the antecedents of competitive anxiety; the effects of anxiety upon performance; and various hypotheses, models, and theories that can be used to describe and explain the effects of anxiety upon performance. Despite the criticism that has been levelled at multidimensional anxiety theory here and elsewhere, it is fairly clear that this theory has allowed researchers to progress from the rather simplistic inverted-U hypothesis.

Researchers in mainstream psychology have long accepted the interaction between cognition and emotionality or physiological arousal (Deffenbacher, 1977; Marañón, 1924; Schachter, 1964; Schachter & Singer, 1962), whereas researchers in sport psychology, perhaps rather surprisingly, have been slower to examine this notion. Future researchers interested in the effects of anxiety or other emotions upon performance (or performance-related variables) will need to adopt interactive paradigms if they are to take the sport psychology field to “the next level”. Some research questions that are particularly worthy of attention are:

- 1) What are the organizational issues that impinge upon athletes’ preparation for competition and how can these be best addressed and, at least partially, resolved?
- 2) How do cognitive anxiety and physiological arousal (or somatic anxiety) exert their influence upon performance (or performance-related variables)?
- 3) What role, if any, does effort play in delaying drops in performance or in curtailing the magnitude of such decrements?
- 4) Does effort moderate the effects of cognitive anxiety upon performance?
- 5) Which personality and individual variables influence Individualized Zones of Optimal Functioning?
- 6) What moderating role, if any, does self-confidence play in the effects of cognitive anxiety and physiological arousal upon performance?
- 7) How do other emotions (e.g., excitement and anger) affect performance?

Conclusions

Sport psychology research on anxiety has made significant advances over the last couple of decades. The inverted-U hypothesis is now discussed in most textbooks only as an introduction and to bring attention to its limitations. Although multidimensional anxiety theory has undoubtedly allowed anxiety research to move beyond simplistic notions of arousal, anxiety, and performance, the research on the interpretation of anxiety suggests that current operationalisations of anxiety need to be reconsidered and that anxiety and other emotions need to be investigated through different viewpoints. Even though the cusp catastrophe model is probably not *the* model of anxiety and performance, it has encouraged an understanding of the interactive effects of different anxiety components upon performance. Also, with the possibilities that processing efficiency theory, the conscious processing hypothesis, and the theory of ironic effects can offer, these are exciting times for those who are eager to embrace the challenge.

Chapter 3

The relative impact of cognitive anxiety and self-confidence upon sport performance: A meta-analysis⁵

Abstract

This meta-analysis ($n = 42$) investigated 2 relationships in competitive sports: state cognitive anxiety with performance, and state self-confidence with performance. The cognitive anxiety mean effect size was $r = -0.12$ ($p < 0.05$). The self-confidence mean effect size was $r = 0.28$ ($p < 0.001$). A paired-samples t -test revealed that the magnitude of the self-confidence mean effect size was significantly greater than the cognitive anxiety mean effect size. The only moderator variable for the cognitive anxiety - performance relationship was sex. The mean effect size for men ($r = -0.19$) was significantly greater than the mean effect size for women ($r = -0.00$). The significant moderator variables for the self-confidence - performance relationship were sex and skill level. The mean effect size for men ($r = 0.27$) was significantly greater than the mean effect size for women ($r = 0.12$). The mean effect size for high-level athletes ($r = 0.32$) was significantly greater than the mean effect size for low-level athletes ($r = 0.16$).

⁵ Based upon Woodman, T, & Hardy, L. (2001c). *The relative impact of cognitive anxiety and self-confidence upon sport performance: A meta-analysis*. Manuscript submitted for publication.

Introduction

The relationships between anxiety, self-confidence, and sport performance have attracted much research attention over the past twenty years, and researchers have attempted to clarify these relationships by advancing a number of models and theories. These include: catastrophe models (Hardy, 1990, 1996b); multidimensional anxiety theory (Martens, Burton, Vealey, Bump, & Smith, 1990); reversal theory (Apter, 1982; Kerr, 1990); and zones of optimal functioning models (Hanin, 1980, 1986).

In multidimensional anxiety theory, Martens et al. (1990) proposed a series of two-dimensional relationships between cognitive anxiety, somatic anxiety, self-confidence, and performance. Cognitive anxiety was defined as “negative expectations and cognitive concerns about oneself, the situation at hand, and potential consequences” (Morris, Davis, & Hutchings, 1981, p. 541). Somatic anxiety was conceptualised as the perceptions of one’s physiological arousal. Self-confidence was conceptualised as one’s belief that one can meet the challenge of the task to be performed. In multidimensional anxiety theory (Martens et al., 1990) cognitive anxiety is hypothesized to have a negative linear relationship with performance; somatic anxiety is hypothesized to have a quadratic (inverted-U shaped) relationship with performance; and self-confidence is hypothesized to have a positive linear relationship with performance.

A number of investigations have been conducted to test these proposed effects. For example, Burton (1988) found a negative linear trend between cognitive anxiety and swimming performance and a positive linear trend between self-confidence and performance. In the two samples investigated in this study, cognitive anxiety accounted for up to 46% of swimming performance variance, and self-confidence accounted for up to 21%. Gould et al. (1984) also found a significant negative linear relationship between cognitive anxiety and performance, although no significant trend between self-confidence and performance was revealed. Conversely, Martin and Gill (1991) found self-confidence to be significantly and positively related to distance running performance, but no significant relationship between cognitive anxiety and running performance. Similarly, in their study of pistol shooters, Gould

et al. (1987) found no significant relationship between cognitive anxiety and performance. However, in this study, a significant *negative* relationship between self-confidence and performance was revealed. Other studies have revealed no significant relationships between cognitive anxiety and performance (Hammermeister & Burton, 1995; Maynard & Cotton, 1993; Vadocz et al., 1997), or between self-confidence and performance (Maynard & Cotton, 1993; Williams & Krane, 1992). Thus, the relative impact of cognitive anxiety and self-confidence upon competitive sport performance remains unclear.

The inventory derived from multidimensional anxiety theory was the Competitive State Anxiety Inventory-2 (CSAI-2; Martens et al., 1990). The CSAI-2 was originally intended to be an anxiety scale comprising two subscales, cognitive anxiety and somatic anxiety. However, in the exploratory factor analysis of the items comprising the CSAI-2, Martens et al. (1990) found that cognitive anxiety effectively separated into two factors, one that included negatively phrased items and one that included positively phrased items. These factors were subsequently labelled cognitive anxiety and self-confidence respectively. Thus, a self-confidence subscale was also included in the CSAI-2. In the discussion of their factor analyses, Martens et al. stated:

These findings suggest that cognitive A-state and state self-confidence represent opposite ends of a cognitive evaluation continuum, state self-confidence being viewed as the absence of cognitive A-state, or conversely, cognitive A-state being the lack of state self-confidence. (Martens et al., 1990, p. 129)

Given that cognitive anxiety and self-confidence emerged as orthogonal (i.e., independent) factors in these factor analyses, it is surprising that Martens et al. (1990) should view them as interdependent (bipolar). This said, when a psychological rating scale contains positively and negatively worded items, the factor analyses of its item responses often reveal two apparently distinct factors, one that reflects the positive items and one that reflects the negative items. However, in such instances, the two factors might not in fact be meaningfully distinct. They might simply reflect the positively and negatively worded items of the *same* construct (cf. Marsh, 1996). This explanation allows the possibility that cognitive anxiety and self-

confidence lie at opposite extremes of a single dimension despite Martens et al.'s findings that they were independent factors. Also, Burton (1988) found a significant negative linear relationship between cognitive anxiety and swimming performance, and a significant positive linear relationship between self-confidence and performance. This is consistent with the proposition that cognitive anxiety and self-confidence are interdependent.

Despite these possible explanations of the results reported by Martens et al. (1990), and the research reported by Burton (1988), there appears to be sufficient evidence to suggest that cognitive anxiety and self-confidence are meaningfully distinct constructs (Burrows, Cox, & Simpson, 1977; Gould, Petlichkoff, Simons, & Vevera, 1987; Gould, Petlichkoff, & Weinberg, 1984; Jones & Cale, 1989; Hardy, 1996a; Hardy & Whitehead, 1984; Parfitt & Pates, 1999; Thayer, 1978). For example, although Gould et al. (1984) found a significant negative linear relationship between cognitive anxiety and performance, they found no significant trend between self-confidence and performance. Also, in their work on the antecedents and temporal patterning of cognitive anxiety and self-confidence, Jones, Swain, and Cale (1990, 1991) provided more evidence for the relative independence of cognitive anxiety and self-confidence. Furthermore, in their study of basketball players, Parfitt and Pates (1999) found that self-confidence accounted for significant proportions of performance variance over and above those accounted for by cognitive anxiety.

Multidimensional anxiety theory (Martens et al., 1990) is an attempt to explain the relationship between cognitive anxiety, somatic anxiety, self-confidence, and performance in a series of two-dimensional relationships. It has been argued that this is a limitation if one is fully to understand the potentially complex relationship that might exist between these variables (e.g., Hardy, 1990). In an attempt to overcome this limitation, Hardy and associates (Hardy, 1990, 1996b; Hardy & Fazey, 1987; Hardy & Parfitt, 1991) proposed a cusp catastrophe model of cognitive anxiety, physiological arousal, and performance. Hardy and his associates chose physiological arousal rather than somatic anxiety as one of the predictor variables. This is because physiological arousal could have both direct and indirect effects upon performance, whereas somatic anxiety could only have an indirect effect. The cusp

catastrophe model depicts the relationship between cognitive anxiety, physiological arousal, and performance as an interactive process, whereby cognitive anxiety has either a positive effect or a negative effect upon performance, depending upon the level of physiological arousal (see Hardy, 1996b, for further details). Hardy (1990, 1996a) also proposed a higher-order catastrophe model in which self-confidence acts as a bias factor. In this model, the bias factor (i.e., self-confidence) moderates the relationship between cognitive anxiety, physiological arousal, and performance. More specifically, higher levels of self-confidence swing the cusp of the catastrophe model to the right. In practical terms, this suggests that self-confidence might “protect” an individual from a catastrophic drop in performance under high levels of cognitive anxiety and physiological arousal. Of course, one of the assumptions underlying this proposition is that cognitive anxiety and self-confidence are at least partially independent. In a study of golfers aimed at comparing the amount of performance variance accounted for by multidimensional anxiety theory and catastrophe models, Hardy (1996a) found that self-confidence accounted for performance variance over and above the performance variance accounted for by cognitive and somatic anxiety. These results suggest that cognitive anxiety and self-confidence are, at least partially, independent constructs.

The somewhat equivocal findings revealed in studies investigating the relationships between cognitive anxiety, self-confidence, and sport performance reflect the need for an objective and systematic synthesis of the research in this area. The meta-analysis reported in this paper is intended to provide such a synthesis. More precisely, the meta-analysis aims to investigate the relative importance of cognitive anxiety and self-confidence in relation to competitive sport performance.

Method

Literature Search

Computer-based literature searches were conducted to locate published and unpublished research in the areas of cognitive anxiety, self-confidence, and performance. The databases used for this search were: Applied Social Sciences Index and Abstracts (ASSIA), Bath Information and Data Services (BIDS), PsycINFO, PsycLIT, Social Science Citation Index (SSCI), and Sport Discus. The last search

was conducted at the end of September 2000. Keywords used for the searches were: “cognitive anxiety”, “confidence”, “sport”, and “performance”. A number of “wild card” searches were also conducted to ensure that the search did not miss studies containing related words such as “anxiety”, “worry”, and “competition”. The reference lists of the located studies were examined for further possible articles that might fulfil the criteria for inclusion. Studies were included in the meta-analysis if they fulfilled the following criteria:

- 1) A measure of state cognitive anxiety or state self-confidence was taken prior to a competitive sport situation.
- 2) Competitive sport performance was measured in a field setting.

Statistical methods

The meta-analytic procedures used in the present study are described in Rosenthal (1991). Effect sizes were calculated for those studies that satisfied the criteria for inclusion. The correlation coefficients (r) between cognitive anxiety and performance and between self-confidence and performance were used to compute effect sizes. As the population value of r gets further from zero the distribution of r 's becomes more and more skewed (Rosenthal, 1991). Fisher's (1928) transformation converts r to z_r , which results in a more normal distribution. Hence, the present study employed z_r as an estimate of effect size. The transformation from r to z_r is:

$$z_r = 0.5 \ln [(1 + r)/(1 - r)]$$

In order to calculate the significance of the effect sizes, the standard normal deviate Z was used. The transformation from r to Z is:

$$Z = r \sqrt{n} \text{ where } n = \text{sample size}$$

The cognitive anxiety Z s were reversed to reflect the expected (negative) direction of the effect. For example, if $r = -0.20$ and $n = 100$, then $Z = 2$. If no data were available to calculate the effect size (r) or the significance level (p , one-tailed), the primary author of the study in question was contacted by telephone or electronic mail.

Omitting studies that report non-significant results can artificially inflate the effect size. Hence, if clarification of the data was not obtained from the primary author, p was assumed to be 0.50 and r was assumed to be 0.00. However, this procedure is conservative and can result in effect size estimates being too low. Following Rosenthal's (1995) recommendations, both procedures are presented in the present

study. A summary of all the studies included in the meta-analysis is presented in Table 1.

The following methods (Rosenthal, 1991) were used for transforming a t statistic to r , or an F ratio to r , respectively:

$$r = [t^2 / (t^2 + df)]^{0.5}$$

where $df = n_1 + n_2 - 2$, and

$$r = \{F(1, -) / [F(1, -) + df \text{ error}]\}^{0.5}$$

where $F(1, -)$ represents any F with one degree of freedom in the numerator.

If more than one effect size estimate was available from one study, the method of mean result (Rosenthal, 1991) was employed. That is, each r from the study was first converted to z_r before calculating the mean of these transformed effect sizes. In order to calculate the standard normal deviate Z , the mean z_r was converted back to r using the following equation:

$$r = (e^{2zr} - 1) / (e^{2zr} + 1)$$

where e is the base of the system of natural logarithms ($e \approx 2.71828$)

Table 1. Summary of the studies ($n = 42$) included in the meta-analysis.

<i>Authors</i>	<i>Measures</i>	<i>Sport</i>	<i>n</i>	<i>Cognitive anxiety</i>		<i>Self-confidence</i>	
				<i>r</i>	<i>Z</i>	<i>r</i>	<i>Z</i>
Barnes et al. (1986)	CSAI-2	Swimming	14	-0.39	1.46	0.19	0.71
Bejek & Hagtvet (1996)	CSAI-2	Artistic Gymnastics	69	-0.09	0.76	0.09	0.72
Bird & Horn (1990)	CSAI-2	Softball	161	0.21	-2.63	0.05	0.58
Burton (1988)	CSAI-2	Swimming	98	-0.39	3.85	0.30	2.97
Chapman et al. (1997)	CSAI-2	Tae Kwon-Do	142	-0.37	4.36	0.43	5.10
Duesing (1984)	CSAI-2	Middle/long distance running	40	0.31	-1.97		
Edwards & Hardy (1996)	CSAI-2	Netball	45	0.10	-0.67	-0.17	-0.12
Gayton & Nickless (1987)	SSCI	Marathon	35			0.36	2.13
Gould et al. (1987)	CSAI-2	Pistol shooting	39	0*	0.00	-0.27	-1.67
Gould et al. (1984)	CSAI-2	Wrestling	37	-0.29	1.74	0.02	0.09
Gould et al. (1993a)	CSAI-2	Middle/long distance running	11	-0.07	0.23		
Gould et al. (1981)	Wrestling questionnaire	Wrestling	49	0.20	-1.42	0.52	3.64
Hammermeister & Burton (1995)	CSAI-2	Endurance Sports	293	-0.08	1.37		
Hardy (1996a)	CSAI-2	Golf	8	0.10	-0.27	0.16	0.44
Highlen & Bennett (1979)	Wrestling questionnaire	Wrestling	39			0.56	3.47
Jones et al. (1993)	CSAI-2	Artistic Gymnastics	48	-0.01	0.07	0.29	2.01
Krane (1993)	CSAI-2	Soccer	16	0*	0.00	0*	0.00
Krane & Williams (1987)	CSAI-2	Golf & Gymnastics	80	0*	0.00	0*	0.00
Krane et al. (1992)	CSAI-2	Golf	100	0.04		0.07	
Martin & Gill (1991)	CSAI-2 & SSCI	Middle/long distance running	86	-.10	0.86	0.57	4.83

Maynard & Cotton (1993)	CSAI-2	Field Hockey	20	0*	0.00	0*	0.00
Maynard et al. (1995)	CSAI-2	Soccer	24	-0.14	0.66	0.40	1.94
Maynard & Howe (1987)	CSAI-2	Rugby	22	-0.20	0.93	-0.01	-0.05
McAuley (1985)	CSAI-2	Golf	7	-0.11	0.28	0.01	0.02
McCann et al. (1992)	CSAI-2	Road Cycling	23	-0.42	2.01	0.37	1.77
McKay et al. (1997)	CSAI-2	Golf	15	0.50	-1.94	0.07	0.27
Moraes (1987)	CSAI-2	Judo	70	0*	0.00	0*	0.00
Parfitt & Pates (1999)	CSAI-2	Basketball	12	-0.07	0.26	0.49	1.69
Perreault & Marisi (1997)	CSAI-2	Wheelchair basketball	37	-0.02	0.23	-0.02	-0.15
Prapavessis et al. (1992)	CSAI-2	Rifle shooting	1	-0.92	0.92	0.96	0.96
Rodrigo et al. (1990)	CSAI-2	Soccer	51	-0.52	3.71	0.16	1.14
Swain & Jones (1996)	CSAI-2	Basketball	10	-0.18	0.57	0.34	1.07
Taylor (1987)	CSAI-2	Mixture	84	0.35	-2.09	0.34	2.05
Terry et al. (1996)	CSAI-2	Tennis	100	-0.12	1.15	0.42	4.20
Terry & Slade (1995)	CSAI-2	Karate	208	-0.46	6.49	0.42	5.92
Thelwell & Maynard (1998)	CSAI-2	Cricket	20	-0.32	1.43	0.64	2.86
Vadocz et al. (1997)	CSAI-2	Roller skating	57	0*	0.00	0.51	4.48
Wiggins & Henson (2000)	CSAI-2	Tennis	7	0.05	-0.13		
Williams & Krane (1992)	CSAI-2	Golf	83	-0.22	2.00	0*	0.00
Woodman et al. (1997)	CSAI-2	Bowling	25	0.05	-0.25		
Yang (1994)	CSAI-2	Mixture	56	-0.76	5.69	0.49	3.67
Zhu & Fang (1998)	CSAI-2	Distance running	88	0.39	-3.69	0.26	2.39

* Not significant, effect size assumed to be zero, $p = 0.50$, one-tailed.

Study characteristics

Of the 42 studies included in this meta-analysis, 40 contributed a cognitive anxiety effect size estimate and 37 contributed a self-confidence effect size estimate. Thirty-five of the 42 studies contributed both cognitive anxiety and self-confidence effect size estimates to the meta-analysis. Twenty-seven studies were reported between 1991 and 2000, 14 studies were reported between 1981 and 1990, and one study was reported in 1979. Thirty-eight studies were reported in journals and three studies were reported in theses (two master's theses and one doctoral thesis).

Results

Outliers

The meta-analysis was conducted with all studies included in the data set. A second meta-analysis was run with outliers deleted from the data sets. This is because visual inspection of the data revealed that some effect size estimates appeared to represent “wild scores”. For example, in the cognitive anxiety data, the effect sizes of -0.92 and + 0.50 did not seem representative of the cognitive anxiety data set. Similarly, in the self-confidence data, the effect sizes of -0.27 and +0.96 did not seem representative. Consequently, following the recommendations of Tukey (1960) and Huber (1980), 10% of extreme data points were deleted from the data set. Thus, four studies – the two studies with the highest effect sizes and the two studies with the lowest effect sizes – were deleted from each data set. The deletion of these effect sizes resulted in 36 studies being included in the cognitive anxiety data set, and 33 studies being included in the self-confidence data set. This second meta-analysis, with the outliers excluded, did not reveal any marked differences in the results. Thus, for the sake of clarity, only the first set of results (with all the studies included) is presented here⁶.

Descriptive statistics

Table 2 displays a stem-and-leaf plot of the cognitive anxiety effect sizes included in the meta-analysis. Table 3 displays a stem-and-leaf plot of the self-confidence effect sizes included in the meta-analysis. Table 4 contains information

⁶ For the sake of completion, results with the outliers removed from the data set are presented in Appendix A and Appendix B.

with regard to central tendency, variability, significance tests, and confidence intervals for the cognitive anxiety data. This table presents two sets of results: one with all cognitive anxiety studies included, the other with those studies where r was assumed to be zero omitted. Table 5 contains this information for the self-confidence data.

