University of Southern Queensland

The working relationship between horse and rider during training and competition for equestrian sports

A dissertation submitted by

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Certification of Dissertation

I certify that the ideas, experimental work, results, analyses and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

Signature of Candidate Date

Endorsement

Signature of supervisor Date

The Horse

Where in this wide world can man find nobility without pride,

Friendship without envy, or beauty without vanity.

Here, where grace is served with muscle and strength by gentleness confined

He serves without servility; he has fought without enmity.

There is nothing so powerful, nothing less violent.

There is nothing so quick, nothing more patient.

Our past has been borne on his back.

All our history is in his industry.

We are his heirs, he our inheritance.

Duncun (1954)

Publications

Bridgeman, D. J., & Pretty, G. M. (2005). *Exploring heart rate as an indicator of synchronisation between dressage horse and rider at training and competition.* Paper presented at the ISSP 11th World Congress of Sport Psychology, Sydney, Australia.

Pretty, G. M., & **Bridgeman, D. J.** (2005). Of two minds: Consulting with the horse-and-rider team in dressage, showjumping and polo. In J. Dosil (Ed.), *The Sport Psychologist's Handbook* (pp. 569 - 585). Chichester, West Sussex: John Wiley.

Bridgeman, D. J., Pretty, G. M. & Tribe. A. (2006). *Heart rate synchronisation of dressage horse and rider during the warm up period for a competition dressage test.* Paper presented at the Australian Equine Science Symposium, Surfers Paradise, Australia.

Abstract

The working relationship between horses and riders is a unique association requiring cooperation between both to achieve the goals of humans in their selected equestrian sport. This dissertation chose the equestrian sports of eventing and dressage to investigate this working relationship between horse and rider, and its stability across training and competition settings. Consideration was given to psychological, physiological and behavioural factors for the human and horse. The research required the development of a measure to indicate the harmony of the working relationship, which resulted in a rider and observer inventory, and of a physiological indicator of the relationship which became the correlation between the horse and rider heart rate and was called heart rate synchronisation. To examine reactive behavioural factors of the horse a horse Behaviour Check List was created, and to consider possible psychological factors implicated in this behaviour a Horse Temperament Inventory was developed. Anxiety was the psychological factor chosen to assess the rider, and the Competitive State Anxiety Inventory – 2 and the Emotion and Mood Components of Anxiety – Questionnaire were used as its different components.

It was hypothesized that there would be significant environmental differences between most factors with the competition environment showing evidence of lower working relationship scores, higher heart rates, higher rider anxiety, and more reactive horse behaviours. Horse temperament was considered to be a trait and therefore no differences were predicted. Negative relationships were hypothesized between the working relationship measures and rider anxiety components, horse temperament and critical horse behaviours. A positive relationship was hypothesized between rider self confidence and the working relationship. Negative relationships were also predicted between rider anxiety, horse temperament and horse behaviour. No specific predictions

were made regarding relationships between rider and horse heart rates and the other factors.

In Study 1 with five eventing teams, results from Cohen's *d* analyses of differences between means supported some hypotheses. A moderate to large effect size was found for rider's somatic anxiety and heart rate being higher in the competition environment, but no significant effects were found for the rider's cognitive anxiety and levels of self-confidence across environments. However, contrary to hypotheses, working relationship and the heart rate synchronisation factors had higher scores in the competition environment and showed a small and large effect size respectively. The horse's temperament was also more positive in the competition environment, with the Horse Temperament Inventory – Rider (HTI-R) revealing a small effect size and the Horse Temperament Inventory – Observer (HTI-O) without the rider a large effect size, suggesting that it seems to be identifying a psychological state of the horse rather than the hypothesized temperament traits. The hypothesis regarding the horse and rider's heart rate was also accepted as they also increased in the competition environment. The horse's maximum heart rate and minimum heart rate showed a moderate effect size and a large effect size was found in the differences of the horse's mean heart rate. The rider's maximum heart rate and mean heart rate data also showed a large effect size and the rider's minimum heart rate means showed a moderate effect size. Due to unforeseen circumstances and the low number of participants, the hypotheses could not be evaluated using inferential statistics. However, the patterns of the findings led to some modifications of methods and the selection of another equestrian sport for Study 2.

The findings from Study 2 with thirty dressage teams indicate the working relationship between horse and rider was stable across environments during a dressage test. The heart rate synchronisation analysis was able to identify significant

relationships between most horse and rider teams during a dressage test in both the training and competition environments. At a group level the correlation between the horse and rider heart rates displayed a significant positive relationship in the training environment, but not in the competition environment. A t-test analysis found stability of the horse's temperament across environments, suggesting that the Horse Temperament Inventory is measuring temperament traits. Also the rider's somatic anxiety showed a significant increase in the competition environment, which was also reflected in the rider's emotional experience of this anxiety. Unexpectedly the rider's self-confidence was also significantly higher in the competition environment. However, no predicted associations were found between working relationship scores and heart rate synchronisation, or between these measures and horse and rider factors.