Table 2. Cognitive anxiety Stem-and-Leaf Plot

Stem	Leaf (with all studies included). $n = 40$	Stem	Leaf (excluding $r = 0$ results). $n = 34$
+0.5	0	+0.5	0
+0.4		+0.4	
+0.3	1 4 9	+0.3	1 4 9
+0.2	0 0	+0.2	0 0
+0.1	0	+0.1	0
+0.0	0 0 0 0 0 0 3 5 5 9	+0.0	3 5 5 9
-0.0	1 2 6 7 8 9	-0.0	1 2 6 7 8 9
-0.1	0 0 1 3 7 9	-0.1	0 0 1 3 7 9
-0.2	1 8	-0.2	1 8
-0.3	2 6 8 9	-0.3	2 6 8 9
-0.4	2 6	-0.4	2 6
-0.5	2	-0.5	2
-0.6		-0.6	
-0.7	6	-0.7	6
-0.8		-0.8	
-0.9	2	-0.9	2

Table 3. Self-confidence Stem-and-Leaf Plot

Stem	Leaf (with all studies included). $n = 37$	Stem	Leaf (excluding $r = 0$ results). $n = 32$
+0.9	6	+0.9	
+0.8		+0.8	
+0.7		+0.7	
+0.6	4	+0.6	
+0.5	1 2 6 7	+0.5	1 2 6 7
+0.4	0 2 2 3 9 9	+0.4	0 2 2 3 9 9
+0.3	0 4 4 6 7	+0.3	0 4 4 6 7
+0.2	6 9	+0.2	6 9
+0.1	6 6 9	+0.1	6 6 9
+0.0	0 0 0 0 0 1 2 5 7 7 9	+0.0	1 2 5 7 7 9
-0.0	1 2	-0.0	1 2
-0.1	7	-0.1	
-0.2	7	-0.2	

Table 4. Statistical summary of the cognitive anxiety studies ($n = 40$) included in the meta-analysis.

Statistic	Value (including assumed $r = 0$ results), $n = 40$	Value (excluding assumed $r = 0$ results), $n = 34$
<i>Central tendency (r)</i>		
Unweighted mean	-0.12	-0.14
Weighted mean	-0.11	-0.13
<i>Significance tests</i>		
Combined Stouffer Z ($\Sigma Z/\sqrt{n}$)	4.04, $p < 0.001$	4.39, $p < 0.001$
t -test for mean z_r	2.11, $p < 0.05$	2.12, $p < 0.05$
<i>Variability (r)</i>		
Maximum	0.50	0.50
Quartile 3 (Q_3)	0.05	0.06
Median	-0.07	-0.10
Quartile 1 (Q_1)	-0.27	-0.33
Minimum	-0.92	-0.92
$Q_3 - Q_1$	0.32	0.39
Standard deviation (SD)	0.29	0.31
Standard error (SD/\sqrt{n})	0.05	0.05
<i>Confidence intervals (r)</i>		
90%	-0.05 to -0.20	-0.06 to -0.23
95%	-0.03 to -0.21	-0.04 to -0.25
99%	-0.01 to -0.24	-0.01 to -0.28

Table 5. Statistical summary of the self-confidence studies ($n = 37$) included in the meta-analysis.

Statistic	Value (including assumed $r = 0$ results), $n = 37$	Value (excluding assumed $r = 0$ results), $n = 32$
<i>Central tendency (r)</i>		
Unweighted mean	0.28	0.32
Weighted mean	0.25	0.28
<i>Significance tests</i>		
Combined Stouffer Z ($\Sigma Z/\sqrt{n}$)	9.67, $p < 0.001$	10.40, $p < 0.001$
t -test for mean z_r	4.70, $p < 0.001$	4.93, $p < 0.001$
<i>Variability (r)</i>		
Maximum	0.96	0.96
Quartile 3 (Q_3)	0.42	0.47
Median	0.26	0.32
Quartile 1 (Q_1)	0.00	0.07
Minimum	-0.27	-0.27
$Q_3 - Q_1$	0.42	0.40
Standard deviation (SD)	0.26	0.26
Standard error (SD/\sqrt{n})	0.04	0.05
<i>Confidence intervals (r)</i>		
90%	0.21 to 0.35	0.24 to 0.39
95%	0.19 to 0.36	0.23 to 0.41
99%	0.17 to 0.39	0.20 to 0.44

Effect sizes and significance testing

Cognitive anxiety. Of the 40 studies reporting a relationship between cognitive anxiety and performance, 58% ($n = 23$) reported a negative relationship, 15% ($n = 6$) reported non-significant results (so r was assumed to be zero), and 28%

($n = 11$) reported a positive relationship. The mean effect size was -0.12 . When studies were weighted for degrees of freedom, the mean effect size was -0.11 . When those studies where the effect size was assumed to be 0 were omitted from the analyses, the mean effect size was -0.14 and the weighted mean effect size was -0.13 . The Stouffer Z associated with the mean effect size was statistically significant ($Z = 4.04, p < 0.001$). The t -test for the mean z_r was also significant ($t(39) = 2.11, p < 0.05$).

Self-confidence. Of the 37 studies reporting a relationship between self-confidence and performance, 76% ($n = 28$) reported a positive relationship, 14% ($n = 5$) reported non-significant results (so r was assumed to be zero), and 11% ($n = 4$) reported a negative relationship. The mean effect size was 0.28. When studies were weighted for degrees of freedom, the mean effect size was 0.25. When studies where the effect size was assumed to be 0 were omitted from the analyses, the mean effect size was 0.32 and the weighted mean effect size was 0.28. The Stouffer Z associated with the mean effect size was statistically significant ($Z = 9.67, p < 0.001$). The t -test for the mean z_r was also significant ($t(36) = 4.70, p < 0.001$).

File drawer analysis

Non-significant results are less likely to be published and more likely to remain in the file drawers of researchers' laboratories (Rosenthal, 1991). Rosenthal suggested some simple calculations for determining the extent to which a meta-analysis is robust to the file drawer problem. The two questions that are addressed here are: (1) How many non-significant studies (where $r = 0, p = 0.50$) would have to be unearthed in order to make the probability of meta-analysis non-significant? (2) What constitutes an unlikely number of unearthed non-significant studies? The following figures for cognitive anxiety and self-confidence are based on fairly conservative calculations suggested by Rosenthal (1991).

Cognitive anxiety. For the probability of this meta-analysis to become non-significant ($p > 0.05$), 202 studies with mean probability of 0.50 would have to be stored away in researchers' file drawers. A figure of 210 would have been considered

robust to the file drawer problem. Thus, the cognitive anxiety data are marginally short of being fully robust to the file drawer problem.

Self-confidence. For the probability of this meta-analysis to become non-significant, 1,242 studies with mean probability of 0.50 would have to be stored away. A figure of 195 would have been considered robust to the file drawer problem. Thus, the self-confidence data are highly robust to the file drawer problem.

The relationship between cognitive anxiety and self-confidence

If cognitive anxiety and self-confidence lie at opposite ends of the same continuum, then their effects upon performance should mirror each other. That is, the strength of the relationship between self-confidence and performance should be similar to the strength of the relationship between cognitive anxiety and performance, only in the opposite direction. If cognitive anxiety and self-confidence are independent constructs, the strength of these relationships will likely be different. Thus, a paired samples *t*-test was run between the cognitive anxiety effect sizes and the self-confidence effect sizes to determine whether cognitive anxiety and self-confidence reflected independent constructs. In order to make meaningful comparisons between cognitive anxiety and self-confidence, cognitive anxiety effect sizes were first transformed using $y = -x$.

The paired samples *t*-test revealed a significant difference between cognitive anxiety and self-confidence effect sizes ($t(34) = 2.21, p < 0.05$). Equally, when non-significant effect sizes (i.e., those effect sizes where $r = 0$ was assumed) were removed, there was still a significant difference between cognitive anxiety and self-confidence effect sizes ($t(27) = 2.39, p < 0.05$). When the outliers were removed from the analyses, this difference fell marginally short of conventional significance ($t(27) = 1.96, p = 0.06$). When both the non-significant effect sizes and the outliers were removed from the analyses, again the difference fell marginally short of conventional significance ($t(21) = 1.90, p = 0.07$).

In order to test the degree of co-dependence between cognitive anxiety and self-confidence, correlation coefficients were calculated between the effect sizes for

cognitive anxiety and self-confidence. When all studies were included, the correlation between the effect sizes for cognitive anxiety and self-confidence was $r = -0.44, p < 0.01$. When the non-significant effect sizes (i.e., those effect sizes where $r = 0$ was assumed) were removed from the analyses, the correlation was $r = -0.47, p < 0.05$. When the outliers were removed from the analyses, these correlation coefficients were insignificant ($r = -0.09, p = 0.65$; and $r = -0.05, p = 0.84$, respectively).

Moderator variables

Heterogeneity tests revealed that the effect sizes were highly heterogeneous for cognitive anxiety ($\chi^2(39) = 163.51, p < 0.001$) and self-confidence ($\chi^2(36) = 122.19, p < .001$). This suggests that other factors were moderating the relationships between cognitive anxiety and performance, and between self-confidence and performance. Sport type and individual difference variables were considered as possible moderator variables. The results of these analyses are given below, and a summary is presented in Table 6.

Sport type. Three comparisons between types of sport were made: individual versus team sports; subjectively versus objectively scored sports; and contact versus non-contact sports. In the analyses reported by Martens et al. (1990), cognitive anxiety was higher in individual sports, subjectively scored sports, and contact sports. Also, self-confidence was lower for athletes involved in these sports. This is likely to be due largely to the greater pressure and exposure associated with these types of sport. Thus, cognitive anxiety and self-confidence are likely to affect athletes' performance in these sports more than in team sports, objectively-scored sports, and non-contact sports. Consequently, it was hypothesised that the cognitive anxiety and self-confidence effect sizes would be larger for individual sports, subjectively scored sports, and contact sports.

Separate *t*-tests revealed no significant differences between the cognitive anxiety effect sizes for individual and team sports ($t(35) = 0.01, p = 0.50$), objectively and subjectively scored sports ($t(34) = 0.50, p = 0.31$), or contact and non-contact sports ($t(38) = -1.03, p = 0.15$). Also, separate *t*-tests revealed no significant differences

between the self-confidence effect sizes for objectively and subjectively scored sports ($t(31) = 0.71, p = 0.24$), or contact and non-contact sports ($t(35) = -0.18, p = 0.43$). The mean effect size for individual sports was greater than that for team sports, although this difference fell short of conventional significance ($t(33) = 1.33, p < 0.10$).

Individual differences. Two individual-difference comparisons were made: high- versus low-level athletes, and men versus women. The high- versus low-level comparison reflects level of competition rather than the skill level of the athlete. Studies were classified as “high-level” if the sample studied was competing at national or international level. Studies were classified as “low-level” if the sample was competing at a competitive level that was less than national (e.g., regional, state, etc.). Specific individual-difference hypotheses are difficult to formulate with regard to the relationships considered in this meta-analysis. For example, one might predict that the relationship between cognitive anxiety and performance would be stronger for high-level athletes. Such a hypothesis would be made on the basis that high-level competition is associated with increased pressure. Cognitive anxiety might reflect athletes’ inability to deal with this pressure, and hence would likely play an important role in subsequent performance. However, one might propose the opposing hypothesis (i.e., that the effect sizes would be stronger for low-level athletes) on the basis that athletes who compete at a high level are more likely to have practised anxiety control and cognitive restructuring strategies. In this way, they would be *less likely* to be affected by cognitive anxiety. With these considerations in mind, hypotheses were made largely on the premise that increased pressure is likely to play an important moderating role in the relationships between cognitive anxiety, self-confidence, and competitive performance. Thus, it was hypothesised that the cognitive anxiety and self-confidence effect sizes would be greater for high-level athletes, when compared to comparatively low-level athletes. Once the degrees of freedom had been corrected for heterogeneous variances, the difference between the mean cognitive anxiety effect sizes of high- and low-level athletes fell short of conventional significance ($t(35) = 1.46, p < 0.09$). Independent t -tests also revealed that the self-confidence effect sizes for high-level athletes were significantly larger than the effect sizes for low-level athletes ($t(31) = 1.89, p < 0.05$).

As women typically experience higher levels of cognitive anxiety and lower levels of self-confidence than men (cf. Martens et al., 1990), their ability (or inability) to deal with competitive pressure is more likely to affect subsequent performance. Thus, it was hypothesised that the cognitive anxiety and self-confidence effect sizes would be greater for women than for men. Contrary to the hypothesised direction, the effect sizes for men were significantly larger than the effect sizes for women ($t(24) = -2.11$, $p < 0.05$). Also contrary to the hypothesised direction, the self-confidence effect sizes for men were significantly larger than the effect sizes for women ($t(24) = -3.54$, $p < 0.01$).

Finally, cultural differences were explored as a possible individual-difference moderating variable. The vast majority of the studies included in the meta-analysis were conducted with samples from North America or Europe. Thus, the investigation of cultural differences as a possible moderating variable was limited to the comparison of these two cultures. As no specific hypotheses were postulated for this potential moderating variable, two-tailed independent t -tests were conducted. No significant differences were revealed either for cognitive anxiety ($t(32) = 0.88$, $p = 0.39$) or for self-confidence ($t(29) = 1.17$, $p = 0.25$).

Table 6. Summary of the moderator variables considered.

	Cognitive anxiety mean effect size		Self-confidence mean effect size	
<i>Sport type</i>	<i>Individual</i>	<i>Team</i>	<i>Individual</i>	<i>Team</i>
	-0.10	-0.10	0.29 ^a	0.17 ^a
	<i>Objectively scored</i>	<i>Subjectively scored</i>	<i>Objectively scored</i>	<i>Subjectively scored</i>
	-0.09	-0.14	0.21	0.29
	<i>Contact</i>	<i>Non-contact</i>	<i>Contact</i>	<i>Non-contact</i>
	-0.07	-0.17	0.24	0.25
<i>Individual differences</i>	<i>High level</i>	<i>Low level</i>	<i>High level</i>	<i>Low level</i>
	-0.22 ^a	-0.05 ^a	0.32*	0.16*
	<i>Men</i>	<i>Women</i>	<i>Men</i>	<i>Women</i>
	-0.19*	-0.00*	0.27**	0.12**
	<i>North America</i>	<i>Europe</i>	<i>North America</i>	<i>Europe</i>
	-0.05	-0.12	0.19	0.29

^a $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Discussion

The focus of this meta-analysis was on two relationships: (1) the relationship between cognitive anxiety and competitive sport performance, and (2) the relationship between self-confidence and competitive sport performance. The mean effect size for cognitive anxiety was $r = -0.12$. The mean effect size for self-confidence was $r = 0.28$. Both of these mean effect sizes were significant. The results of the paired samples t -test revealed that self-confidence was significantly more related to sport performance than was cognitive anxiety. Sex was the only significant moderating variable for the cognitive anxiety-performance relationship. Sex and skill level were the significant moderating variables for the self-confidence-performance relationship.

The significant negative mean effect size between cognitive anxiety and competitive sport performance, and the significant positive mean effect size between self-

confidence and sport performance, are consistent with the predictions of multidimensional anxiety theory (Martens et al., 1990). However, the significant difference in the magnitude of these two mean effect sizes runs contrary to the proposition that cognitive anxiety and self-confidence may be viewed as a bipolar continuum. Rather, the significant difference between the mean effect sizes of cognitive anxiety and self-confidence is consistent with past research (e.g., Gould et al., 1984; Hardy, 1996a; Jones & Cale, 1989; Jones et al., 1990, 1991; Martens et al., 1990) suggesting that cognitive anxiety and self-confidence are orthogonal constructs, which do not lie at opposite ends of the same continuum.

Both sets of effect sizes (cognitive anxiety and self-confidence) were heterogeneous. This begs the question: what is moderating the relationships between cognitive anxiety and performance, and between self-confidence and performance? The only significant moderating variable of the cognitive anxiety-performance relationship was sex, the mean cognitive anxiety effect size being significantly greater for men ($r = -0.19$) than for women ($r = -0.00$). For the self-confidence data, the only significant moderating variables were sex and skill level. The mean self-confidence effect sizes were significantly greater for men ($r = 0.27$) and for high-level athletes ($r = 0.32$) than for women ($r = 0.12$) and lower-level athletes ($r = 0.16$), respectively.

The differences between the sexes for the cognitive anxiety and self-confidence mean effect sizes suggest that pre-competitive cognitive anxiety and self-confidence have a greater impact upon the performance of men than that of women. This does not seem to sit very well with anecdotal evidence that both women and men tend to perform well when confident. Similarly, there does not seem to be any obvious reason why women would be less affected by any detrimental effects of cognitive anxiety upon performance. For example, previous research has shown that, compared to men, women experience higher levels of cognitive anxiety (Martens et al., 1990; Russell, Robb, & Cox, 1998), lower levels of self-confidence (Krane & Williams, 1994; Martens et al., 1990), and less stability prior to competing (Jones & Cale, 1989; Jones, Swain, & Cale, 1991). Thus, one might expect women to be *more* affected by anxiety than men. Perhaps women are more likely to openly express their pre-competitive anxiety, and this expression might largely protect them against any

potential negative effects. In light of the insignificant cognitive anxiety effect size for women revealed in this meta-analysis, this seems a worthwhile avenue for future research.

The self-confidence mean effect size was greater for high-level athletes compared to lower-level athletes, and this difference approached significance for cognitive anxiety. One possible reason for this difference is that high-level performance is typically associated with lower levels of “random effects”. That is, high-level athletes typically operate within a more controlled personal environment than their comparatively low-level counterparts. In other words, athletes competing at a higher level are more likely to “control the controllables” (Hardy, Jones, & Gould, 1996a). As such, it seems reasonable to expect that the effect of self-confidence (and cognitive anxiety) upon performance will be clearer with elite athletes. In the present meta-analysis, truly high-level (international) performers were investigated in one study only. The other studies comprising the “high-level” group consisted of national level athletes. This lack of studies involving truly elite athletes poses a fairly serious problem in terms of generalisation of research findings to elite performers. For example, the stress that elite athletes endure may be rather different to that endured by relatively low-level athletes. Certainly, recent research (Gould, Guinan, Greenleaf, Medbery, & Peterson, 1999; Woodman & Hardy, 1998, 2001b) suggests that elite performers may be exposed to various kinds of relational and organizational stress before and during major international competitions. Thus, generalisations of findings with lower-level sport performers to elite performers might be inappropriate (cf. Balague, 1999; Hardy et al., 1996a). Certainly, further research with elite performers is likely to further our understanding of the effects of stress, anxiety, and self-confidence in an elite environment.

Apart from sex differences, no significant moderating variables were revealed for the cognitive anxiety - performance effect size. However, sex differences are unlikely to be the sole moderating variable of this relationship. Other potentially important moderating variables were not investigated in the majority of the studies included in the meta-analysis. One theory that appears worthy of future research in this respect is Eysenck and associates’ processing efficiency theory (Eysenck, 1992; Eysenck &

Calvo, 1992). This theory postulates that increases in cognitive anxiety will likely result in increased effort on the task, provided that there is at least a moderate chance of success. One would expect the relationship between cognitive anxiety and performance to be positive when effort is invested in the task and negative when less effort is invested in the task (or when effort is withdrawn). Although much of the research supporting processing efficiency theory has been conducted in laboratory settings, there is some evidence for the theory's application in a sport field setting. For example, Hardy and Jackson (1996) found that rock climbers performed better and exerted more cognitive and physiological effort when they were cognitively anxious compared to when they were not cognitively anxious. Also, Mullen, Hardy, and Tattersall (1999) found that golfers exerted more effort when they were anxious, although changes in anxiety did not induce any significant changes in performance. Thus, effort could be an important moderating variable within the anxiety-performance relationship, and this seems a particularly fruitful area for future research.

The vast majority of studies included in this meta-analysis used the CSAI-2 (Martens et al., 1990) as a measure of cognitive anxiety and self-confidence. Thus, it was not possible to test whether the different instruments used to measure cognitive anxiety and self-confidence moderated the relationships with performance. In the CSAI-2, 8 of the 9 cognitive anxiety items use "concern" as an expression of cognitive anxiety (e.g., "I'm concerned about reaching my goal"), and it has been argued that the expression "I am concerned" can be interpreted positively or negatively (Barnes, Sime, Dienstbier, & Plake, 1986; Jones 1991; Jones & Swain, 1992; Woodman & Hardy, 2001a). These differences in interpretation led Jones and his colleagues (Jones, 1991; Jones & Swain, 1992) to add an interpretation scale to the CSAI-2, which measures the extent to which performers interpret their anxiety symptoms as either facilitative or debilitating. Research using this modified scale suggests that interpretation may be an important moderating variable in the relationship between cognitive anxiety and performance. For example, Jones, Swain, and Hardy (1993) found that high- and low-performance gymnasts did not differ in levels of cognitive anxiety intensity. However, the high-performance gymnasts reported their cognitive anxiety to be more facilitative than did the low-performance gymnasts. Similar

findings have been reported in other studies (e.g., Jones, Hanton, & Swain, 1994; Perry & Williams, 1998; Swain & Jones, 1996). An important issue here is whether the cognitive anxiety subscale of the CSAI-2 does in fact measure cognitive anxiety or some other construct (cf. Burton & Naylor, 1997). Certainly, there seems to be scope for the development of a questionnaire that measures the construct of cognitive anxiety more precisely.

The difference in magnitude between the cognitive anxiety and self-confidence mean effect sizes suggests that future researchers would do well to consider cognitive anxiety and self-confidence either independently or as an interactive dyad. It is the interaction between cognitive anxiety and self-confidence that seems likely to yield the most fruitful findings (Hardy, 1996a). For example, the combination of high cognitive anxiety with high self-confidence could be a desirable state for elite athletes. Certainly, from an anecdotal perspective, it seems that many exceptionally fine performances are achieved when athletes are both anxious (“I am so nervous, this is the biggest competition of my life”) and self-confident (“I know I can do well, I have prepared so well for this competition,”). Also, from a theoretical perspective, both processing efficiency theory (Eysenck & Calvo, 1992) and higher-order catastrophe models (Hardy, 1996a) would support this view. More precisely, as stated earlier, processing efficiency theory predicts that individuals will invest more effort in the task at hand if they perceive they have a reasonable chance of success. Also, within a higher-order catastrophe model framework, Hardy (1990, 1996a) has proposed that high levels of self-confidence might protect cognitively anxious performers from catastrophic drops in performance. Thus, both processing efficiency theory and catastrophe models seem worthy of further research with respect to investigating the interaction between cognitive anxiety and self-confidence.