The relationship between reactive horse misbehaviours and rider anxiety, and the team's working relationship was analysed. A significant association was found between each of the rider's and judge's ratings of the working relationship and heart rate synchronisation with the horse's misbehaviour scores in the competition environment. The rider's somatic anxiety also showed a significant association with the horse's misbehaviour in both the training and competition environments. Significant relationships were also found between horse misbehaviour and performance in both training and competition environments. To extend this investigation further a discriminant function analysis was conducted to determine if the riders with levels of high and low cognitive and somatic anxiety could be categorised on the basis of horse temperament. It revealed that riders with high and low levels of somatic anxiety could be categorised on the basis of the horse's temperament score, whereas riders with high and low levels of cognitive anxiety could be classified on the basis of the horse's heart rate means in the competition environment.

Overall, the dissertation has significant methodological, conceptual and practical outcomes. It demonstrates possible self report, observational and physiological indicators to assess the horse-rider working relationship, and a reliable measure of horse temperament. It also addresses several speculations, assumptions and anecdotal references in the literature about the interactive association between horse and rider. Findings here point to significant associations between horse and rider psychology and physiology, and patterns of relationships that may indicate some relevance to the working relationship, and ultimately performance.

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Preface

A life amongst horses drives a desire to comprehend how we have this extraordinary working relationship with nature's most noble creature.

Horsemanship skills have been passed traditionally by word of mouth from one horse trainer to the next. Thus, a lot of knowledge and skill has been lost with the passing of these horsemen as little documentation exists of their expertise. Indeed, much of the literature that does exist regarding the working relationship between horse and rider is derived from a few anecdotal sources. These originate from historical accounts which also reflect superstition and cultural traditions of horsemen from around the world. These horsemen used many different training strategies and techniques which are based on as many varied philosophies. The horse-rider partnership is considered to be very emotive, and conjecture regarding this working relationship is that it is within the domain of a sacred attachment (Keaveney, 2008).

To a person who regularly trains horses this absence of evidence-based understanding of the equine-human working relationship is frustrating. Equestrian sport demands horse and rider work together to succeed. Thus, the evaluation and understanding of both horse and rider behaviour as it occurs interactively is required to determine factors that promote good teamwork and performance during competition.

To consider both horse and rider factors in the one study requires the researcher to cross the boundaries of several scientific disciplines; animal behaviour, comparative psychology, human and animal physiology, and sport and exercise psychology. There are many challenges in integrating terminologies, conceptual frameworks and methodological traditions of such diverse fields, which often disagree with each other. For example, in reviewing the literature for animal behaviour, some researchers examine and describe animal behaviour without attribution of complex

cognitive, emotive or social processes (Tribe, 1998). However, there is another perspective taken by other researchers who consider animal behaviour to be associated with cognitive and emotional processes such as problem solving, attitudes and mood (Fraser & Broom, 1990).

The literature and research informing this dissertation and reviewed in Chapter One integrates both perspectives. The author does not set out to critique or take a position on these two perspectives as part of the rationale for the dissertation or its design.

This dissertation draws together theories and methods that span the scientific disciplines of horse and human behaviour, physiology and psychology. It is recognised that each discipline has different traditions in its organisation and presentation of literature reviews, methods data, and findings. This dissertation was developed and supervised within a Department of Psychology, and hence the tradition in which it is written is within the discipline of psychology and complies with the American Psychology Association (APA 5th edition) format.

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I acknowledge and give my thanks to the eventing and dressage riders throughout Southeast Queensland who willingly gave up their valued time and allowed me into their competitive sporting domain to be part of my investigations.

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Introduction

The rationale and overview of the dissertation

The equestrian team is comprised of a human and a horse working interactively to achieve the sport goals and the related personal satisfaction of the human. The horse provides the transportation, speed, agility and power for the sport. The rider gives direction and encouragement to the horse to perform the sporting activity. Therefore, an understanding of the dynamics of this unique human-animal working relationship requires the knowledge of the interactive characteristics of both horse and rider. Within the few empirical studies that are available, the focus is on either the horse or the rider, but not on the horse-rider team. The study of the horse by equine scientists, and the study of the rider by sports psychologists, each explore only half of this team's dynamics. Also, while psychological factors are primarily the subject of rider research, physiological and behavioural factors are primarily the subject of equine research. It is therefore necessary to investigate all three domains for rider and horse to provide evidence of factors important to the working relationship and performance outcomes. Hence this is the general rationale for and purpose of this dissertation. However, due to the lack of empirical work within these three domains for humans and equines, the availability of appropriate valid and reliable methods was limited. Therefore, a second general purpose of the dissertation is to further the development of such methods to capture physiological, behavioural and psychological components of the interaction. At the time of writing this dissertation, five published studies directly relating to working relationship between the horse and rider were found in extensive literature searches. Two originate from work conducted for this dissertation and presented by the author at conferences (Bridgeman & Pretty, 2005; Bridgeman, Pretty, & Tribe, 2006) and three studies (Lansade, Bouissou, & Erhard,

2008; Peham, Licka, Kapaun, & Scheidl, 2001; Peham, Licka, Schobesberger, & Meschan, 2004) are published in scientific journals.