In summary and conclusion, this meta-analysis has revealed that both cognitive anxiety and self-confidence are significantly related to competitive sport performance. Also, in view of the significant difference in magnitude between the two mean effect sizes, researchers should view cognitive anxiety and self-confidence as distinct constructs, rather than two extremes of a single construct. The mean effect sizes for cognitive anxiety and self-confidence were significantly stronger for men

than for women. Also, the mean self-confidence effect size was significantly stronger for high-level athletes. In order to increase the proportion of performance variance accounted for by cognitive anxiety and self-confidence, other moderator variables should be investigated. Effort seems particularly worthy of attention in this respect. Furthermore, the development of a questionnaire that measures cognitive anxiety more directly is likely to help clarify our understanding of the anxiety-performance relationship. The interaction between cognitive anxiety and self-confidence is likely to be a fruitful avenue for future research, and the current theoretical paradigms that seem the most amenable to investigation of this interaction are processing efficiency theory and higher-order catastrophe models.

Chapter 4

Is Self-confidence a Bias Factor in Higher-order Catastrophe Models? An Exploratory Analysis⁷

Abstract

This paper examines Hardy's (1990, 1996a) proposition that self-confidence might act as a bias factor in a butterfly catastrophe model. Male golfers ($n = 8$) participated in a golf tournament and self-reported their cognitive anxiety, somatic anxiety, and self-confidence prior to the tee shot of each hole. All anxiety, self-confidence, and performance scores were standardized within subjects in order to control for individual differences. The data were then collapsed across subjects and categorized into a high self-confidence condition and a low self-confidence condition by means of a median split. A series of two-way (cognitive anxiety x somatic anxiety) ANOVAs was conducted on each of these self-confidence conditions in order to flag where the maximum cognitive anxiety x somatic anxiety interaction effect size lay along the somatic anxiety axis. These ANOVAs revealed that the maximum interaction effect size between cognitive anxiety and somatic anxiety was at a higher level of somatic anxiety for the high self-confidence condition than for the low self-confidence condition, thus supporting the moderating role of self-confidence within a catastrophe model framework. The results are discussed in light of these findings and future directions for research in this area are offered.

⁷ Based upon Hardy, L., Woodman, T., & Carrington, S. (2001). *Is Self-confidence a Bias Factor in Higher-order Catastrophe Models? An Exploratory Analysis*. Manuscript submitted for publication.

Introduction

The cusp catastrophe model proposed by Hardy and associates (Hardy, 1990, 1996a, 1996b; Hardy & Fazey, 1987; Hardy & Parfitt, 1991) resulted largely from dissatisfaction with interpretations of Yerkes and Dodson's (1908) inverted-U hypothesis (e.g., Broadhurst, 1957; Oxendine, 1970, 1984) and with Martens, Burton, Vealey, Bump, and Smith's (1990) multidimensional anxiety theory. Detailed discussions of the major criticisms of the inverted-U hypothesis and multidimensional anxiety theory have been provided by Jones (1990) and Hardy (1990), respectively, and they will not be revisited here. However, one of the major criticisms that has been levelled at multidimensional anxiety theory is the proposition that cognitive anxiety and somatic anxiety affect sport performance independently of each other. In contrast with multidimensional anxiety theory, the cusp catastrophe model (see Figure 2 in Chapter 2) proposes that cognitive anxiety and physiological arousal affect performance in an interactive fashion (Hardy, 1990, 1996a, 1996b; Hardy & Fazey, 1987; Hardy & Parfitt, 1991). More specifically, the model proposes that: under conditions of low physiological arousal, cognitive anxiety will have a positive relationship with performance (see the left hand edge of Figure 2); but under conditions of high physiological arousal, cognitive anxiety will have a negative relationship with performance (see the right hand edge of Figure 2). Also, under conditions of low cognitive anxiety, the relationship between physiological arousal and performance will follow a smooth continuous inverted-U path (see the back edge of Figure 2) whereas, under conditions of high cognitive anxiety, this relationship will follow a discontinuous hysteresis path, whereby, at some critical level, a small increase in physiological arousal will result in a large drop in performance (see the front edge of Figure 2). Once performance has dropped to the lower performance surface under high cognitive anxiety, physiological arousal needs to return to levels below those at which the catastrophe occurred before the upper performance can be regained. In other words, under these hysteresis conditions, the path that performance follows is different depending upon whether physiological arousal is increasing or decreasing. In the catastrophe model, cognitive anxiety is termed the splitting factor, and physiological arousal is termed the asymmetry (or normal) factor. The splitting factor (cognitive anxiety) determines whether the effect of the asymmetry factor

(physiological arousal) will be small and smooth, large and catastrophic, or somewhere in between these two extremes.

To date, researchers appear to have been fairly reticent in testing catastrophe models of anxiety, physiological arousal, and performance, possibly due to the perceived complexity of these models (Gill, 1994). However, research testing the central features of the cusp catastrophe model has been fairly supportive of its predictions. For example, support has been provided for the hysteresis hypothesis with samples of basketball players (Hardy & Parfitt, 1991) and crown green bowlers (Hardy, Parfitt, & Pates, 1994). In these studies, consistent with cusp catastrophe model predictions, hysteresis was revealed under conditions of high cognitive anxiety, but not under conditions of low cognitive anxiety. Also, maximum performance was significantly higher and minimum performance was significantly lower in the high cognitive anxiety condition than in the low cognitive anxiety condition. Again, this is consistent with the predictions of the cusp catastrophe model. Other studies have provided some fairly conclusive evidence for the interactive effects between cognitive anxiety and somatic anxiety/physiological arousal (Deffenbacher, 1977; Edwards & Hardy, 1996; Woodman, Albinson, & Hardy, 1997) although the details have not always been consistent with the cusp catastrophe model.

The three-dimensional cusp catastrophe is arguably the simplest of the seven elementary catastrophes (Thom, 1975; Zeeman, 1976). The butterfly catastrophe model (Hardy, 1990, 1996a; Zeeman, 1976) is essentially an extension of the cusp catastrophe model and contains two further factors (dimensions): a bias factor and a butterfly factor. The bias factor has the effect of swinging the cusp at the front edge of the model to the left or to the right. The butterfly factor promotes the growth of a pocket containing a new fold in the performance surface. This pocket produces a third stable performance surface between the upper and lower surfaces (see Zeeman, 1976, for further details). Hardy (1990, 1996a) suggested that self-confidence might act as a bias factor in a butterfly catastrophe model of sport performance. That is, self-confidence will moderate the interaction between cognitive anxiety and physiological arousal by swinging the fold at the front of the model to the right under high levels of self-confidence and to the left under low levels of self-confidence. In

practical terms, this suggests that high levels of self-confidence will allow performers to tolerate higher levels of physiological arousal when they are cognitively anxious before suffering a performance decrement.

Using Guastello's (1982) method of dynamic differences to test the catastrophe model's fit with golfers' putting performance, Hardy (1996a) offered some empirical support for self-confidence as a bias factor. However, the statistical properties of the time series used in the method of dynamic differences are neither well known nor well understood. Furthermore, this method has been strongly criticized by Alexander, Herbert, DeShon, and Hanges (1992). Although these criticisms were refuted by Guastello (1992), there remains a clear need to explore other methods of testing the central features of catastrophe models. In particular, in terms of Hardy and associates' (Hardy, 1990, 1996a; Hardy & Fazey, 1987; Hardy & Parfitt, 1991) catastrophe models of sport performance, there is a need for further research that tests the proposition that self-confidence moderates the interactive effects of cognitive anxiety and physiological arousal upon performance.

In order to render research on the catastrophe model more readily accessible, Hardy (1996b) proposed a number of ways of testing its various features. One of Hardy's proposals was the use of moderated hierarchical regression to explore the interactive effects of cognitive anxiety and physiological arousal upon performance. However, due to the discontinuous nature of catastrophe models, this method may not be the most appropriate. Indeed, by its very nature, the catastrophe process predicts discontinuity in the dependent variable (e.g., where the performance surface flips from the upper performance surface to the lower performance surface under conditions of high cognitive anxiety), whereas the multiplicative (interactive) term in a regression equation represents a continuous change in the relationship between the primary independent variable and the dependent variable. Other problems associated with the use of regression as a method of testing catastrophe models include violations of the assumptions of homoscedasticity and normality. Indeed, homoscedasticity is necessarily violated within a catastrophe model framework because of the increased variance in the dependent variable (e.g., performance) under high levels of the splitting factor (cognitive anxiety). Also, the assumption of

normality will be violated because of the bimodal distribution of data under high levels of the splitting factor. More precisely, for a certain range of values in the independent variables (i.e., corresponding to the bifurcation set), there are *two* possible values for performance, depending upon the level of cognitive anxiety. In such circumstances, the data are bimodal (Cobb, 1978; Gilmore, 1981; Zeeman, 1976) and will not satisfy the normality assumption.

Hardy (1996b) also suggested quadrant analysis as a possible method for exploring the interactive effects of cognitive anxiety and physiological arousal. Using median splits to perform such a quadrant analysis, Edwards and Hardy (1996) found that cognitive anxiety and performance were positively related under conditions of low physiological arousal and negatively related under conditions of high physiological arousal. Thus, consistent with the cusp catastrophe model, it was shown that cognitive anxiety could have either a facilitative or a debilitating effect upon performance, depending upon the level of physiological arousal. Although intuitively appealing for exploring interactive effects, the use of median splits for performing a quadrant analysis is unlikely to be the most subtle means of analysing catastrophe data. Indeed, depending on the level of self-confidence, the front edge of the model could be farther to the right or to the left of the median. That is, the level of physiological arousal at which the relationship between cognitive anxiety and performance shifts from positive to negative will depend upon the level of self-confidence possessed by performers. Thus, in order to perform an effective quadrant analysis on the interactive effects between cognitive anxiety and physiological arousal, it would be judicious to split the data at precisely that point along the physiological arousal continuum where the point of discontinuity occurs. One method of investigating such discontinuous changes would be to split the data at the point of maximum cognitive anxiety x physiological arousal effect size and then analyse differences between the resulting quadrants. If Hardy's (1990, 1996a) contention that self-confidence acts as a bias factor in catastrophe models is to be supported, then the maximum interaction effect size between cognitive anxiety and somatic anxiety will occur at a lower level of physiological arousal for conditions of low self-confidence than for conditions of high self-confidence. This is the hypothesis of the present study.

Method

Participants

Participants were 8 male golfers who were members of a private golf club in the United Kingdom. The mean age of the golfers was 34.88 ($SD = 18.12$). All golfers were medium handicapped ($M = 12.13$, $SD = 5.08$), thus increasing the likelihood of inducing a meaningful anxiety effect. Highly experienced golfers were not included as it was felt that the seriousness of the competition used and the magnitude of incentive offered by the present study were unlikely to induce a meaningful anxiety effect with such performers. Golfers with higher handicaps (less experience) were not used as it was thought that other (essentially random) factors associated with their level of expertise might mask anxiety effects.

Participants were informed of the general nature of the study. That is, they were informed that anxiety can sometimes facilitate and sometimes debilitate performance and that the study was an attempt to elucidate these issues. All participants volunteered for the study and provided written informed consent.

Measures

Competitive State Anxiety Inventory-2 (CSAI-2). The CSAI-2 (Martens et al. 1990) contains three subscales: cognitive anxiety, somatic anxiety, and self-confidence. Each of the three subscales in the CSAI-2 comprises nine items. Consequently, there are a total of 27 items in the inventory. The cognitive anxiety subscale includes statements such as “I am concerned about this competition”; the somatic anxiety subscale includes statements such as “My body feels tense”; and the self-confidence subscale includes statements such as “I’m confident about performing well”. Participants are asked to rate each statement on a scale of 1 (*not at all*) to 4 (*very much so*). The CSAI-2 has been shown to have good construct validity and good internal consistency with alpha coefficients ranging from .79 to .90 (Martens et al., 1990). In line with Martens et al.’s (1990) recommendations, it was emphasized that participants should answer as honestly as possible, and that individual data would be treated in confidence. Following Hardy (1996a), participants were trained to report single-integer scores for each of the three subscales of the CSAI-2 and these were used as the measure of cognitive anxiety, somatic anxiety, and self-confidence (see procedure).

Somatic anxiety (as measured by the CSAI-2), rather than physiological arousal, was used as a physiological approximation of anxiety. Physiological arousal reflects the somatic symptoms of anxiety, and its indicators typically include heart rate, skin conductance, and levels of adrenaline. Somatic anxiety is the *perception* of one's physiological arousal (Morris, Davis, & Hutchings, 1981) and is typically measured by self-report questionnaire. In Hardy and associates' catastrophe models, physiological arousal (not somatic anxiety) was chosen as the asymmetry factor because of its potential direct and indirect effects upon performance. Thus, in terms of testing the predictions of the catastrophe model, physiological arousal would normally be preferred over somatic anxiety. However, direct measures of physiological arousal can be intrusive in a field setting. Also, if a heart rate measure (for example) was to be taken, the participants would have needed familiarisation sessions to become adept at measuring their physiological arousal. For these reasons, and as past research has revealed similar relationships for somatic anxiety and other estimators of physiological arousal with performance (e.g., Parfitt, Hardy, & Pates, 1995), somatic anxiety was deemed an appropriate approximation of physiological arousal for the purpose of this study.

Performance. Two assessors who operated independently of each other measured golf driving performance subjectively. One of the golf assessors was one of the experimenters and an experienced golfer; the other was a very experienced golfer (handicap of four). Several factors were considered when evaluating the quality of golf drives. First, tempo, swing length, swing plane, and body rotation were used as an indicator of the quality of the swing. These components of the swing were then condensed into a composite measure of swing performance. Second, distance, accuracy (position of the ball), and trajectory of the ball were considered as separate measures of driving performance. Thus, four aspects of golf driving performance were used: quality of swing, distance, accuracy (position of the ball), and trajectory of the ball. Each of these aspects was measured on a 10-point Likert-type scale relative to each individual's ability (1 = *much poorer than usual* to 10 = *much better than usual*), yielding a score between 4 and 40. The mean of the two assessors' scores was used as the overall performance measure. One of the assessors

had played with the players for a number of years and hence had good knowledge of each individual's ability. In order to enable the second assessor to familiarize himself with the golfers' driving ability, he observed each golfer performing 20 practice shots on the golf club practice ground. The assessors then compiled brief notes on each golfer's driving performance in order to enable a more accurate recollection and assessment of each golfer's performance during the competition.

Procedure

Two workshops and a golf tournament were run over two consecutive days. The first workshop was conducted on the first day; the second workshop and the golf tournament were conducted on the second day.

Workshops. In the workshops prior to the golf tournament, participants were taught how to self-report the subcomponents of the CSAI-2 on a single-integer scale from 0 to 27 (the same range of possible scores for each subcomponent in the CSAI-2; 9-36). In the first workshop, participants were introduced to the concepts of cognitive anxiety, somatic anxiety, and self-confidence. Each participant was then asked to complete the three subscales of the CSAI-2 with respect to three hypothetical scenarios: "how you felt prior to a previously very good golfing performance," "how you felt prior to a previously very bad golfing performance," and "how you felt prior to any other (good or bad) sporting performance." Immediately after completing the three subscales for each scenario, participants were asked to self-report a single score between 0 and 27 for cognitive anxiety, somatic anxiety, and self-confidence corresponding to each of the scenarios previously described. After each set of ratings, participants were provided with both sets of scores (CSAI-2 and single-integer scores) for each scenario so that they could see the accuracy of their single-integer scores⁸.

The second workshop commenced with a review of the concepts of cognitive anxiety, somatic anxiety, and self-confidence. Participants were then asked to complete the original CSAI-2 (Martens et al., 1990) with respect to four scenarios.

⁸ Direct comparisons between the two measures were made possible by subtracting nine from each CSAI-2 subscale score.

These scenarios were: “How you felt prior to another competition in another sporting situation”; “How you think you will feel immediately prior to the forthcoming competition”; “How you felt after a very poor hole as you approached the next tee area”; and “How you felt after a very good hole as you approached the next tee area.” Participants were asked to report single-integer scores for each subscale with respect to these scenarios. Again, after each set of ratings was obtained, participants were shown their scores so that they could ascertain the accuracy of their single-integer scores in relation to those of the inventory.

The two workshops aimed at increasing the accuracy of participants’ self-reporting of their cognitive anxiety, somatic anxiety, and self-confidence with single-integer scores rather than the more lengthy and intrusive process of completing a 27-item inventory. This was deemed necessary to avoid over-intrusive measures during the golf tournament that participants were to participate in. During both workshops, participants were encouraged to ask any questions that might aid their understanding.

Golf tournament. The golf tournament was conducted on day two after the second workshop. It was held in two parts with each participant playing a single round of golf in a group of four (a “four ball”). Participants were instructed to score their round in accordance with Stapleford rules. In Stapleford rules, golfers are awarded points for each hole played with a higher number of points reflecting better performance. For each hole, points are awarded as follows: Nett Albatross = 5 points; Nett Eagle = 4 points; Nett Birdie = 3 points; Nett Par = 2 points; Nett Bogey = 1 point; and worse than a Bogey = 0 points. In this way, if a player scores a level par for the round, he scores 36 points. The players were informed that prize money would be awarded based on Stapleford rules as follows: £15 for first place; £10 for second place; and £5 for third place.

Prior to each tee shot, players were asked to score their cognitive anxiety, somatic anxiety, and self-confidence as single-integer scores directly on their scorecard, which was modified for this purpose. Thus, each player wrote down three numbers before the tee shot for each hole he played: one for his cognitive anxiety; one for his somatic anxiety; and one for his self-confidence. After the player had played his tee

shot, the two assessors scored the driving performance on their own separate cards. These scores were derived based on the criteria mentioned previously relative to each individual's ability. The assessors were "blind" with respect to the performers' anxiety and self-confidence scores. At the end of the competition, prize money was given to the three players with the highest scores based on the Stapleford rules.

Results

Reliability of the self-report measures

In order to assess the reliability of the single-integer measures of cognitive anxiety, somatic anxiety, and self-confidence, correlation coefficients were calculated between the single-integer scores and the CSAI-2 scores for each of these variables. The data were first standardized within participants in order to control for potential individual differences in inventory response sensitivity. The data were then pooled across participants. This yielded 56 observations (seven scenarios x eight participants).

Pearson's correlation coefficients were $r = 0.59$ ($p < 0.01$) for cognitive anxiety, $r = 0.56$ ($p < 0.01$) for somatic anxiety, and $r = 0.68$ ($p < 0.01$) for self-confidence. Closer inspection of the participants' data revealed that one individual's single-integer scores correlated poorly with the CSAI-2 scores. Consequently, this participant's data were removed from the data set for all subsequent analyses. As a result of this removal, there were 49 observations rather than 56. The resulting Pearson's correlation coefficients were: $r = 0.67$ ($p < 0.01$) for cognitive anxiety; $r = 0.72$ ($p < 0.01$) for somatic anxiety; and $r = 0.80$ ($p < 0.01$) for self-confidence. For the purpose of the present study, these correlation coefficients were considered high enough to justify the use of the single-integer scores in the subsequent analyses.

Data analysis

All anxiety, self-confidence, and performance scores were standardized within participants using z-score transformations and then collapsed across subjects yielding a total of 126 data points. The dependent variable was subjective golf performance as measured by the golf assessors. Objective golf performance scores were not deemed an appropriate measure of performance, as distance alone is not a

very good indicator of quality. Also, a biomechanical analysis was not practical in such a field setting.

In order to test the hypothesis that self-confidence acts as a bias factor in the catastrophe model, the data were first split into two subsets: high self-confidence and low self-confidence. This was done by means of a median split. A *t*-test confirmed that there was a significant difference in self-confidence scores between the “high” and “low” conditions ($t(124) = 15.27, p < .001$). The two resulting sets of data (high self-confidence and low self-confidence) were treated separately from this point forward. All of the procedures described hereafter in this section were applied separately to both sets of data.

The median was determined for cognitive anxiety and for somatic anxiety. The data were then coded as either low (below the median) or high (above the median) for each of these two variables. In the low self-confidence subset, separate *t*-tests confirmed that significant differences existed between the “high” and “low” conditions for cognitive anxiety ($t(65) = 13.45, p < .001$) and for somatic anxiety ($t(65) = 10.19, p < .001$). In the high self-confidence subset, separate *t*-tests also confirmed that significant differences existed between the “high” and “low” conditions for cognitive anxiety ($t(57) = 7.75, p < .001$) and for somatic anxiety ($t(57) = 9.21, p < .001$). These median splits resulted in four possible conditions: high cognitive anxiety/high somatic anxiety; high cognitive anxiety/low somatic anxiety; low cognitive anxiety/high somatic anxiety; and low cognitive anxiety/low somatic anxiety. Cognitive anxiety and somatic anxiety were subsequently treated as independent variables in two-factor analyses of variance (ANOVAs) in which the standardized performance scores were the dependent variable.

Although median splits allow data sets to be split in half at the median, there is no reason to believe that the maximum interaction effect size between cognitive anxiety and somatic anxiety will lie precisely on the somatic anxiety median. In fact, the butterfly catastrophe model predicts that performance decrements will occur at different levels of somatic anxiety (or physiological arousal) depending on the level of self-confidence. Consequently, the somatic anxiety data were subsequently split at

various points below and above the median. More specifically, the somatic anxiety data were split at regular intervals of $0.1 SD$ below and above the somatic anxiety median. The fairly small gradation of $0.1 SD$ was chosen in order to allow for the emergence of a precise point or points (corresponding to the bifurcation set) along the somatic anxiety continuum where the maximum interaction effect size lay. If the hypothesis were to be supported, then these points would be at a lower level of somatic anxiety for the low self-confidence group than for the high self-confidence group. That is, the fold at the front edge of the catastrophe surface would be farther to the right for high self-confidence and farther to the left for low self-confidence. In order to test this hypothesis, separate two-factor (cognitive anxiety x somatic anxiety) ANOVAs were conducted for the low self-confidence group and for the high self-confidence group with that data split into high and low somatic anxiety, at the median $+0.7$, the median $+0.6$, the median $+0.5$, etc. down to the median -0.7 . Beyond the highest and lowest points, one of the resulting quadrants was too small to allow a meaningful ANOVA to be performed. For each ANOVA, the magnitude of the cognitive anxiety x somatic anxiety interaction effect size was noted.

Analysis of Performance Data

As mentioned previously, the performance data were split at the self-confidence median. This yielded two conditions: high self-confidence (above the median) and low self-confidence (below the median). These two conditions will be discussed separately here.

Low self-confidence. Two-factor (cognitive anxiety x somatic anxiety) ANOVAs were conducted with somatic anxiety splits ranging from [median - $0.7 SD$] to [median + $0.7 SD$] in increments of $0.1 SD$. This resulted in a total of 15 ANOVAs being performed, a different one for each different split in the somatic anxiety data. The range of somatic anxiety splits ([median - $0.7 SD$] to [median + $0.7 SD$]) either side of the somatic anxiety median was determined by the range of scores for which there were enough data points to perform a cognitive anxiety x somatic anxiety ANOVA. These ANOVAs revealed two significant interactions between cognitive anxiety and somatic anxiety corresponding to splits in the somatic anxiety data at the median and at [median - $0.1 SD$]. No significant main effects were revealed for either

cognitive or somatic anxiety. The interaction F ratios and corresponding effect sizes are displayed in Table 7. The maximum eta-squared interaction effect size was .094. This interaction is illustrated in Figure 6. The corresponding standardized value for somatic anxiety at this level was $z = -0.55$.

Table 7. Golfers' low self-confidence condition. F ratios and effect sizes for the interaction between cognitive anxiety and somatic anxiety for different splits in the somatic anxiety data.

Somatic anxiety split	Standardized value for Somatic Anxiety	Interaction $F(1, 63)$	Eta- squared
Median + .7	0.25	0.17	0.003
Median + .6	0.15	0.32	0.005
Median + .5	0.05	0.32	0.005
Median + .4	-0.05	0.32	0.005
Median + .3	-0.15	0.30	0.005
Median + .2	-0.25	0.30	0.005
Median + .1	-0.35	1.53	0.024
Median	-0.45	4.60*	0.068
Median - .1	-0.55	6.52*	0.094
Median - .2	-0.65	3.61	0.054
Median - .3	-0.75	2.66	0.041
Median - .4	-0.85	2.96	0.045
Median - .5	-0.95	.70	0.011
Median - .6	-1.05	1.41	0.022
Median - .7	-1.15	0.44	0.007

* $p < 0.05$

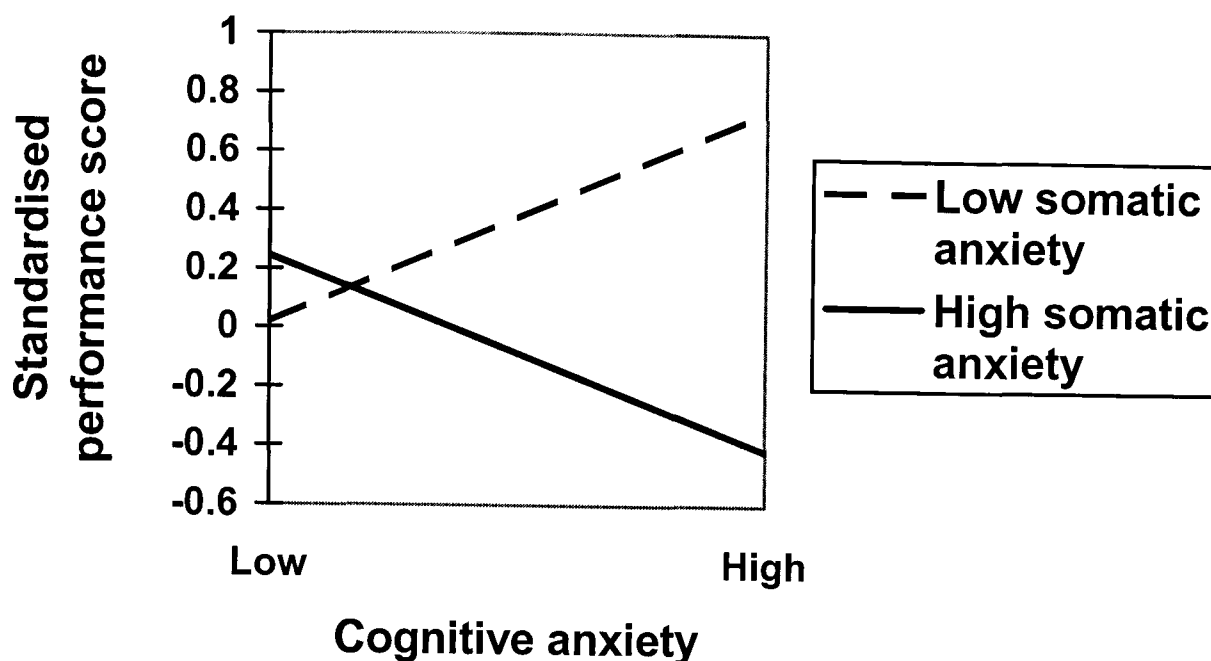


Figure 6. Low self-confidence. Interaction between cognitive anxiety and somatic anxiety.

High self-confidence. Two-factor (cognitive anxiety x somatic anxiety) ANOVAs were conducted with somatic anxiety splits ranging from [median - 1.3 *SD*] to [median + 0.6 *SD*] in increments of 0.1 *SD*. This resulted in a total of 20 ANOVAs being performed, a different one for each different split in the somatic anxiety data. The range of somatic anxiety splits ([median - 1.3 *SD*] to [median + 0.6 *SD*]) either side of the somatic anxiety median was determined by the range of scores for which there were enough data points to perform a cognitive anxiety x somatic anxiety ANOVA. There were three significant interactions between cognitive anxiety and somatic anxiety. These corresponded to splits in the somatic anxiety data between [median - 0.3 *SD*] and [median - 0.1 *SD*]. The interaction *F* ratios and corresponding effect sizes are displayed in Table 8. It should be noted here that the data did not change for these three values. That is, changing the split in the somatic anxiety data from $z = 0.03$ to $z = 0.23$ did not result in any data points moving from the high somatic anxiety subset to the low somatic anxiety subset. Thus, the eta-squared effect size for all of these interactions was .073. The nature of this interaction is illustrated in Figure 7. The corresponding standardized value for somatic anxiety at this level ranged from $z = 0.03$ to $z = 0.23$. At these three splits in the somatic anxiety data, the ANOVAs also revealed significant main effects for cognitive anxiety and somatic anxiety. These main effects are not reported here as

they are not of primary interest in this study and they are potentially confounded by the significant interactions, which are of primary interest.

Table 8. Golfers' high self-confidence condition. *F* ratios and effect sizes for the interaction between cognitive anxiety and somatic anxiety for different splits in the somatic anxiety data.

Somatic anxiety split	Standardized value for Somatic Anxiety	Interaction <i>F</i> (1, 55)	Eta-squared
Median + .6	0.93	0.16	0.003
Median + .5	0.83	0.02	0.000
Median + .4	0.73	0.02	0.000
Median + .3	0.63	0.02	0.000
Median + .2	0.53	0.27	0.005
Median + .1	0.43	0.50	0.009
Median	0.33	0.34	0.006
Median - .1	0.23	4.35*	0.073
Median - .2	0.13	4.35*	0.073
Median - .3	0.03	4.35*	0.073
Median - .4	-0.06	3.65	0.062
Median - .5	-0.16	0.98	0.018
Median - .6	-0.26	0.34	0.006
⁹ Median - 1.3	-0.96	0.34	0.006

* $p < 0.05$

⁹ For splits in the somatic anxiety data between [median -0.6] and [median - 1.3], changes in the somatic anxiety split did not change the resulting quadrants. Hence the *F*-values and effect sizes were identical for these splits in the somatic anxiety data.

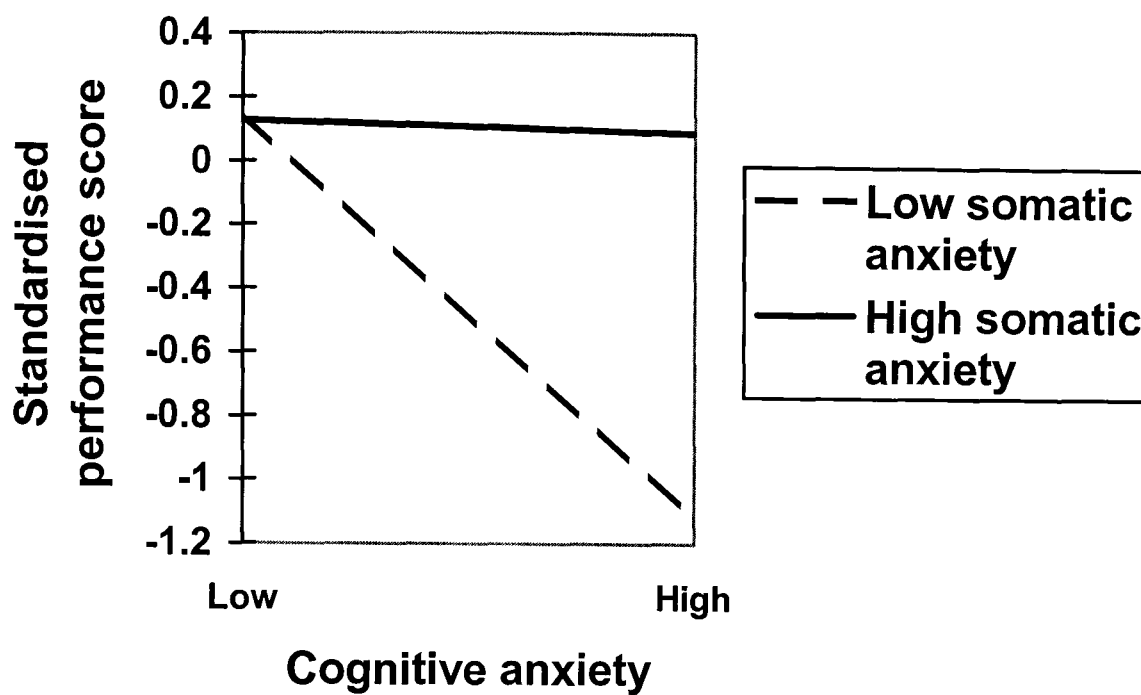


Figure 7. High self-confidence. Interaction between cognitive anxiety and somatic anxiety.

Comparison of high and low self-confidence conditions

Figure 8 depicts the cognitive anxiety x somatic anxiety interaction effect sizes as a function of the split in the somatic anxiety data for both self-confidence conditions (i.e., low and high). This clearly illustrates that the maximum interaction effect size occurs at a higher level of somatic anxiety for the high self-confidence condition than for the low self-confidence condition.

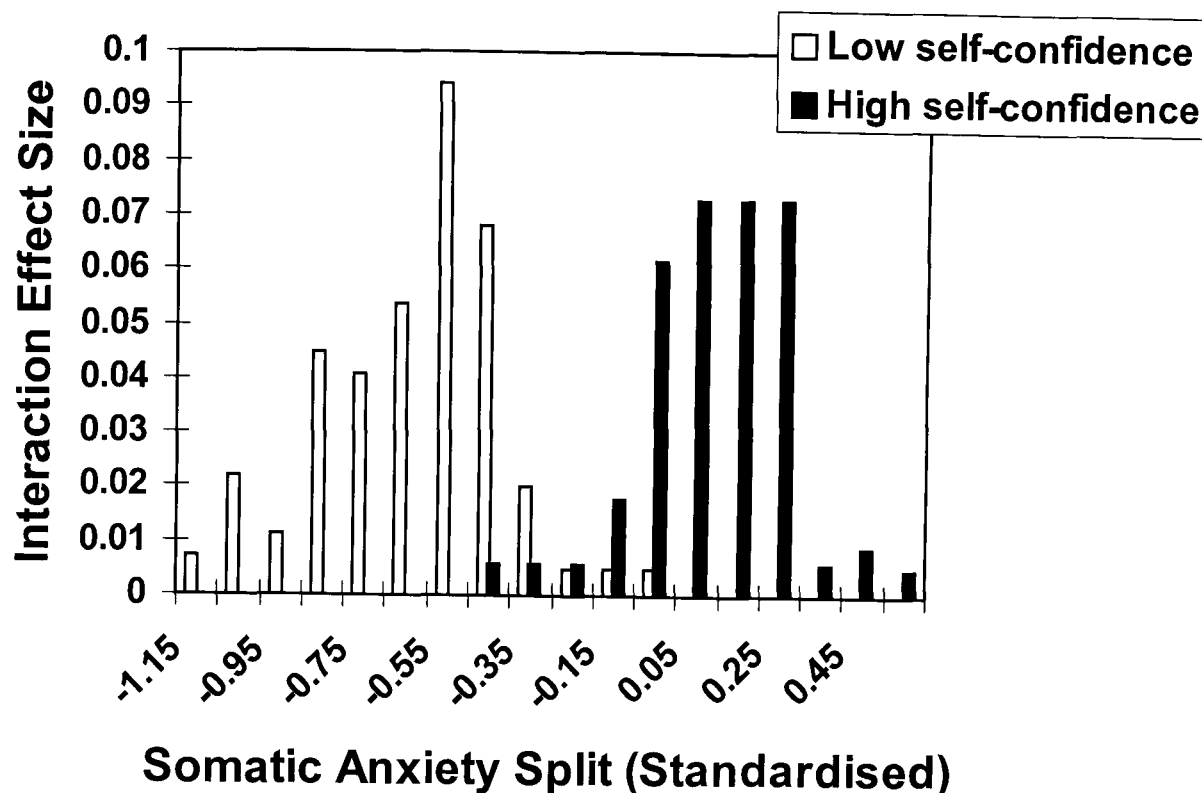


Figure 8. Cognitive anxiety x somatic anxiety interaction effect sizes for low and high self-confidence as a function of somatic anxiety.

Discussion

The segmental quadrant analysis employed in this study offers an effective method for investigating the proposed role of self-confidence as a bias factor within Hardy's butterfly catastrophe model (Hardy, 1990, 1996a). Certainly, as confirmed in this study, there is no reason to expect the maximum interaction effect size between cognitive anxiety and somatic anxiety to lie precisely at the median of somatic anxiety. However, by splitting the somatic anxiety data at various points below and above the median, one can ascertain the precise point at which the maximum interaction between cognitive anxiety and somatic anxiety occurs.

The results of the present study provide support for the proposition that self-confidence moderates the interactive effects of cognitive anxiety and somatic anxiety upon performance. That is, the maximum interaction effect size between cognitive anxiety and somatic anxiety was at a higher level of somatic anxiety for the high self-confidence condition than for the low self-confidence condition (see Figure 8). This is consistent with the prediction that self-confidence might act as a bias factor within a butterfly catastrophe model (Hardy, 1990, 1996a).

In the low self-confidence condition, the nature of the interaction between cognitive anxiety and somatic anxiety was as predicted by the catastrophe model. That is, when somatic anxiety was low, cognitive anxiety was positively related to performance, and when somatic anxiety was high, cognitive anxiety was negatively related to performance. This is similar to the interaction between cognitive anxiety and physiological arousal revealed by Edwards and Hardy (1996) with netball players (although Edwards and Hardy's interaction was a crossover interaction, not a diverging interaction). However, under conditions of high self-confidence, the interaction between cognitive and somatic anxiety was somewhat different: cognitive anxiety was more positively related to performance when somatic anxiety was *high* than when it was low. At first, this may seem to contradict catastrophe model predictions. However, as self-confidence swings the front edge of the catastrophe model to the right then the "high" somatic anxiety condition may still lie within the bifurcation set. Thus, performance in the high somatic anxiety condition could stay on the upper performance surface at (or near) the cusp, and would therefore be better than performance in the low somatic anxiety condition. However, the generally highly depressed performance scores that were obtained throughout the high self-confidence data are extremely difficult to explain. This is counterintuitive and contrary to most published research (e.g., Burton, 1988; Jones, Swain, & Hardy, 1993). One exception was reported by Gould, Petlichkoff, Simons, and Vevera (1987) whose analyses revealed a significant *negative* trend between self-confidence and pistol shooting performance. It is interesting to note that both pistol shooting performance and golf are relatively fine motor skills. However, quite how this might result in self-confidence having a negative impact upon performance is not at all clear and this is an avenue that needs further research.

It is worth saying something at this juncture about the distinction between somatic anxiety and physiological arousal. The present study used somatic anxiety as an indicator of perceived physiological arousal. Hardy and associates (Hardy, 1990, 1996a; Hardy & Fazey, 1987; Hardy & Parfitt, 1991) argued for the use of physiological arousal (as opposed to somatic anxiety) as the asymmetry factor in catastrophe models of anxiety and sports performance. This was because physiological arousal can affect performance both directly (e.g., heart rate, skin

conductance, adrenaline levels, etc.) and indirectly (i.e., via the perception of one's physiological arousal). In terms of testing the catastrophe model, the present study is limited by the sole investigation of indirect effects (i.e., somatic anxiety), and the fact that discrepancies between golfers' actual physiological arousal and their perceptions of that physiological arousal could not have been detected. This limitation might be important because, for example, a golfer might perceive himself to be fairly relaxed despite a high level of physiological arousal reflected in muscular tension. In such an instance, the golfer's swing might suffer because of tight shoulders, even though he might have reported a low level of somatic anxiety. Certainly, some past research (e.g., Karaterliotis & Gill, 1987; Yan Lan & Gill, 1984) has revealed poor correlations between somatic anxiety and physiological arousal as measured by heart rate and blood pressure. Also, Parfitt et al. (1995) found performance on an anaerobic task to be more strongly related to physiological arousal than to somatic anxiety. Consequently, future researchers would do well to consider both the potential direct and indirect effects of physiological arousal upon performance.

It is interesting to note that the poorest performances in the high self-confidence condition were in the quadrant representing high cognitive anxiety and low somatic anxiety. Of the four possible quadrants (high and low cognitive and somatic anxiety), the high cognitive anxiety/low somatic anxiety appears to be the most unlikely combination (i.e., "I am confident and worried but my body is relaxed"). Perhaps such a condition is indicative of some form of repression reflecting internal contradiction. For example, researchers have found that repressors (high-anxious individuals who report low levels of anxiety) report low levels of distress despite experiencing high levels of physiological arousal (Asendorpf & Scherer, 1983; Derakshan & Eysenck, 1997; Weinberger, Schwartz, & Davidson, 1979). Also, a study on female golfers (Williams & Krane, 1992) revealed that repressors reported higher self-confidence and similar state anxiety when compared to truly low-anxious individuals. Furthermore, when the repressors were deleted from Williams and Krane's analyses, the CSAI-2 subscales accounted for more than twice as much performance variance than when the repressors were included (14% vs. 5.9%). This suggests that repression may be an important confound in anxiety research in sport making it an area that is worthy of future research. At an applied level, it is possible

that repressors invest so many resources to effectuate such a repression (either consciously or subconsciously) that their performance subsequently suffers from a lack of available resources to attend to the task at hand.

There are a number of other limitations associated with the present study. The first concerns the use of multiple ANOVAs. One could argue that conducting a series of ANOVAs increases the likelihood of obtaining significant results and that a correction factor (e.g., Bonferroni) should have been employed to correct for this potential bias. This argument is sound when one is hypothesis testing. However, the use of multiple ANOVAs is not a major limitation in the present study because the ANOVAs were not used to test one particular hypothesis but rather to locate (along a somatic anxiety continuum) the maximum cognitive anxiety x somatic anxiety effect size.

A second limitation concerns the cell sizes in segmental quadrant analysis. As the split in the data is moved from the median towards the end of the somatic anxiety continuum the cell sizes become more imbalanced. This imbalance in cell sizes could be problematic for two reasons. First, any wild scores in cells with a small number of observations could increase the likelihood of obtaining spurious significant interactions in this type of analysis. Clearly this was not a problem in the present study, as significant interactions emerged near the somatic anxiety median only (i.e., where the cell sizes are fairly equal). The second way that the unequal cell sizes might affect the results of this analysis is the converse of the first problem. That is, the relatively small size of the cells at the ends of the somatic anxiety continuum might *inhibit* the emergence of significant interactions. Thus, significant interactions would be limited to those analyses where the cell sizes were relatively large (i.e., near the median). At first sight, this seems to provide an alternative explanation for the results of the present study, as for both the high self-confidence and the low self-confidence conditions, the significant interactions occurred near the somatic anxiety median. However, there were also a large number of cases where relatively large cell sizes did not result in significant interactions between cognitive anxiety and somatic anxiety. Rather, significant interactions occurred only in line with the hypotheses. Furthermore, the present analyses focused on effect sizes, not *F*-ratios, and effect

sizes are not so affected by cell size as are F -ratios. In light of all these arguments, the authors would argue that this alternative explanation of the results is not the most parsimonious one.