Before continuing to describe the structure of the dissertation, the following background to equestrian sport is provided for the reader who may not be familiar with its disciplines and skill set. The working relationship between horse and rider is defined in this dissertation as *the interaction between horse while under saddle and its rider where the horse is directed to execute specific behaviour in an equestrian sporting context such as jumping a fence or performing dressage movements at walk, trot and canter*. The studies in this dissertation assess this interaction based on operational definitions of quality human-horse interaction which include: significant positive relationship between heart rates of horse and rider during the interaction, riders' high ratings on the Working Relationship Inventory, and A level dressage judges' ratings on the Working Relationship Inventory. Training sessions and competitions in the equestrian sports of eventing (cross country phase) and dressage provided the contexts for the studies. A brief description of these sports will be provided next, again so the reader can appreciate the relevance of the particular factors chosen for investigation in the dissertation. A more detailed description follows in each chapter describing the particular study.

Eventing is the triathlon of equestrian sports, conducted over one or three days. It combines dressage, cross-country and showjumping phases. Each phase requires different expertise of the rider and talent from the horse, and together they seriously challenge the horse-rider relationship. For the first study the cross country phase of eventing was chosen as the site for investigation. It requires the horse, under the direction of the rider, to jump a series of fixed obstacles on a course which is laid out in natural environments, such as fields, hills and wooded areas. Performance

demonstrates the courage, endurance, manageability, obedience, and suitability of both horse and rider within this discipline. All of these are indicative of a good working relationship.

Dressage is the training of a horse to be obedient and responsive to perform gymnastic movements with cadence, suppleness and impulsion in the three gaits of walk, trot and canter. This is achieved through the horse's acceptance of the rider and its relaxation while being obedient to the rider. The horse's calm, obedient response to the rider's subtle instructions reveals the level of harmony in the working relationship between human and horse.

In each of these sports the horse responds to the rider's direction through the rider's use of what are called riding aids. These aids are the communication line between horse and rider. They include the rider's use of his hands, legs, weight and voice. The rider's hand position on the rein, leg pressure on the saddle girth and weight distribution in the saddle governs the gait, speed and direction of the horse. Furthermore, these aids are used in unison to generate power in the hindquarters of the horse. This produces the level of impulsion required for the collection and cadence needed in the horse's gaits to manage a jump over cross-country obstacles or execute the more complex dressage movements. The rider's voice is used to sooth and calm the horse, as well as to motivate it during challenging circumstances. In summary then, quality of the working relationship requires physical, psychological and behavioural aspects of the rider's correct and timely use of his aids, and the horse's calm, athletic and obedient response to the aids. The outcome of the application of the rider's aids is reflected in the heart rate synchronisation of horse and rider, the rider's ratings and the judge's ratings of the horse-rider working relationship.

When considering the working relationship of horse and rider in equestrian sport, it is also necessary to consider whether the relationship is consistent across training and competition environments. This is because, as will be described later, the horse tends to be very attentive and sometimes reactive to changes in environment. This can further challenge the rider psychologically and physically to maintain the performance standard evident in the horse's home training environment. To investigate factors related to the consistency of their working relationship, equestrian teams were studied in their home training setting and in their subsequent competition setting.

The choice of factors that may be associated with the quality of the horse – rider working relationship was fairly narrow as within the equine behaviour science and sport psychology science few constructs have been explored. The literature review points to the possible relevance of the horse's temperament and misbehaviour, both of which are considered to have some emotive connection. Factors related to the rider that are considered relevant include state anxiety (cognitive and somatic), self confidence and the emotion and mood components of anxiety.

Dissertation Objectives

This dissertation has several objectives. Initially the work had to address the development of a method and process for assessing the quality of working relationships between horse and rider in equestrian sport. This involved establishing the heart rate synchronisation of horse and rider, and a rating method of the horse-human interaction by the rider and trained judges. Secondly, the dissertation sought to establish horse and rider factors associated with quality working relationships, and investigated factors suggested from previous research and anecdotal writing about the horse's temperament and misbehaviour and the rider's level of anxiety. Thirdly, the studies considered

whether the working relationship and the horse and rider factors associated with it were stable across training and competition environments.