A third criticism that could be levelled at this study is a limitation of catastrophe model research in general. That is, although catastrophe models do have defining characteristics, catastrophe surfaces are rubberised surfaces that can be bent or stretched to meet the precise theoretical or empirical needs of models. As such, one could argue that they are difficult to disprove and are thus of limited practical value (cf. Gill, 1994). Having said this, the present results have provided further evidence that cognitive anxiety and somatic anxiety/physiological arousal need to be investigated as an interactive system and, at present, catastrophe models are the only models that offer interactive predictions between cognitive anxiety, physiological arousal, self-confidence, and performance. Furthermore, although tests of catastrophe models are limited within a surface-fitting framework, Hardy (1996b) has offered other, fairly straightforward, means of testing the various predictions of the models. These include: cognitive anxiety x physiological arousal interactive effects; the facilitative and debilitating effects of cognitive anxiety; and the hysteresis hypothesis (see Hardy, 1996b, for further details).

In conclusion, the present results provide evidence for the moderating role of self-confidence upon the combined effects of cognitive anxiety and somatic anxiety upon performance within a butterfly catastrophe model framework. With further evidence of the interactive effects of cognitive and somatic anxiety upon performance, the present study suggests that research that explores anxiety, self-confidence, and sport performance as an interactive process is likely to further advance our knowledge in this area.

Chapter 5

A Case Study of Organizational Stress in Elite Sport¹⁰

Abstract

This paper is an investigation of organizational stress in elite athletes. Fifteen elite athletes were interviewed with regard to potential sources of organizational stress in preparation for major international competitions. Four main organizational stress issues were examined: environmental issues; personal issues; leadership issues; and team issues. The main environmental issues that were revealed were: selection; the training environment; and finances. The main personal issues were: nutrition; injury; and goals and expectations. The main leadership issues revealed were: coaches; and coaching styles. The main team issues were: team atmosphere; support network; roles; and communication. The results are presented largely in the form of direct quotes to convey the intricate nature of the issues. The results are discussed in terms of the important practical and theoretical implications of organizational stress in elite sport, particularly for those researchers and practitioners who wish to gain a better understanding of elite performers as they prepare for major international competitions. Also, some possible strategies for coping with organizational stress in elite sport are discussed.

¹⁰ Based upon Woodman, T., & Hardy, L. (2001b). A Case Study of Organizational Stress in Elite Sport. *Journal of Applied Sport Psychology*, 13, 207-238.

Introduction

Organizational stress has been defined as “work-related social psychological stress” (Shirom, 1982, p. 21). Organizational stress is conceptualised as an interaction between the employee and the work environment to which he/she is exposed (Shirom, 1982). In line with Lazarus’s (1966) conceptualisation of stress, organizational stress resides neither in the work environment nor in the individual. Rather, it is the individual’s cognitive appraisal of the situation within the work environment that is central to this organizational stress process. It is not surprising, given this definition, that research in organizational stress has been driven predominantly by professional settings such as business, medicine, and education. Indeed, organizational stress has been investigated in a number of settings including: medical professions (Flett, Biggs, & Alpass, 1995; Florio, Donnelly, & Zevon, 1998; Jamal, 1984; Singh, 1990); police departments (Buunk & Verhoeven, 1991; Gulle, Tredoux, & Foster, 1998); military organizations (Rogers, Li, & Shani, 1987); schools (Cox, Boot, Cox, & Harrison, 1988; Mazur & Lynch, 1989); government agencies (Rogers, Li, & Ellis, 1994); banks (Seegers & van Elderen, 1996); and various corporations (Cangemi & Khan, 1997; Fried, Tiegs, Naughton, & Ashforth, 1996; Singh, 1991; Srivastava, 1991).

Sources of organizational stress in these settings include: work load, work design, job qualifications, performance evaluation, organization structure, responsibility and authority ambiguities (e.g., Rogers et al., 1994; Rogers et al., 1987); role ambiguity, role conflict, role overload (e.g., Jamal, 1984, 1985); and lack of knowledge, and lack of responsibility (e.g., Seegers & van Elderen, 1996). These factors have been found to have an effect on both job satisfaction (Hendrix, Ovalle, & Troxler, 1985; Kemery, Mossholder, & Bedeian, 1987) and job performance (Jamal, 1984, 1985; Rabinowitz & Stumpf, 1987).

Organizational stress in sport can be conceived as an interaction between the individual and the sport organization within which that individual is operating. Jones (1990) defined stress as a state in which some demand is placed on the individual, who is then required to react in some way in order to be able to cope with the situation. By extension, organizational stress can be defined as the stress that is

associated primarily and directly with an individual's appraisal of the structure and functioning of the organization within which he/she is operating. Consequently, issues that are not normally directly related to the sport organization (e.g., parents, school) are not viewed as potential sources of organizational stress (although they might be sources of stress). However, those issues that are directly related to the sport organization (e.g., coaches, selection criteria) are viewed as potential sources of organizational stress.

In their study of Canadian National Sport Organizations, Chelladurai and Haggerty (1991) found administrators' perceptions of decision-making (i.e., whether decisions within the organization were made in an appropriate fashion) and personnel relations to be positively associated with levels of job satisfaction. Although Chelladurai and Haggerty's study was not an investigation of organizational stress, it was, to the best of our knowledge, the first to show that organizational factors can have a significant effect on member satisfaction in a sport organization.

A number of researchers have examined sources of stress in elite sport performers (Gould, Horn, & Spreeman, 1983; Gould, Jackson, & Finch, 1993a; Scanlan, Ravizza, & Stein, 1989; Scanlan, Stein, & Ravizza, 1991). For example, Scanlan et al. (1991) found five major sources of stress in elite figure skaters: negative aspects of competition (e.g., worries about the competition); negative significant-other relationships (e.g., interpersonal conflict, skating conflicts); demands/costs of skating (e.g., financial demands, time demands); personal struggles (e.g., physical/mental difficulties, self-doubts about talent); and traumatic experiences (e.g., family disturbances, death of a significant other). The Gould et al. (1993a) study of national champion figure skaters revealed similar sources of stress to those found by Scanlan et al. (1991). While studies that have examined sources of stress are valuable in that they encompass a wide spectrum of athletes' stressful experiences, they often do not necessarily investigate the origins of these stressors. Clearly, some of these stressors will be beyond the level of the sport organization (e.g., family disturbances), but others could be a result of the organizational setting within which athletes find themselves. For example, a negative relationship between two team-mates might well be caused or exacerbated by the situation in which they have been placed within

the sport organization (e.g., living together for a long time at a residential national training centre).

Despite the clear importance of organizational stress in a number of working environments, the sport arena seems to have been somewhat overlooked by researchers. However, the research on sources of stress mentioned above (e.g., Gould et al., 1983; Gould et al., 1993a; Scanlan et al., 1991) does suggest that organizational factors might play an important part in athletes' preparation for competition. Consequently, the present study is an attempt to investigate the issues that underlie organizational stress as athletes prepare for major international competitions.

In view of our rather scant knowledge of organizational stress in sport, this investigation is best suited to a qualitative methodology (cf. Steckler, McLeroy, Goodman, Bird, & McCormick, 1992). One of the main advantages of qualitative research is that it allows researchers to gain an *in-depth* understanding of the participants. Thus, if interview transcriptions are simply reduced into textual summaries and subsequently inserted into a hierarchical tree, the very essence of qualitative research would largely be lost. If the reader is to share an in-depth understanding of the participants, then comprehensive portions of the interview transcriptions should be available. Therefore, while the present investigation will report the traditional hierarchical trees in order to illustrate the array of issues involved, a considerable amount of data will be reported in the form of direct quotes.

Method

Participants

Sixteen international elite performers (eight women and eight men) were selected for interview in this study. One of the participants did not complete the interview due to time constraints. Only the results from the remaining 15 interviews are reported here. When selecting participants, the major consideration was that they had been to an Olympic Games or a World Championships. Furthermore, the authors attempted to select participants who had had different experiences of the sport organization (e.g., athletes who trained at a national centre and athletes who trained

at their club). This was possible thanks to the second author's experience as a consultant with some of the athletes within this organization. The selected participants were first contacted by telephone to inform them of the nature of the study and to elicit their participation. At this point, the potential participants were told that the purpose of the project was to gain an in-depth understanding of their experience of major international competitions in order to help make future recommendations to the organization. All athletes agreed to take part in the study. Upon meeting the interviewer, participants were reminded that any information discussed would remain anonymous.

Participants were either current, or recently retired (less than four years), national squad members¹¹. Changes in coaching staff, athletes, managers, and administrators increase the likelihood of a change in the organizational climate. Consequently, in order to set the present study within a relatively short time frame, it was decided to include only those athletes who were still involved in elite international competition or had retired less than four years previously. Participants ranged in age from 17 to 30 ($M = 23.9$; $SD = 3.6$).

The Sport Organization

Given that the authors have chosen to report the results of this study anonymously, a detailed description of the organization is not possible. However, most qualitative researchers would recognize the importance of setting a study of this kind in the context of the sport organization. In light of these considerations, a fairly general description of the organization is provided here.

The present sample was drawn from an individual sport in the UK. Athletes trained either at their club or at a national centre. When they trained at their own club, their personal coach largely governed their training regimen. When the athletes lived and trained at a national training centre, national coaches largely directed their training. Prior to travelling to major international competitions, athletes were normally brought together at a national training centre for two to six weeks. Although the

¹¹ Due to the often-sensitive nature of organizational stress, the sport and its corresponding organization will remain anonymous for the purpose of this report.

men's and women's training programmes were separate, the athletes shared the same national training centre. At the time of the interviews, apart from individual and team sponsorships, the athletes were not paid. However, if they accepted the invitation to train at a national training centre, their living expenses were paid for.

Interview Guide

There is, at present, no theoretical framework on which to base organizational stress research in sport. However, it seems likely that one of the sources of organizational stress is sub-optimal group dynamics in the sport organization as a whole. For example, organizational stress will likely be more prominent in a setting where directors, managers, administrators, coaches, and athletes do not form a cohesive group than in a setting where such group dynamics are better. In view of this, the interview questions were broadly based on Carron's (1982) model of group cohesion. The participants were asked to discuss their experiences of "major international competitions such as World Championships and Olympic Games" as they related to: environmental issues, personal issues, leadership issues, and team issues (cf. Carron, 1982).

In their work as practising sport psychologists, the authors had some knowledge of the organizational stress that the participants might have experienced. In particular, the second author had worked as a sport psychology consultant within international sport for over twenty years. Consequently, the interview questions were developed through discussion between the two authors based on the second author's experience of international sport. These questions were then integrated into Carron's (1982) framework of sources of group cohesion.

Upon meeting the interviewer, participants were reminded that the purpose of the study was to gain insight into their experience of the sport organization as they prepared for major international competitions. Participants were also reminded that any information discussed would remain anonymous and that they could stop the interview at any time.

The interview started with general questions to ensure that the participants were free to discuss any issues that they felt were important in preparation for a major international competition. These general questions included: (a) the team's psychological preparation for the competition, (b) the structure of training, and (c) any change in training sessions. The four subsequent sections were: (1) *Environmental factors*, including: (a) training scholarships and bursaries, (b) the selection process, and (c) the training environment; (2) *Personal factors*, including: (a) different people's roles within the team, and (b) people's goals and expectations; (3) *Leadership factors*, including: (a) coaches, and (b) coaching styles; and (4) *Team factors*, including: (a) the team atmosphere, (b) the team's goals, (c) people's contributions to the team, (d) the support received, and (e) communication within the team (see Appendix B for complete interview guide).

Open questions such as "Can you tell me about the team's psychological preparation for these competitions?" were followed by questions such as "What effect did that have?" until saturation was deemed to have occurred on a particular issue (Glaser & Strauss, 1967). Clarification and elaboration probes were used to ensure an accurate and in-depth understanding of what the participants were describing. Before proceeding to the next section, participants were asked whether there was anything else they could tell the interviewer concerning what had just been discussed. Participants were asked to take their time to respond to questions and to tell the interviewer if they could not remember something rather than guess (Hindley, 1979; Moss, 1979).

The first author, who was trained in qualitative research methods and had four years' experience in sport psychology consultancy, conducted all interviews. Each participant was asked the same questions with similar prompts in order to obtain responses that were as consistent as possible in terms of depth and complexity (Patton, 1990). Although efforts were made to ensure that the sequencing of questions was similar for each participant, the order of presentation of the questions varied to allow the athletes to pursue the interview in the direction that they deemed appropriate. This has the advantage of allowing participants to express themselves in

their preferred manner while retaining the systematic nature of data collection between participants (Patton, 1990).

Interviews ranged in duration from 50 minutes to 150 minutes. This range reflects the athletes' different ways of expressing themselves. One athlete was particularly elaborate during the interview. Most interviews lasted between 60 and 90 minutes. All interviews were tape recorded and transcribed verbatim. This resulted in 491 pages of single-spaced text.

Pilot Study

A former elite performer, recently retired from the sport under investigation, was interviewed using the interview guide described above. This interview was recorded using a video camera. The aim of this interview was twofold: first, to ensure that the questions in the interview guide enabled the performer to discuss all the issues that she felt were pertinent with regard to her preparation for major international competitions; second, to enable the interviewer to gain advice on his interview techniques, body language, and clarification and probing techniques. Two researchers, who had a sound understanding of qualitative methods and had conducted qualitative research in the past, gave this advice. As a result of the interview and subsequent discussion between the interviewer, the interviewee, and the aforementioned researchers, the interview was modified to include two further questions (about injury and nutrition). Throughout the study, advice on interviewing techniques (e.g., effective open-ended questioning) was also provided by the second author who had considerable experience in qualitative research.

Methodological Considerations

Proponents of grounded theory (e.g., Glaser & Strauss, 1967; Pidgeon & Henwood; 1997; Strauss & Corbin, 1997) would acknowledge that a study of this kind could not develop from a theoretical *tabula rasa*, thus recognizing that the researchers bring their knowledge to the research process, and that questions will be based on a subjective view of the world. Most of the interview questions were based on the researchers' past experience and knowledge of sport organizations, broadly structured around Carron's (1982) group dynamics framework. The pilot study

allowed for the emergence of further issues related to organizational stress. The interview guide was subsequently modified to accommodate these issues and the resulting guide was used for all subsequent interviews. Thus, although there was not a *constant* “flip flop” (Pidgeon & Henwood, 1997, p. 255) between data and the researchers’ conceptualisations, there was at least some interplay. In summary, this study employed both traditional inductive/deductive content analysis (Weber, 1985) and inductive grounded theory (Glaser & Strauss, 1967) approaches.

Data analysis

All 15 transcribed interviews were formatted for analysis in the QSR NUD*IST 4 statistical package (1997). The hierarchical content analysis yielded meaningful segments of text that were related to organizational stress, and these were labelled under one of the four general categories: environmental issues, personal issues, leadership issues, and team issues. Environmental issues were defined as those issues pertaining to the sport environment in which the athlete was operating or used to operate. Personal issues were defined as those issues pertaining directly to the individual. Leadership issues were defined as those issues pertaining directly to the coaches and managers. Team issues were defined as those issues pertaining directly, and for the most part, to the team.

Reliability criteria were met through numerous and regular discussions between the two authors. Using QSR NUD*IST 4 (1997), the first author extracted raw quotes (i.e., quotes representing a meaningful point) and categorized the data into raw themes and first-order themes. Discussion between the two authors resulted in either a consensus with regard to a category or changes in categorization until such consensus was attained between the two authors. Also, a third researcher who was trained in qualitative methods was given a random selection of the raw quotes (30; 5%) and was asked to categorize these quotes into their raw themes and first-order themes. This researcher correctly categorized 90% (27 out of 30) of the quotes into their raw themes, and 99% (96 out of 97) of the raw themes into their first-order categories.

Results

The organizational stress pertaining to environmental issues, personal issues, leadership issues, and team issues are displayed in Figures 9, 10, 11, and 12 respectively. Although these trees display the full range of issues, the true intricate and complex nature of organizational stress would mostly be lost if the presentation of the data were restricted to such trees. For this reason, the authors have reported the results based on a substantial selection of direct quotations¹². This has the considerable advantage of allowing the quotes to “speak for themselves,” thus enabling the reader to understand fully the issues involved.

Environmental Issues

The full range of environmental issues is illustrated in Figure 9. The main environmental issues were: selection; finances; and training environment.

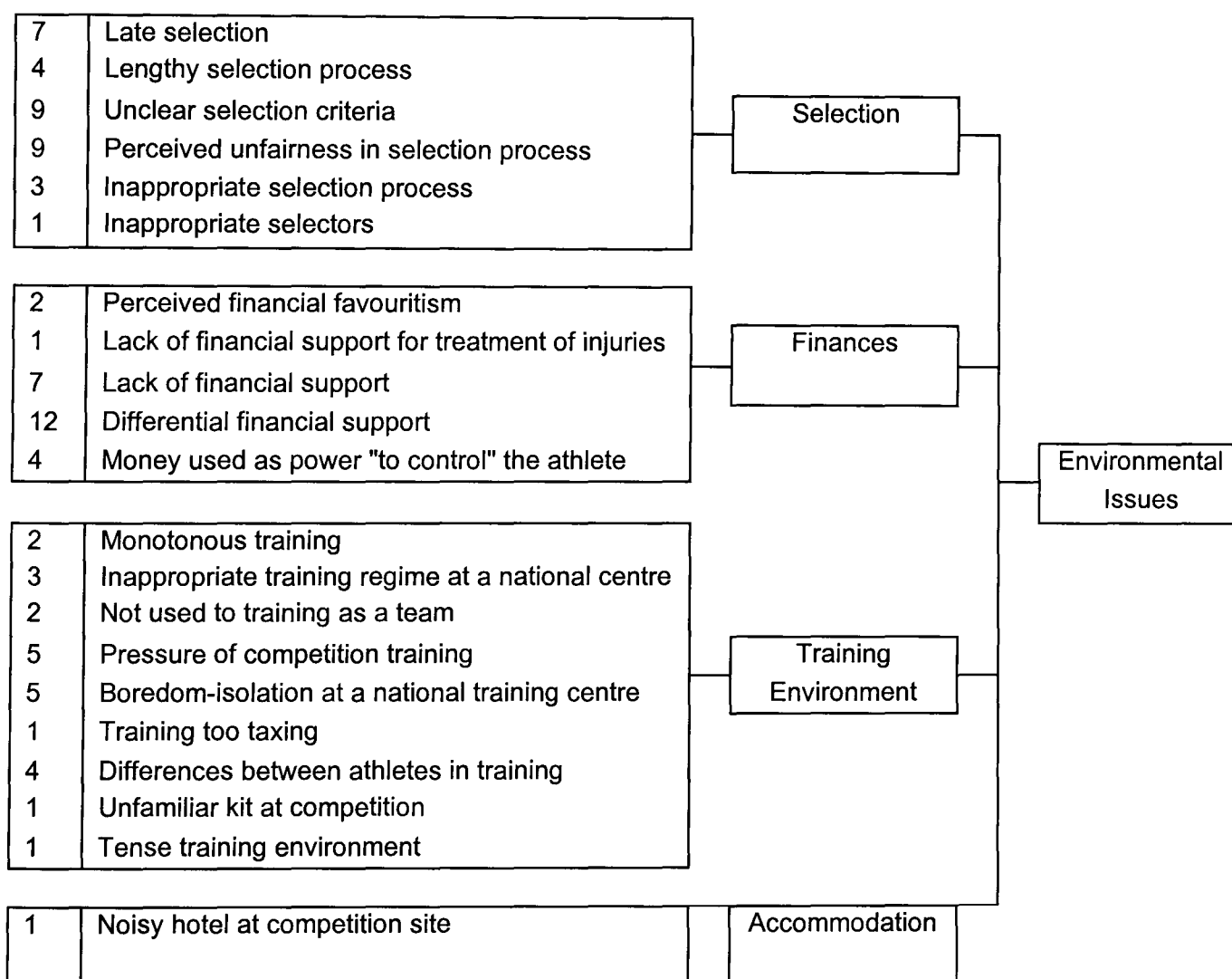


Figure 9. Organizational Stress: Environmental Issues (the number of athletes mentioning each raw theme is listed in the first column).

¹² All names have been changed.

Selection. All participants mentioned selection criteria and procedures as a source of organizational stress. The main selection issues were: late selection (i.e., too close to the competition), a lengthy selection process, unclear selection criteria, and perceived unfairness in the selection process. Selection appears to be a particularly sensitive issue in that any lack of clarity increases the likelihood of bad feelings within the squad. The following quote from a female athlete illustrates the frustration that athletes can experience from perceived favouritism on behalf of the selectors:

I was just like, “well, what’s the point? You know who you want to take, you know who’s going to go, you know where you want them to be ranked, so therefore you fix it. So why am I going through this? Why can’t I do my normal training to make me compete well at the competition instead of having these stupid f***ing trial things.”

While perceived favouritism in selection is clearly frustrating to the athlete, a late selection can result in poor preparation for major competitions, as is illustrated in this quote by another female athlete:

They didn’t pick the team for the World Championships in Santiago until we got to Santiago... they didn’t tell us who was competing [until] like the day before the competition... I think it made everybody really tense and nervous and it didn’t do a lot for the team motivation or team spirit.

Selection for a major international event is extremely important to athletes as it is often seen as a “gateway” to a peak in their career. For some of the participants in this study, selection was so important that it became the peak rather than the gateway. This is apparent in the quote below:

The worst thing was that we hadn’t had a break... we did four control comps a week and we couldn’t cope, we peaked too early... We were working really hard to get selected and we’d peak for control comps and by the time the Worlds came we’d gone down.

Selectors keen to ensure that they select the best and/or most consistent athletes might be tempted to expose athletes to a number of competitions prior to a major event. However, if this process is too lengthy, athletes are more prone to fatigue and

injury and will likely not be optimally prepared for a major international competition. The following quote illustrates the problems associated with a lengthy selection process:

I think the method of selection for the Olympic Games was ridiculous... because we did the national championships, that counted... I went straight off to Italy for an International... That's where I actually injured my foot... so I was actually training with the injury all through the trials for the Olympics. Then I had to go to the European Championships, I had a really good competition there... so I was really pleased with that, but while I was out there I got a stress fracture in my back. Then we came back... we had a few trials at [a specific training centre]... Then we flew to Norway, we had a two-day competition there which was absolutely awful... and then straight from there we had to get a train to Denmark where we trained... with the Danish national squad for a week, so that was really tough. And at the end of it we had another two-day competition and then... that was the final decision. And then we got told [if we were selected for the Olympics] and then we came home and it was just like (sigh). But then you couldn't relax because I knew I was going to the Olympics... I had to train.

Training Environment. The main training environment issues were: monotonous training; difficulties training at a national training centre; not used to training as a team; pressure of competition training; and differences between athletes in preparation. Because of the sometimes different loyalties towards one's personal club and towards one's national team, difficulties can arise if the two environments are not compatible. For those athletes used to training at their personal clubs, it can be rather difficult to adjust to national training as the following quote from a male athlete suggests:

... a lot of us trained at different places, so you didn't get a team training over a length of time, so psychologically you were just doing your own thing in your own club with your personal coach. And then maybe a week, or two weeks, before a major competition you're all put together at [a specific training centre] which in some cases destroyed some people that you compete against all the time. And some people are together because they train together and you're sort of out of that little clique... So psychologically sometimes it boosted you because you were... wanting to beat somebody else... and in other cases it destroyed you.

The difficulties of creating the “right” training environment over a period of time before travelling out to a major competition are well illustrated in this quote:

I think it [training at a specific training centre for a month] might have drained us. We just wanted to go to the World Championships, get everything over with and get back to normal. But you can't say what's wrong and what's right because maybe if the team hadn't come together then you wouldn't have got a team atmosphere, but I don't know whether the right one was created, so it's difficult.

Finances. The main financial issues were: not having enough money; differential financial support; and the perception of money being used “to control” the athlete. Elite athletes commit many years of their life to their sport and many often do not have time to earn money outside training for their sport. Consequently, they rely on their family, sponsorship, or their sport organization to provide them with sufficient funds to pursue their career in elite sport. When this financial support is not forthcoming or is poorly managed, athletes will often feel discarded and might retire prematurely. The following quote illustrates this:

The more money you [have] the easier it is to organize training sessions and training camps... It affects [you] a lot really. I mean if you have more money, then I think our sport would be a lot higher... in the world than we are today. A lot of the girls struggle, the guys struggle... I mean some of them were asked to live at [a specific training centre] but couldn't because they couldn't find the money, so they had to stay in their own clubs and they slowly fizzled out, because all the guys that were at [a specific training centre] were getting better and they weren't because they didn't have their financial support.

Differential financial support for athletes, particularly if it is not well justified, has the potential to create bad feelings within national squads. Indeed, when athletes perceive that they are unjustifiably receiving less financial support than other athletes in the national squad, they are likely to feel rather despondent as the following quote shows:

It's not fair... if we're all together in the same team we should get the same amount of money. I don't think anybody should be singled out because that's when there's a bit of friction towards everyone... There's some people in the national team, because they're at a

different club... they get sponsored by [brand name], they can get free [kit] and Janet... and Jane, they get all free [kit]. But then when we come we have to pay for ours, or we get [it] half price which I don't think is fair. I think if we're members of the national squad like them, we should be allowed the same opportunities. It's stupid.

Personal Issues

The full range of personal issues is illustrated in Figure 10. The major personal issues were: nutrition; injury; and goals and expectations.

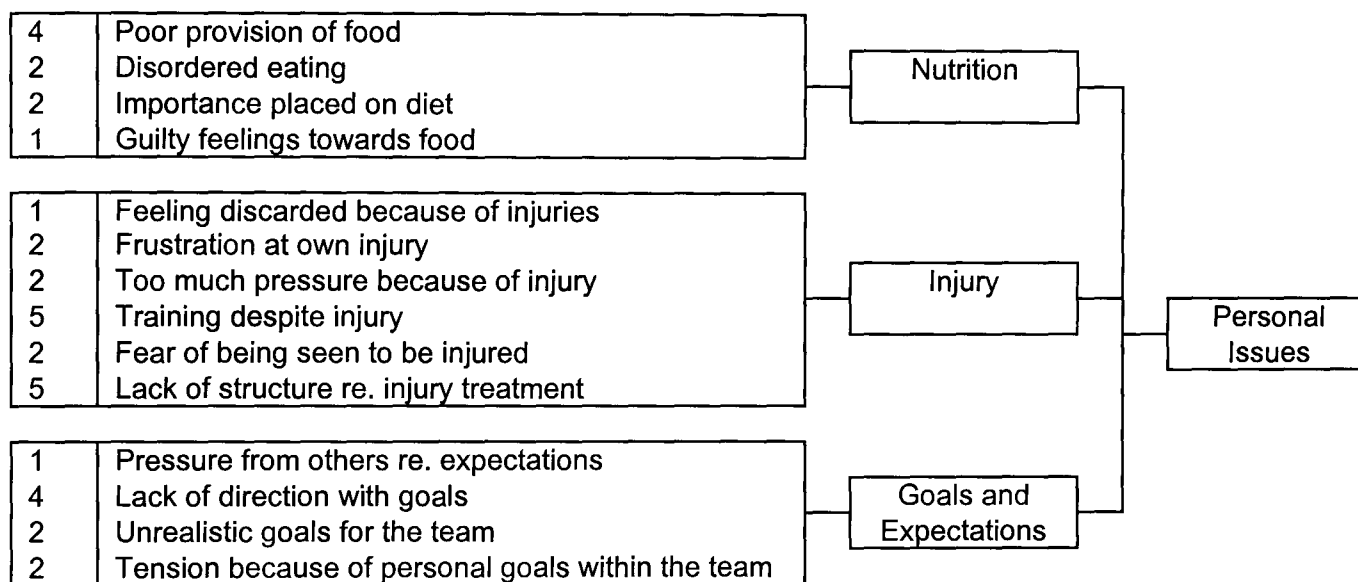


Figure 10. Organizational Stress: Personal Issues (the number of athletes mentioning each raw theme is listed in the first column).

Nutrition. The main issues with respect to people's nutrition were: poor provision of food; disordered eating; and the importance placed on diet. Nutrition was most often an issue for the female athletes in this study. This comment by a female athlete highlights the importance of diet: "I'd say 90% of our sport is about diet... Diet is my worst subject." Although diet can be a major issue in itself, the following quote shows that a lack of sensitivity on behalf of coaches can exacerbate the problem:

We were weighed twice a day, and he [a national coach] used to not threaten us but he used to like make you..., "you've got to watch your weight. If you're heavier then you won't train today" and you knew that that would be the worst thing... He tried different tactics by putting it up on a wall so everyone could see how much we weighed and that. It was embarrassing.

The female athletes' experiences with regard to nutrition suggest that problems can arise from a number of sources, notably coaches' attitudes, a lack of education on nutrition, and a lack of support following a serious injury. The quote below shows the complexity of this issue:

The pressure on people is far, far too much... I made myself ill over it through losing too much weight because I wasn't educated enough on it, and I saw Jane being taken to the hospital because she was so ill. And there was me, I was taking up to 60 laxatives a day... That was mainly after my foot operation when I had been told that I was grossly overweight. I had no sort of support... nothing to sort of aim at. I think it's a big mixed up problem.

As mentioned previously, nutrition and weight control were predominantly issues for the female athletes in this study. The following quote shows a contrasting attitude from a male athlete:

It didn't bother me in the slightest [being called fat], because you look at somebody who's fat and then you look at yourself and you think, "I can cope with that," and then you can go and do your sport. You're like, "well, if I was fat, I wouldn't be able to do this." I wasn't even bothered at all.

Injury. The main issues with regard to injury were: frustration at one's own injury; too much pressure because of injury; training despite injury; fear of being seen to be injured; and lack of structure re. injury treatment. Injury can be a particularly devastating aspect of an athlete's career (Brewer, 1994; Evans & Hardy, 1995; Pederson, 1986; Udry, Gould, Bridges, & Beck, 1997) and the following quote suggests that an organization that is not extremely sensitive to these issues will likely engender negative feelings from its athletes.

I just feel like there's... no routine to anything with the [organization]. There should be a routine... If one of the squad [athletes] is injured... they're just left to it. No one cared, no one even knew what state I was in, no one even knew how I was recovering, and no one even gave a damn that I wasn't going to be in the World Championships.

Although major injuries most often preclude an athlete from competing, athletes in many sports compete with injuries. The athletes interviewed in this study were no

exception. The following quote illustrates the difficulty for athletes who are faced with the dilemma of either competing while injured or not competing because of the injury:

I was at the Worlds in Berlin and I had to compete on it [my ankle] so the physio taped it up. But apparently afterwards I found out that no amount of taping would do any good. I just had to do it, because that was what I was there for. I hurt my ankle before the Europeans and Jerry [a national coach] said to me, “if you don’t train, then you don’t compete” so what could do I do? My ankle was like a balloon, I couldn’t even see the bone, and it was blue all over from the swelling and the bruising. I had to compete on that; I had it taped up and I had to train on it. The physio just kept putting this piece of... card on the anklebone and he said that it’d press out the swelling. And I still had to compete on it, just for myself. I mean I could’ve just said, “all right then, I’m not doing it,” but I *wanted* to do it.

Goals and Expectations. The main issues with respect to goals and expectations were related to: lack of direction with goals; unrealistic goals; and tension because of personal goals within the team. Goals are widely accepted as being an important aspect of an athlete’s preparation for competition, which can either have a negative or a positive influence on athletes (Beggs, 1990; Hardy, Jones, & Gould, 1996). Despite studies that have shown the benefits of appropriate goal-setting (Anderson, Crowell, Doman, & Howard, 1988; Burton, 1989; Kingston & Hardy, 1997), it appears that some coaches do not implement such psychological skills in their training programmes. The quote below suggests that coach education remains an important aspect of consultancy work:

It was... kind of, “oh, in training we’ll do this”... It was much better working it out with Sam [a sport psychologist]... it was *my* goal settings as opposed to Harry’s [a national coach]... When I sat with Harry it was, “well, you’ve got the World Championships coming up there, but in May you’ve got this international,” but I mean basically he was just giving me a calendar... he wasn’t giving me proper goal-setting.

In the sport under study here, the national team needs to be ranked in the top 12 at the World Championships prior to the Olympic Games in order to qualify a full team for the Olympic Games. Because of this, directors and coaches might have a tendency to emphasize the importance of qualifying in the top 12 even if such an

expectation might appear unrealistic to the performers. An example of this is evident in the quote below:

The team goal for... the Belgium World Championships was..., I would have said top 15, that would have been a realistic goal, but the goal that was set down was still top 12. I mean we ended up 18th or 19th.

Leadership Issues

Coaches. A wide array of coach issues arose from these interviews (see Figure 11).

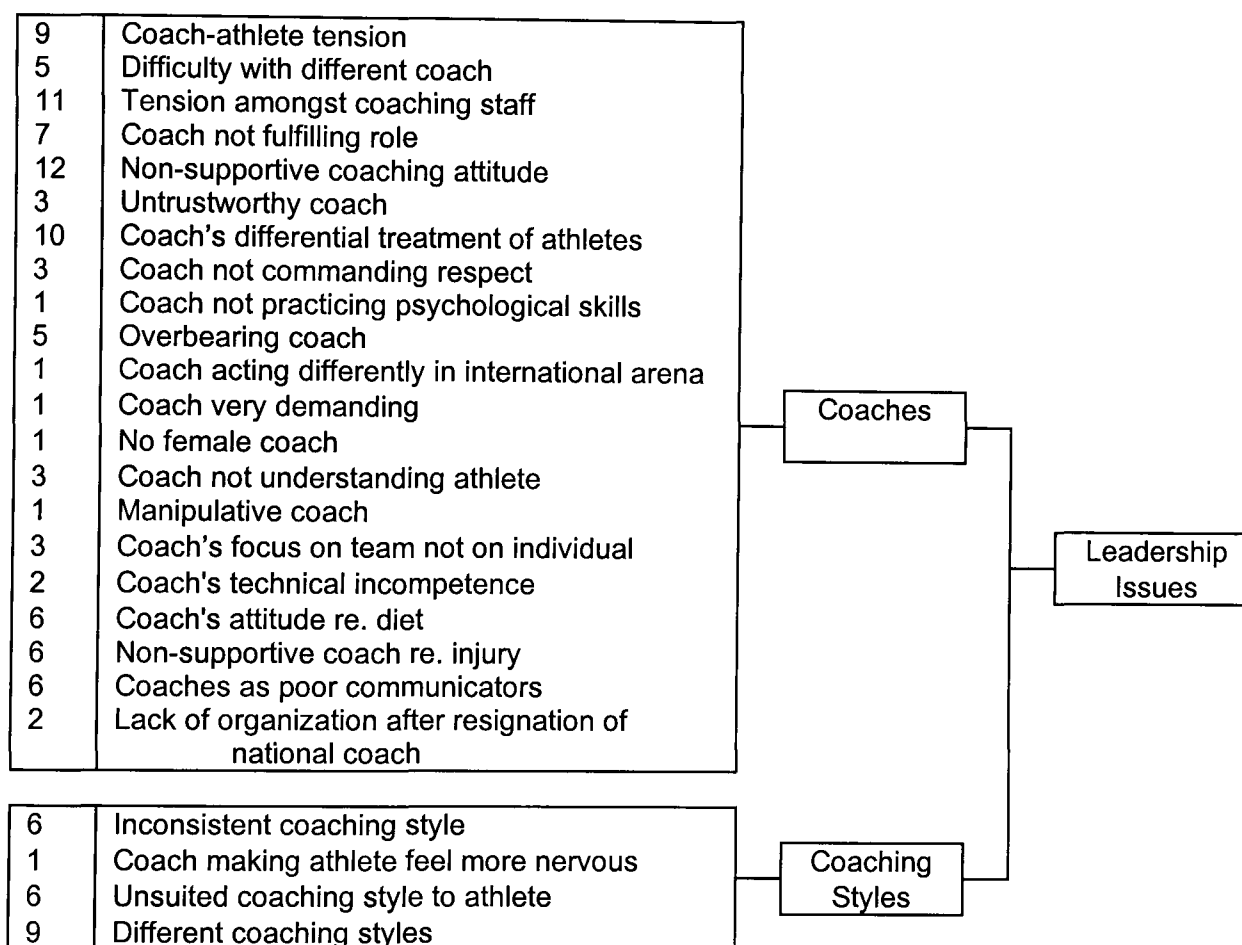


Figure 11. Organizational Stress: Leadership issues (the number of athletes mentioning each raw theme is listed in the first column).

In view of the significance of the coach's role in an elite athlete's career, the relationship between athlete and coach is particularly important if the athlete is to attain his/her potential. In the present sample, it was not uncommon for athletes to train at their club with their personal coach, but to go to a specific training centre to train with the rest of the national squad prior to travelling to major international

competitions. One of the major sources of stress with regard to preparation for these competitions was the tension between coaching staff, notably between personal and national coaches. The following quote is an example of such friction:

All the [athletes] had their own personal coaches, but obviously when they came together as a team at [a specific training centre], they were underneath the national coach which caused a lot of friction between individual coaches and the national coach. Sometimes they wanted their [athlete] to do one thing and the national coach wanted them to do another, but individual coaches know their [athlete] best because they work with them every day. I can't honestly say that there was any one point in time where all the coaches got on, it just didn't happen.

The effect of such friction amongst the coaching staff can be seen in the following quotes from a female athlete and a male athlete respectively:

As much as you try not to let it affect you, you see the coaches arguing, what's to stop the girls from arguing too?... It's just, it's there in the atmosphere.

We were thinking, "Well, they're telling us that we shouldn't be doing this and that... and they're doing the same." We all discussed that... after the meetings. We were saying, "Why are they telling us that we have to get on?" It came up in a meeting, Jack [an athlete] said it to Roger [a national coach], he said, "why are you lecturing us... that we must stick together as a team, and you lot in the office can't agree on anything, and you're always arguing?" And they couldn't answer it. They couldn't say, "Well, we don't," because it was obvious... I mean, we were looking at *them* and they weren't getting on, so why should *we* get on?

It is fairly clear from these quotes that friction between coaching staff can rub off on the athletes and result in a poor group atmosphere. The following quote suggests that such friction is unlikely to be conducive to ideal preparation for a major international competition:

Because James [a national coach] and Frank [a personal coach] didn't get on, then he [Frank] didn't get to go and they wouldn't even give him a pass to come to training... I'd said that I'd do the World Championships as long as I didn't have to work with the other coaches, I'd work with my own coaches at [a specific training centre], which I did. And Frank did in fact get a pass so it was all right. It was a pain really.

Tension between coaches might simply be an artefact of conflicting personalities. However, it might also be caused by different approaches to coaching. The following quote suggests that coaches' divergent and headstrong views on coaching can be detrimental to athletes' preparation:

There's different techniques... and one coach would tell you one thing and the other would tell you, "no, don't do that, do this" and... I remember crying at one point just because we didn't know what we were doing, because the coaches weren't communicating because they were obviously arguing about something. And they were telling you one thing and then the next [coach] would tell you another thing... You forget which technique you're doing with which coach, and if you did it wrong then *you'd* get shouted at, and it would be like it was all your fault. And then you'd go, "well, so-and-so told me to do *this*" and then the coach would go, "well, is so-and-so your coach?"... Who do you listen to? It's confusing; it's all about communication.

A major international competition can be an intimidating experience for athletes as well as for the support staff. By behaving differently in this international arena, coaches can inadvertently detract from their athletes' preparation as this quote indicates:

Coaches start acting a bit funny when they get into the international environment... I think that they have to prove themselves to other coaches... It's not helping you to become a better performer; it's all about themselves.

Coaching Styles. The main coaching style issues were: inconsistent coaching style; coach making the athlete feel more nervous; unsuited coaching style to the athlete; and different coaching styles.

As mentioned earlier, some of the athletes in this study trained at their club most of the time. If selected for a major international, they would then train at a national training centre with the rest of the selected athletes. Thus, for most of the year, these athletes are trained by their personal coach. However, when at national training, they are coached by a national coach. The quote below illustrates an athlete's frustration at being exposed to a different style of coaching in these instances:

I'm the kind of person that if I get shouted at it makes me really not want to do it at all... I'd do it ten times worse because someone shouted at me. I don't think coaches understand each individual performer enough. I suppose your own coach does, but your own coach isn't always with you at national training. You just have one coach and they just shout at everyone the same; it doesn't work for everyone the same.

Clearly, being exposed to different coaches increases the likelihood of being exposed to different coaching styles. However, the following quote suggests that an inconsistent coaching style with one coach can be equally frustrating:

With Graham [a national coach] there was no respect at all... that was *his* fault because he was so inconsistent. He wanted to be your best mate one day, and the next day he wanted to be this ruthless sort of leader, like, "do what I say or else," and the next day he'd be like, "oh, are you all right mate?"... You didn't know where you were with Graham, he was up and down, up and down... unbelievable. I mean he would be really friendly with you one day, and the next day he'd just bite your head off. If he was a s**t with you all the time, then you'd know where you stand with him, but you didn't. Like you try and have a laugh with him, then you find out that he's in a bad mood and it's at your expense, he had a right go at you.

Team Issues

The full range of team issues is illustrated in Figure 12. The major team issues revealed were: team atmosphere; support network; and communication.

Team Atmosphere. The major issue with respect to the team atmosphere was tension between the athletes. Team members are likely to have minor fall-outs when they spend long periods of time with each other in a typically tense atmosphere (e.g., preparing for one of the most important competitions of their career). Also, it might be difficult for new team members to integrate a team that has been together for a long period of time. The following quote is an example of how a new team member can affect the team atmosphere during a World Championships:

It was just that our mind wasn't on what we were supposed to be concentrating on... we were too busy thinking about things that were going on amongst ourselves... We weren't focusing 100%... and that

turned into a bad atmosphere with everyone. You could sense, you could feel it among us, even the coaches could... They were saying to us, "come on, you've got to try it," and we went to the coaches so many times, we went to the physios and said, "look, you've got to do something about this, we can't cope with her"... I think our actual performance in the competition was created by our lack of concentration in training as well and everything that had been going on.

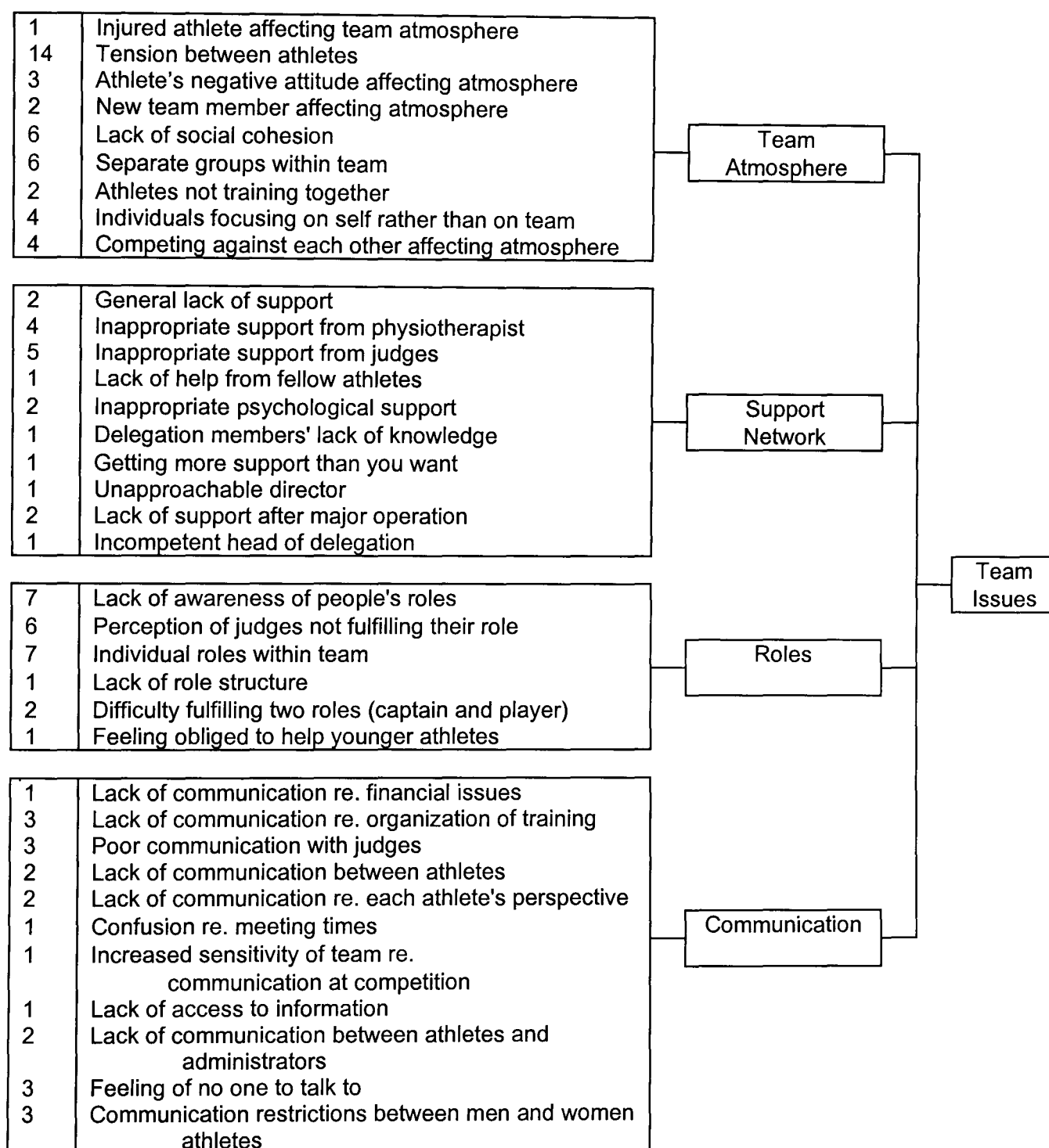


Figure 12. Organizational Stress: Team Issues (the number of athletes mentioning each raw theme is listed in the first column).

Support Network. Support issues were most often related to a lack of support or inappropriate support on behalf of support team members. If the overriding aim of

the organization is for athletes to attain their potential at major competitions, it is not surprising that these athletes expect appropriate support from each support team member. If this support is inappropriate, athletes are likely to feel despondent as the following quote illustrates:

She [a physiotherapist] was just absolutely useless, she'd leave notes on her door: "Back in three hours, I've gone shopping," things like that. And you've just come back from a training session and you need treatment and you'd see her having lunch and you'd say, "can I have some treatment?" and she'd go, "Yes, I've only got 20 minutes, because I'm going swimming afterwards." She was there [at the competition venue] on holiday, which didn't go down very well.

Although a range of support issues was revealed in this study (e.g., psychological support, physiological support), support for injuries was the most widely mentioned issue. Serious injury can be a devastating experience for an athlete (cf. Evans & Hardy, 1995; Udry et al., 1997) and if support is not forthcoming, athletes will likely feel isolated and used. The following quote is a female athlete's account of her feelings with regard to the lack of support following an operation three months prior to a World Championships:

I was just falling deeper into this trap that I just couldn't get out [of]. And I think if I had been encouraged straight from... coming out of hospital, "look, you've got the World Championships in three months, we want you in it, we really want you in it. You come up to [a specific training centre], you have all the rehab. you want, you have all the help you want, you train as much as you want," and I would have been there. But no, I was shoved back to my own little [club]. You then get, you're shut off, you don't know, you can't see what everyone else is doing... you're sort of blind to everything and... it's really hard to... be determined when you're... on your own.

This quote is a potent reminder that squad members might well perceive that they are being treated as a disposable amenity if they do not receive appropriate support when they are injured (see also Udry et al., 1997).

Roles. The main issues to arise with respect to roles were: lack of awareness of people's roles; individual roles within the team; lack of role structure; difficulty fulfilling two roles; and pressure to help others. Being team captain and having to

perform to one's potential was sometimes seen as a difficult task to fulfil as the following quote illustrates:

I didn't like being team captain because I didn't really want any of that rush. I'd shout, "yeah, come on" like that, when I'm ready, not when I'm prompted, like, "the rest of the team are a bit quiet, I think I'll get them going." But then I'd think that my concentration was going a bit because I'm thinking of someone else.

Delegations that travel to major international competitions often comprise many people. It is likely that these people will be more readily accepted as part of the team if everyone else knows what they are there for. It is clear from some of the quotes in this study that this was sometimes not the case. The following quote demonstrates the degree to which some of the athletes were unaware of some of the delegation members' roles:

I don't know what they do, they just always seem to be at competitions, really old people, they don't know what you do in the sport, they haven't got an idea about the training, they just think we're a bunch of little girls.

Communication. The communication issues are listed in Figure 12. Although sound communication between athletes is clearly important for effective team building (cf. Yukelson, 1993, 1997), the present results emphasize the importance of communication throughout the organization as all the members of that organization strive towards a common goal. This is illustrated in the quote below:

You can't sort of be united and everyone striving for one goal when everyone seems to be sort of split into different directions so that no one knows what's happening. You can never really peak as a nation... try and get everything together, because no one knows what anyone else is doing. We don't know what they're doing, they don't know what we're doing.

The following quote shows how poor communication between a coach and a manager not only affects those people, but can affect the whole team:

Bill [a national coach] and Jim [a manager] didn't get on for a long time from the Sydney situation. They didn't talk so there was no

communication between them as in what happens [at training]. Jim would give Bill more paperwork so Bill wouldn't be [at training] so that means we wouldn't get coached. We'd have a go at Bill for not being [at training], and then money became tight... and Jim would say, "some of them have got to go" and then life became difficult because they weren't talking. And because that became difficult we couldn't get on as a unit.

Discussion

Before commencing a discussion of these results, the authors would like to make a number of points. First, organizational stress is by its very nature negative in content. Thus, the present study sought out that which was perceived to be negative. It most certainly is not a *balanced* view of the organization as a whole. Second, in just the same way that the experience of negative emotions does not necessarily have a detrimental effect upon performance (see, for example, Hardy et al., 1996; Woodman & Hardy, 2001a), so it may be that the experience of some organizational stress could be tolerated or even beneficial to performance. Third, in view of the sensitive nature of organizational stress, we believe that the present organization has shown a great deal of foresight in allowing the present study to be conducted and presented in a scientific journal. Indeed, this study is the first step toward positive change and it would be a gross misinterpretation to suggest that this study is simply an indictment of the organization. Fourth, there have been many changes in this organization since the study was conducted. For example, a large number of national coaches have been appointed, and the selection criteria have been made much clearer. Fifth, after recognizing and addressing a number of the issues (e.g., selection criteria), the organization's directors are keen to continue addressing and resolving the issues presented here.

The method employed in this study was designed to yield information on the organizational stress that athletes can experience as they prepare for major international competitions. To the best of our knowledge, this study is the first to investigate organizational stress within a sport organization. Because of its largely exploratory nature, a qualitative methodology was employed. The main sources of organizational stress that were identified were: selection; training environment;

finances; nutrition; goals and expectations; coaches and coaching styles; team atmosphere; roles; support network; and communication.

Unlike business, medical, and military milieus for example, sport organizations (in the UK) may sometimes appoint team managers on the basis of loyalty to their sport rather than on their managerial skills. This can create a difficult working relationship between members of the executive board, senior technical staff, coaches, support staff, and performers. For example, an executive board often comprises former performers and coaches who normally have a good understanding of their sport but have no experience of managing an organization. Thus, amateur managers (e.g., former coaches) oversee professional senior technical staff, regional (often amateur) coaches, and national (professional) coaches. If managers are appointed based predominantly on their loyalty to the sport, then their lack of experience in managing large organizations might be detrimental to the sport organization. Indeed, the present results suggest that coaches, managers, and performance directors need to manage an array of complex skills, including: clear and transparent selection criteria; effective team-building strategies; coach education, particularly on sensitive issues (e.g., weight control); congruent pre-competition plans; and realistic goal setting.

The results of the present project, taken together with those of previous studies (Gould, Eklund, & Jackson, 1992a, 1992b; Gould et al., 1993a; Scanlan et al., 1991), suggest that sport psychologists might have an important role to play in the stress management of members of the sport organizations in which they are involved. As practising sport psychologists, we need to ask ourselves the question: is a sport psychologist equipped with the necessary expertise to help a sporting organization with stress management strategies at the organizational level? Today, with most sport psychology courses biased heavily toward psychological skills training for athletes, we doubt it. Indeed, psychological skills training is unlikely to be particularly helpful in the resolution of many of the issues that have arisen in this project (e.g., poor communication within the organization). However, there are a number of ways in which sport psychologists might be able to help the team at an organizational level. For example, workshops on effective communication strategies could be carried out with coaches, managers, and athletes, using performance profiling (Butler, 1996) as a

catalyst to establish clearer and more open channels of communication between the various members of the organization.

Dale and Wrisberg's (1996) study with a women's volleyball team illustrated the effectiveness of performance profiling techniques for improving communication between coaches and athletes within a team. As a result of the coach and the athletes using profiles over a competitive season, both agreed that there was a more open atmosphere for communication, and the athletes appreciated the increased input they had with regard to their competition goals and training. In light of the predominance of coaching issues in the present study and in a recent study of US Olympic teams (Gould, Guinan, Greenleaf, Medbery, & Peterson, 1999), Dale and Wrisberg's results suggest that performance profiling might prove to be a worthwhile method for improving communication between athletes and coaches. Also, if such techniques were used within the organization as a whole (managers, coaches, athletes, support staff, and administrators), one would hope to see an improvement in communication between members of the organization. Finally, coach education workshops on issues such as nutrition, the emotional response to injury, and appropriate goal-setting would likely be useful tools for increasing coaches' awareness of the potential difficulties that athletes can face.

Over the last fifteen years, there has been a great deal of research on the effects of various types of leadership styles on: group cohesion (Gardner, Shields, Bredemeier, & Bostrom, 1996; Westre & Weiss, 1991); satisfaction (Chelladurai, 1984; Gordon, 1988; Neil & Kirby, 1985; Riemer & Chelladurai, 1995; Weiss & Friedrichs, 1986); effectiveness (Salminen & Liukkonen, 1996; Serpa, Pataco, & Santos, 1991); and burnout in coaches (Dale & Weinberg, 1989). The present data support evidence that athletes' satisfaction is greater when their preferred style of leadership is matched by the leadership style exhibited by the coach (cf. Gordon, 1988). This, in itself, does not seem surprising. However, it has important implications for the structure of training and for the athlete who is exposed to a different style of coaching (e.g., a national coach) as he/she prepares for a major competition. While discrepancies between preferred and actual coaching behaviours have been documented in the literature (e.g., Riemer & Chelladurai, 1995), there are, to our knowledge, no

investigations into a coach's inconsistent coaching style over time, or the effects of being exposed to different coaches with their different coaching styles prior to a major competition. From the evidence of the present data, it seems likely that consistent coaching styles between- and within-coaches will be more conducive to an effective working relationship between coach and athlete. On a larger, national scale, the present results suggest that a clear and comprehensive national coaching program, which clearly defines and monitors good coaching practice, is desirable for attaining peak performance at the elite level. This would likely entail some form of quality-assurance as a requirement for coaches (e.g., a degree in coaching).

Although the present study was an investigation of some of the organizational factors that might affect athletes' preparation, it suffers from two major limitations. One of the limitations of this study is the anonymous way in which the authors have chosen to report the data. The authors felt that this was necessary due to the sensitive nature of the data. However, such anonymity is not without its drawbacks. For example, in order to understand fully the athlete and his/her environment, the organization should ideally be treated within the context of the sport itself and its concomitant structure and culture. It is clear that anonymous reporting of the data precludes such an in-depth discussion of the findings. Despite this limitation, the data reported here are sufficient evidence that organizational stress can be an important issue for elite athletes in their preparation for major international competitions such as World Championships and Olympic Games.

The second major limitation of this study is that the participants were all athletes. If one were to conduct a more complete investigation of an organization, one would need to investigate organizational stress from different members' perspectives within that organization. A question that researchers need to address is: what are the sources of organizational stress for "non-performing" members of the organization (e.g., coaches, officials, managers, support team members, administrators)? Côté and associates' work on the organizational tasks of high-performance gymnastics coaches (Côté & Salmela, 1996; Côté, Salmela, & Russell, 1995a, 1995b) highlights the importance of coaches' being able to deal effectively with tasks that are not directly related to their coaching. In light of the present results, an investigation of coaches'

organizational stress would certainly enhance our understanding of the sport organization from the coaches' perspective.

In their study of schools and school teachers, Cox et al. (1988) adopted a systems approach whereby they investigated stress and possible action strategies in senior school teachers. Most of the strategies suggested by the teachers in the Cox et al. study related to the school as an organization and not to the individual teacher. In their explanation of this systems approach, Cox et al. (1988) concluded: "Whatever the actual mechanism used, it is obvious that dealing with only the teacher, as an individual, was not seen as the way forward." (p. 360). With reference to the athletes interviewed in this study, we concur. Since stress is conceptualised as being a subjective psychological experience (McGrath, 1970), the present authors investigated organizational stress from the individual athlete's perspective. However, as Handy (1986) pointed out, "the root causes of stress are often far removed from the individual person or job and may be more appropriately conceptualised in societal or organizational terms." (p. 206). Consequently, theorists who are interested in developing models of stress in sport would do well to consider not only individuals' subjective experiences, but also the broader organizational, social, political, and cultural environment in which these individuals find themselves.

Much research in sport psychology has focused on the individual and, to a lesser degree, on the performing team. While this research has clearly advanced our understanding of athletes' preparation for competition and the team dynamics involved, it most often overlooks the importance of the organizational setting within which the individual and the performing team are operating. In light of the present project, researchers cannot dismiss the importance of the organizational context if they are interested in understanding how an elite athlete's preparation for competition might affect his/her subsequent performance. Indeed, quotes such as the following one suggest that organizational stress may account for a significant percentage of performance variance.

No one communicated with Bill [a national coach], they just ignored him... In Egypt it was absolutely abysmal and it tore the team apart, and the team we should have beaten by 10-15 marks beat us by 10

marks, so that's the result of what happened... Everyone hated him and everyone sort of carried that on board, and I think that was a big problem.

To date, there is no quantitative evidence to suggest how much performance variance might be accounted for by organizational stress in elite sport. This is likely to be a challenging and fruitful area for future researchers interested in how athletes' preparation for major competitions can affect subsequent performance.

At an applied level, the present results suggest that sport psychologists working with elite teams would do well not to limit themselves to the application of psychological skills training with athletes. Rather, sport psychologists will need to possess and use other skills if they are to address issues such as: increasing coaches' and managers' awareness of sensitive issues such as selection, injury, and weight control; helping coaches with effective coaching styles; and helping managers, directors, coaches, support staff, and athletes to communicate more effectively. At present, the most effective skills for addressing such issues remain unclear. Given the results of this study, this seems an avenue for research that will likely benefit applied sport psychologists, particularly those working with elite sports populations.

Chapter 6

Summary, General Discussion, and Concluding Comments

Introduction

The purpose of this final chapter is to discuss and integrate the findings of the various papers that make up the thesis. The chapter comprises five main sections. The first section is a summary of the aims and major findings. The second section is a critical discussion of the main theoretical implications from the research presented. The third section presents the major applied implications from the studies' findings, and the fourth section outlines the strengths and limitations of the research project as a whole. Finally, recommendations for future research are offered.

Summary

Chapter 2 presented a critical appraisal of stress and anxiety research in sport. Throughout this chapter, a major focus was the relative merits of multidimensional anxiety theory and catastrophe models, the former being an additive theory, the latter being an interactive model. The standpoints of multidimensional anxiety theory (Martens, Burton, Vealey, Bump, & Smith, 1990) and catastrophe models (e.g., Hardy, 1990, 1996a) are not completely compatible for a number of reasons discussed in some detail in Chapter 2. One of the main differences between the two standpoints is the proposed effects of cognitive anxiety and self-confidence upon performance. For example, Martens et al. (1990) proposed that the effects of cognitive anxiety and self-confidence upon performance are independent. Despite these *independent* effects, cognitive anxiety and self-confidence are conceptualised as lying at opposite ends of a *single* continuum (Martens et al., 1990). In contrast, within a butterfly catastrophe model framework, Hardy (1996a) has proposed that the effects of cognitive anxiety and self-confidence upon performance are interactive. In this way, it is argued that higher levels of self-confidence might serve a protective function against the potentially debilitating effects of cognitive anxiety under high levels of physiological arousal. Thus, from these two theoretical standpoints, there are three mutually exclusive views on the effects of cognitive anxiety and self-confidence upon competitive sport performance:

- (a) Cognitive anxiety and self-confidence lie at the two extremes on the continuum of a single construct (Martens et al., 1990).
- (b) Cognitive anxiety and self-confidence exert independent effects upon performance (Martens et al., 1990).
- (c) Cognitive anxiety and self-confidence interact such that high levels of cognitive anxiety combined with high levels of self-confidence are less likely to be detrimental to performance than high levels of cognitive anxiety combined with low levels of self-confidence (Hardy, 1996a).

The aim of the first section of the thesis was to clarify this issue. This section comprised two studies. In the first, a meta-analysis was conducted in order to synthesise the research on the relationships between cognitive anxiety and performance, and between self-confidence and performance. This meta-analysis confirmed that cognitive anxiety and competitive performance are negatively related, and that self-confidence and performance are positively related. Furthermore, the results revealed that self-confidence was significantly more related to performance, thereby suggesting that cognitive anxiety and self-confidence exert somewhat independent effects upon performance. Thus, in relation to the conflicting views outlined above, the first view can be eliminated. In other words, cognitive anxiety and self-confidence do not lie at opposite ends on the continuum of a single construct.

The aim of the second study was to determine whether self-confidence might act as a bias factor within a catastrophe model framework. This study employed an innovative segmental analysis. In this type of analysis, it is possible to determine the precise point(s) along the somatic anxiety continuum (corresponding to the bifurcation set) where the maximum cognitive anxiety x somatic anxiety interaction effect size lies. The main question addressed in this study was: does self-confidence moderate the interactive effects of cognitive anxiety and somatic anxiety upon performance? The results showed that the interaction between cognitive anxiety and somatic anxiety occurred at a higher level of somatic anxiety for the high self-confidence condition as compared to the low self-confidence condition. This finding confirms the moderating role of self-confidence within a butterfly catastrophe model

framework. Although these results did not provide unequivocal support for all the features of a butterfly catastrophe model, they provided fairly unambiguous evidence for the interactive effect of cognitive anxiety, somatic anxiety, and self-confidence upon performance. Thus, in relation to the conflicting views described above, the second view can be eliminated as a possible explanation, and the third view appears the most promising for future research. That is, cognitive anxiety and self-confidence do not exert separate effects upon performance. Rather, their effects (together with those of somatic anxiety/physiological arousal) are interactive and more complex.

One of the problems identified in the meta-analysis was the dearth of studies undertaken with elite performers. In fact, of the 42 studies included in the meta-analysis, only one was conducted with international performers. One of the principal aims of conducting research in this area is to be able to generalise the research findings to other samples within the same population. However, if part of the population of interest (i.e., high-level performers) is not being investigated, such generalisations are likely to be tenuous, at best. At an applied level, this could be particularly problematic. For example, if an applied sport psychologist simply applies knowledge gleaned from relatively low-level performers without a sound understanding of the environment within which the high-level athlete is operating, he/she is likely to lose credibility by making ineffective and inappropriate suggestions (Hardy, Jones, & Gould, 1996a). Previous research investigating high-level performers' sources of stress (e.g., Gould, Jackson, & Finch, 1993a, 1993b; Scanlan, Stein, & Ravizza, 1991) has begun to unearth some of the organizational and occupational stressors in these settings. However, this research has typically not been set within a theoretical framework. Thus, the study presented in Chapter 5 was an attempt to investigate elite athletes' stress within an organizational framework. In delimiting the sources of stress to those related directly to the organization, it was felt that one would begin to better understand the impact of the organization upon elite performers. This interview-based study revealed a number of sources of organizational stress, in particular: selection; the training environment; finances; nutrition; injury; goals and expectations; coaches and coaching styles; the team atmosphere; roles; support networks; and communication.

Theoretical issues

Many theoretical issues in stress and anxiety research were identified in the review chapter of this project. Some of these issues were addressed in the ensuing studies, and others remain to be satisfactorily resolved. The aim of this section is to discuss the main theoretical issues in light of the findings in this project. The section comprises three main headings: (1) the measurement of anxiety, (2) mechanisms underlying anxiety-performance relationships, and (3) alternative paradigms for stress and anxiety research.

The measurement of anxiety

Issues related to the measurement of anxiety were discussed and critically appraised in some detail in Chapter 2 (pp. 31-37). Consequently, they will not be revisited in depth here. However, in light of the findings in this research project, two measurement issues will be discussed in more detail: (1) the measurement of cognitive anxiety, and (2) the measurement of physiological indices of anxiety.

The measurement of cognitive anxiety. The findings from the meta-analysis in Chapter 3 emphatically confirmed the degree to which researchers rely on the CSAI-2 as a measure of cognitive anxiety (and self-confidence) in sport research. Of the 40 studies providing a cognitive anxiety effect size estimate, 38 used the CSAI-2. The other two studies were conducted before the CSAI-2 was available (i.e., before 1983). In light of the criticisms levelled at the CSAI-2 in Chapter 2, the near *sine qua non* status that the CSAI-2 appears to enjoy for anxiety researchers in sport could well represent an impediment to further understanding of anxiety-performance relationships. For example, in Chapter 2 it was argued that the cognitive anxiety items of the CSAI-2 could be interpreted differently, such that they might not be reflective of cognitive anxiety for some performers. Thus, given the reliance on the CSAI-2 as a measure of cognitive anxiety in sport, the call for further validation work on the CSAI-2 (or for a new measure of pre-competitive anxiety) appears more pressing.

The measurement of anxiety using physiological indices. It is now widely accepted that anxiety comprises at least two components: a mental component and a

physiological component. Typically, researchers have measured the physiological component of anxiety in one of two ways: (1) via somatic anxiety, that is, the perception of components of one's physiological arousal, or (2) via the direct measurement of aspects of physiological arousal (e.g., heart rate, skin conductance, adrenaline levels, etc.). At various points in this thesis (e.g., Chapters 2 and 4), a debate has centred on the relative merits of these two methods of measuring the physiological component of anxiety. It has been argued (e.g., Hardy, 1996b) that direct measures of physiological arousal are more likely to advance our understanding of the potentially complex relationship between cognitive anxiety, physiological arousal, and performance. This is because physiological arousal can have both direct and indirect effects upon performance, whereas somatic anxiety can have only indirect effects. In the exploratory analysis investigating butterfly catastrophe models in Chapter 4, somatic anxiety was used as an approximation of physiological arousal. The justification for the use of an indirect measure in this study was based largely on the researchers' reluctance to impose unnecessary constraints in a field setting.

As they are currently used, both indirect and direct measures of the physiological symptoms of anxiety have their advantages and limitations. Somatic anxiety has the advantage of being relatively non-intrusive in a field setting. Also, as measured in the CSAI-2 for example, somatic anxiety taps the perceptions of various indicators of anxiety (e.g., increased heart rate, skin conductance, muscular tension). The major drawback of a somatic anxiety measure is its *indirect* measurement of possible *direct* physiological effects (cf. Hardy, 1996b). Conversely, the principal advantage of direct measures of physiological arousal is that they allow researchers to measure directly the impact of physiological changes upon performance. However, such direct measures can be intrusive in a field setting and thus are normally limited to one indicator (e.g., heart rate). Also, although such indicators are accurate measures of physiological activity, they might be only crude indicators of the physiological symptoms of *anxiety* (cf. Lacey, 1967; Neiss, 1988). Given these considerations and the discussion presented in Chapter 2, direct measures of *anxiety-induced* physiological arousal (e.g., plasma adrenaline) appear to be the most fruitful, albeit challenging, direction for future anxiety-performance research in sport.

Mechanisms underlying anxiety-performance relationships

The results from the meta-analysis confirmed the significant negative relationship between cognitive anxiety and competitive performance. However, the magnitude of this correlation was modest ($r = -0.12$), and the amount of performance variance accounted for by cognitive anxiety was small (in the region of 1.5%). Furthermore, the effect sizes were highly heterogeneous and 28% of the studies reported a *positive* relationship between cognitive anxiety and performance. Finally, the only significant moderator variable was the performers' sex. Taken together, these findings suggest that sport anxiety researchers are not consistently measuring those variables that moderate the relationship between cognitive anxiety and performance.

This could well be an artefact of the fairly unsophisticated theoretical approach advocated by multidimensional anxiety theory. Based largely on theories of attention (e.g., Wine, 1971, 1980), multidimensional anxiety theory postulates that increases in cognitive anxiety will result in performance decrements. However, as discussed in Chapter 2, some models and theories postulate that increases in cognitive anxiety might help to maintain or to improve performance. These include: Humphreys and Revelle's (1984) information processing model, catastrophe models (Hardy & Fazey, 1987), and processing efficiency theory (Eysenck & Calvo, 1992). The conscious processing hypothesis (Masters, 1992) and the theory of ironic processes (Wegner, 1989, 1997) have also offered alternative theoretical explanations for the effects of anxiety upon performance. In terms of possible moderator variables in the anxiety-performance relationship, effort seems to be particularly worthy of more research attention. In simple terms, processing efficiency theory states that an increase in effort will allow a performer to maintain (or improve) performance, albeit at a cost in terms of efficiency. However, conscious processing hypothesis and ironic effects theory both imply that performance will suffer because of *misdirected* effort, that is, effort not normally invested when performance is "automatic" (cf. Näätänen, 1973). Thus, one of the basic differences between the stance taken in processing efficiency theory and the stance taken in both conscious processing hypothesis and ironic effects theory is the nature and role of the effort invested. The effort depicted in

processing efficiency theory is appropriate and will facilitate performance. The effort implied by conscious processing hypothesis and ironic effects theory is inappropriate and will debilitate performance. In terms of exploring the mechanisms underlying the anxiety-performance relationship, both these approaches seem worthy of investigation.

Researchers have provided support for processing efficiency theory (cf. Eysenck & Calvo, 1992; Hardy & Jackson, 1996), conscious processing hypothesis (Hardy, Mullen, & Jones, 1996b; Masters, 1992; Mullen & Hardy, 2000), and ironic effects theory (Wegner, Ansfield, & Pilloff, 1998; Wegner, Broome, & Blumberg, 1997). Thus, it is likely that the approaches advocated by these theories all have some validity. For example, processing efficiency theory could dovetail conscious processing hypothesis fairly nicely (Hardy et al., 1996b). More precisely, in processing efficiency theory, anxious performers are likely to invest more effort by allocating additional processing resources to the task. However, in allocating these extra resources, anxious performers might transfer task control from lower order, automatic subsystems to higher order, controlled subsystems (Eysenck, 1992; Hardy et al., 1996b). Thus, in anxiety-inducing situations, as well as a quantitative shift in processing resources (i.e., an increase in effort), there might be a qualitative shift towards conscious processing (cf. Eysenck, 1992; Hardy et al., 1996b). Furthermore, such conscious processing might reflect either a focus on cues that are normally automatic (Baumeister, 1984) or a focus on cues that are to be avoided (Wegner, 1994).

Despite the appeal of such links between these theories, it is unlikely that any one of these theories can fully account for the behaviour of anxious performers under stress (cf. Hardy et al., 1996b). For example, in attempting to clarify the results from a series of papers investigating the conscious processing hypothesis (e.g., Hardy et al., 1996b; Hardy, Mullen, & Martin, under review; Masters, 1992), Hardy and Mullen (2001) proposed that the potentially detrimental effects of anxiety upon performance might also be viewed from an attentional threshold perspective. Such an argument is based upon the fact that anxiety leads to an attentional deficit in working memory (Eysenck, 1992; Wine, 1971, 1980). In this way, anxiety might take up a portion of

attentional capacity, and relevant cues (associated with conscious processing) might take up an additional portion of attentional capacity. The combination of these two processes might deplete attentional capacity beyond the threshold required for high-level performance. A recent study by Mullen, Hardy, and Tattersall (in preparation) has provided some support for this attentional threshold hypothesis. In this study, golfers' putting performance was impaired in the high anxiety condition by both the shadowing (explicit task-relevant) and tone counting (task-irrelevant) conditions. Although more research is needed in this area, it does seem likely that some sort of attentional threshold exists. Furthermore, when they are anxious, performers are more likely to cross such a threshold (cf. Hardy & Mullen, 2001).

Alternative paradigms for stress and anxiety research

In various parts of this thesis, it has been argued that interactive paradigms are more likely to advance our understanding of the effects of stress and anxiety upon sport performance. The results of the butterfly catastrophe model study (in Chapter 4) support this argument. Although the catastrophe model is not a theory, it does provide a sound framework for investigating the interactive effects of cognitive anxiety, physiological arousal, and self-confidence upon performance. Hardy (1996b) provided a number of ways to test the various aspects of the model, and the analysis employed in Chapter 4 provides an additional method for investigating interactive effects within a catastrophe model framework. In light of the discussion in the previous section (mechanisms underlying anxiety-performance relationships), effort seems worthy of consideration as an asymmetry factor within such a framework (see Chapter 2, pp. 39-45, for further details).

The study presented in the final empirical chapter represented an attempt to gain an understanding of organizational stress within an elite environment. As far as the present author is aware, this study was the first to investigate organizational stress in sport. One of the quotes from this study suggests that organizational stress might account for significant proportions of performance variance in high-level sport. However, to date, there is no quantitative evidence to support such a claim. Notwithstanding the argument presented earlier that more research needs to be conducted in elite settings, it seems unfair and unethical to conduct research on the

precise mechanisms underlying anxiety and performance in such settings. This is because the methods employed might be highly disruptive to performers' preparation whilst the research findings are unlikely to be of direct utility to those performers. However, the findings of Chapter 5 suggest that organizational stress research would be directly applicable and beneficial to elite performers, particularly if follow-up intervention studies were undertaken. Given the passionate nature of some of the quotes, one could argue that it would be unethical *not* to pursue this line of research in elite settings. Certainly, investigations of the stress-performance relationship from an organizational perspective are likely to be fruitful at both a theoretical and applied level.

Applied implications

As the applied implications of the theories and research findings were discussed at various points throughout the project, they will only be listed here. The major applied implications to arise from this research programme are:

- (1) Athletes who are anxious and confident might perform very well. With such athletes, anxiety *reduction* strategies should be used with some caution, if at all.
- (2) Athletes should learn and practise stress management strategies that target cognitive anxiety and physiological arousal separately.
- (3) Sport psychologists should help raise coaches' awareness of behaviours that are likely to diminish an athlete's self-confidence.
- (4) Sport psychologists working with high-level performers should be aware that their efforts might be better invested in organizational issues rather than solely the application of psychological skills training.
- (5) Sport psychologists should help increase coaches' and managers' awareness of the potential impact upon performers of issues such as: inappropriate selection procedures, injury, weight control, inappropriate coaching styles, a poor training environment, and poor communication.

Research strengths and limitations

The principal strength of this research project was its innovative approach to the study of stress and anxiety in sport. After clarification of the terms such as stress, anxiety, and arousal, the review chapter was an attempt to bring together current theories and models from sport psychology and mainstream psychology. The meta-analysis was essentially two meta-analyses, synthesising the research findings of two relationships (cognitive anxiety – performance, and self-confidence - performance). This was principally to examine the relative impact of cognitive anxiety and self-confidence upon performance. The results of the meta-analysis suggested that self-confidence, compared to cognitive anxiety, was more strongly related to performance. Another aim of the meta-analysis was to elucidate the debate regarding the independence (or otherwise) of the effects of cognitive anxiety and self-confidence upon performance. Comparisons between these two relationships provided support for the view that cognitive anxiety and self-confidence exert independent effects upon performance. The study presented in Chapter 4 was an exploratory investigation of the role of self-confidence within a butterfly catastrophe model framework. This involved an innovative segmental analysis, thus providing future researchers with a relatively simple method for testing higher-order catastrophe models. Finally, the study presented in the penultimate chapter was, to the best of the present author's knowledge, the first to investigate organizational stress in a sport organization. This study revealed a number of organizational issues that are likely to have a considerable impact upon performance at an elite level. The study also extended Carron's (1982) group dynamics framework to provide a theoretical basis for future organizational stress research.

There were a number of specific limitations in this thesis. For example, in Chapter 4, a physiological indicator of anxiety (rather than somatic anxiety) would probably have been a better choice for measuring the asymmetry factor of the catastrophe model. Also, in Chapter 5, a more holistic approach to the study of organizational stress would have included different members of the organization rather than simply the performers. As these and other limitations associated specifically with each study were discussed in some detail in the respective chapters, they will not be revisited here. However, as a whole, this research project suffers one major limitation.

Ironically, it is the title of the project that best reflects this limitation. That is, as the present research programme was an attempt to investigate stress and anxiety from a number of different perspectives, it did not adhere to one systematic and coherent line of research. If such a line had been adopted, perhaps this thesis would have allowed further exploration of some of the issues, notably some of those outlined in the next section.

Future research directions

With reference to the findings from the present research project, there are a number of research directions that are worthy of further consideration. A more valid measure of anxiety (of cognitive anxiety in particular) is urgently needed. This is particularly important in light of the criticisms levelled at the CSAI-2 (see Chapter 2) and the degree to which researchers rely on this measure as a measure of competitive anxiety (see Chapter 3). Such has been the reliance on the CSAI-2 that (cognitive) anxiety research in competitive sport could almost be termed “concern” research. Such ambiguity is not likely to be helpful in understanding the effects of *anxiety* upon sport performance.

Physiological arousal cannot be measured with a questionnaire. Thus, future research investigating the effects of cognitive anxiety and physiological arousal should measure physiological arousal both directly and indirectly. However, simply measuring exercise-related physiological arousal (e.g., heart rate) might not be the best way to measure *anxiety*-induced physiological arousal (Lacey, 1967; Neiss, 1988). This is because similar physiological responses might be reflective of different emotional states. For example, elevated heart rate could be symptomatic of high levels of anxiety (e.g., prior to an important competition) or symptomatic of low levels of anxiety (e.g., during a training session). Consequently, physiological indicators that specifically reflect anxiety (e.g., plasma adrenaline, cortisol) should be explored in more detail. One obvious starting point for such research is the exploration of the differential effects of adrenaline and noradrenaline upon different aspects of performance (cf. Dimsdale & Moss, 1980; Fibiger & Singer, 1984; Hoch, Werle, & Weicker, 1988; Williams, Taggart, & Carruthers, 1978). Of course, in many sports, athletes might have high levels of anxiety-induced physiological

arousal and high levels of exercise-induced physiological arousal. The effect of this interaction upon performance might well be different to the effect of either type of physiological arousal alone. This is certainly worthy of future research.

In light of the findings of previous research (e.g., Deffenbacher, 1977; Edwards & Hardy, 1996; Marañón, 1924; Schachter & Singer, 1962) and of the present research project (Chapter 4), there is fairly conclusive evidence that cognitive anxiety and physiological (or somatic anxiety) interact with each other. Thus, research examining their effects upon performance should employ an interactive framework (Hardy, 1990; 1996a). At present, amongst those models and theories of anxiety and performance in sport, catastrophe models alone offer such a framework.

Consequently, they are worthy of further research attention. As the validity of surface-fitting procedures remains to be elucidated (see Alexander, Herbert, DeShon, & Hanges; Cobb, 1978; Guastello, 1992), the two most obvious avenues for future researchers are: the exploration of the interaction between cognitive anxiety and physiological arousal using quadrant analysis techniques (Edwards & Hardy, 1996; Hardy, 1996b); tests of the hysteresis hypothesis (Hardy, 1996b; Hardy, Parfitt, & Pates, 1994); and segmental analyses for exploring bias factors in higher-order catastrophe models (Chapter 4). All of these approaches require only a basic level of understanding of analysis of variance and so are readily amenable to investigation. Another fairly straightforward method of investigating the interaction between cognitive anxiety and physiological arousal would be to use split-sample regression techniques. In using such techniques, one would expect the regression slope between cognitive anxiety and performance to be more positive under low levels of physiological arousal (the left side of the catastrophe model) than under high levels of physiological arousal (the right side of the model).

The catastrophe models are not a theory. That is, they do not provide a theoretical explanation for the proposed effects of cognitive anxiety, physiological arousal, and self-confidence upon performance. Rather, they are an attempt to accurately model these effects (Hardy, 1999). Some theories do provide explanations that fit some of the predictions of the catastrophe model. These theories include: processing efficiency theory, the conscious processing hypothesis, and the theory of ironic

effects. For example, all of these theories could be incorporated into a catastrophe model framework to explain performance catastrophes under elevated cognitive anxiety. However, none of these theories would use physiological arousal as an asymmetry factor to explain these performance catastrophes. For example, in explaining the results of previous hysteresis studies (Hardy & Parfitt, 1991; Hardy, Parfitt, & Pates, 1994), Hardy (1999) suggested that the asymmetry factor for the cusp catastrophe model might be better labelled “effort required”. Thus, in terms of using a catastrophe framework to model the effects of anxiety upon performance, future researchers would do well to investigate effort required as an asymmetry factor (Hardy, 1999). Furthermore, effort required would be fairly easy to manipulate in either a laboratory setting or a field setting.

Although organizational stress research in sport is in its infancy, the implications of the preliminary findings presented in Chapter 5 are potentially significant for elite sport. For example, the results suggest that sport psychologists would do well to invest a considerable proportion of their effort in assisting coaches and managers rather than limiting themselves to psychological skills training with athletes (cf. Hardy & Parfitt, 1994). An obvious lacuna of the study presented in Chapter 5 is the failure to investigate the sources of organizational stress from coaches’ and managers’ perspectives. This is an avenue for future research. In obtaining the perspectives of different members of an organization, researchers will begin to understand more fully the issues that underlie an elite athlete’s preparation for major competitions. Also, the development of an organizational stress questionnaire is likely to be worthwhile in determining the magnitude of organizational stress effects upon the performance of elite athletes.

Conclusion

The aim in the present research project was to explore different approaches to the investigation of stress and anxiety in sport. The review chapter, the meta-analysis, and the catastrophe model study allowed some important conceptual issues to be addressed and largely resolved. In turn, these approaches and the study of organizational stress have brought up new questions that are likely to attract considerable research attention in the future.

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Appendix A

Statistical summary of the cognitive anxiety studies included in the meta-analysis, with outliers ($n = 4$) removed.

Statistic	Value (including assumed $r = 0$ results), $n = 36$	Value (excluding assumed r $= 0$ results), $n = 30$
<i>Central tendency (r)</i>		
Unweighted mean	-0.09	-0.11
Weighted mean	-0.13	-0.15
<i>Significance tests</i>		
Combined Stouffer Z ($\Sigma Z/\sqrt{n}$)	4.10, $p < 0.001$	4.49, $p < 0.001$
t -test for mean z_r	2.51, $p < 0.01$	2.55, $p < 0.01$
<i>Variability (r)</i>		
Maximum	0.35	0.35
Quartile 3 (Q_3)	0.03	0.05
Median	-0.07	-0.10
Quartile 1 (Q_1)	-0.21	-0.30
Minimum	-0.52	-0.52
$Q_3 - Q_1$	0.24	0.35
Standard deviation (SD)	0.21	0.23
Standard error (SD/\sqrt{n})	0.03	0.04
<i>Confidence intervals (r)</i>		
90%	-0.03 to -0.15	-0.04 to -0.18
95%	-0.02 to -0.16	-0.03 to -0.19
99%	-0.00 to -0.18	-0.00 to -0.22

Appendix B

**Statistical summary of the self-confidence studies included in the meta-analysis,
with the outliers ($n = 4$) removed.**

Statistic	Value (including assumed $r = 0$ results), $n = 33$	Value (excluding assumed r $= 0$ results), $n = 28$
<i>Central tendency (r)</i>		
Unweighted mean	0.25	0.29
Weighted mean	0.26	0.30
<i>Significance tests</i>		
Combined Stouffer Z ($\Sigma Z/\sqrt{n}$)	10.07, $p < 0.001$	10.93, $p < 0.001$
t -test for mean z_r	6.54, $p < 0.001$	7.47, $p < 0.001$
<i>Variability (r)</i>		
Maximum	0.57	0.57
Quartile 3 (Q_3)	0.42	0.43
Median	0.26	0.32
Quartile 1 (Q_1)	0.01	0.08
Minimum	-0.02	-0.02
$Q_3 - Q_1$	0.41	0.35
Standard deviation (SD)	0.20	0.19
Standard error (SD/\sqrt{n})	0.04	0.04
<i>Confidence intervals (r)</i>		
90%	0.20 to 0.31	0.23 to 0.35
95%	0.18 to 0.32	0.22 to 0.36
99%	0.16 to 0.34	0.20 to 0.38

Appendix C

Organizational Stress Interview Guide

During this interview, we are interested in your experience of international British [specific sport] and how you perceived certain organizational issues before and during major international competitions such as World Championships and Olympic Games. I will sometimes use the term “team” during this discussion; the team refers to all the athletes, coaches, personnel, and any other people that were involved in the competition as part of the British delegation.

Could you tell me about the team’s psychological preparation for these competitions?

Could you tell me about your psychological preparation for these competitions?

Could you tell me about the structure of training?

Did the training sessions change as the competition approached?

Could you tell me about the training scholarships and bursaries?

Could you tell me about the selection process?

Could you give me a feel for what your training was like during the lead up to the competition?

Could you tell me what the training was like at the competition?

Could you tell me about different people’s roles within the team?

Could you tell me about people’s goals and expectations?

Could you tell me about the team’s goals and how they were decided?

Could you tell me about people’s diets?

Could you tell me about the different coaches that were involved?

Could you tell me about the different coaches’ styles of coaching?

What was the team atmosphere like as the competition approached?

How happy would you say people were before going to the competition?

How happy would you say people were at the competition?

Could you tell me about different people’s contributions to the team?

Could you tell me about the support the athletes received from the rest of the team?

Could you tell me about how injuries were dealt with in the team?

Could you tell about the communication between people in the team?

Is there anything that we haven't talked about that you are able to tell me about your experience of this organization?

Prompts

How did that work?

How did people feel about that?

What effect did that have?

Could you enlarge a bit upon that for me please?

Is there anything else you could tell me about [e.g., the selection process]?

Could I just make sure I have got that right? [Recapitulate the participant's response to the question].