Dissertation organisation

Following this introduction the dissertation begins with a review of the literature in Chapter One which critically considers research related to the working relationship of the equestrian team, and factors related to the horse and rider as separate athletes. Research and anecdotal literature regarding horse behaviour, temperament and heart rate are described with reference to investigations in equine social organisation, senses, and psychology. This is followed by a discussion of conceptual frameworks and related investigations into rider's sport psychology, particularly anxiety, and heart rate. This review then forms the conceptual and empirical basis to hypothesise about the equestrian team's working relationship in training and competition environments. It also points to the challenges in developing valid and reliable methods to investigate these hypotheses.

Chapter Two describes the first study involving eventing teams in the cross country phase. This study involves the initial development of methods and processes for the research that are also appropriate for training and competition environments. The physiological and psychological factors of the individual horses and riders, and the associations between these factors and the working relationship, are analysed. The findings and challenges of the eventing study provide the rationale and design for the the second study with dressage riders in Chapter Three. This chapter describes the replication of some of the methods and analyses of the eventing study with some modifications required to investigate the dressage equestrian team. One of the additional outcomes in the second study is a more in-depth analysis of horse

misbehaviour in training and competition environments, and its relationship to riders' anxiety and performance outcomes. This analysis of horse behaviour is described in Chapter Four. Opportunity for this analysis was afforded by the observers who are trained to evaluate horse behaviour.

Chapter five critically reviews and discusses the overall findings from the two studies with regard to the earlier research and anecdotal speculation about horse-rider working relationships. The challenges of conducting equestrian team research are described with recognition of the methodological limitations of these two studies. It concludes with consideration of focus and methods for future research to address the working relationship between horse and rider.

Chapter 1. Exploring horse and rider factors and interactions, and implications for the equestrian team's working relationship: A literature review

This review considers animal science and sport psychology literature to summarise what is currently known about the dynamics of horse and human interaction, and how each impacts on the other in a working relationship in equestrian sport. The review begins with a brief introduction to the nature of how horses and humans became partners, despite the innate predator-prey relationship. This is followed by an overview of the little research and descriptive writing that has attempted to delineate factors associated with a quality working relationship. On the basis of this literature the selection of specific factors for investigation in this dissertation is made. Critical consideration is next presented of research and methods regarding horse temperament, rider anxiety, and horse and rider heart rate. The integration of this work across animal science and sport psychology concludes with the questions and hypotheses to be investigated in this dissertation.

1.1 A brief history of horse-human relationships

Horses are very adaptive, surviving as a species for 65 million years (Goodwin, 2002). The evolution of the relationship between horse and rider began with the domestication of the horse around 4000 BC when humans herded them for meat (McMiken, 1990). Much literature has been published regarding the behaviour, management and physiology of the horse, and it shows that even though there is a long period of human management and domestication, horses' instincts and behaviours are still similar to their wild congener (Christensen, Zharkikh, Ladewig, & Yasinetskaya, 2002; Waring, 2003).

The earliest anecdotal writings on the topic of horse-human relationships have been scribed from approximately 1350 BC (McMiken, 1990), where the first indications of training horses for more specific work outlined the training of horses for use with chariots (McMiken, 1990). Of interest in these writings is how humans proposed to change the innate predator-prey relationship, such that the horse would be a willing and obedient servant. Xenophon (400 BC, translated by Morgan, 1894) outlined the art of selecting, managing and training warhorses. He advocated in his writings that gentleness in handling horses combined with a strong knowledge of the horse species and its behaviour are required to be a successful horseman. Later, in the early Olympic Games the only equestrian sports were chariot contests; although by the 33rd Olympiad (648 BC) contests for riding horses were also included (Xenophon, 1894). Much later, Xenophon's text formed the basis of the renaissance in horse riding in the sixteenth century and became the foundation of classical dressage training as practised today (Podhajsky, 1967).

Today the demands for the horse to run faster, jump higher and be more artistic is worth millions of dollars to owners, breeders, Olympic scouts and punters. The equestrian sport industry has developed into an international market place, ranging from small family-owned breeders of sport horses to international sport horse dealers. These increasing pressures of the horse and human relationship further impact on the challenges of the working relationship, with the demands for more precision and agility requiring more sensitivity and understanding in training. However, because the potential of a well-bred horse is realised only if a trainer can shape its talent into performance, the industry seeks science-based information on how to improve the working relationship to ensure its equine investments are protected and developed to full potential (Keaveney, 2008). This dissertation therefore endeavours to contribute to

this behavioural science which will inform not only equestrian sport performance, but the general equine industry.

1.2 Factors implicit in the equestrian working relationship

An effective working relationship between horse and rider is central to any equestrian activity. However, there is little empirical literature to inform equestrians seeking to improve this relationship, as few researchers have explored horse and rider interaction (Mullins, 1999). The animal science literature investigates the responses and reactions of horses to humans in general, but there is no delineation of what human factors the responses are associated with. Similarly, the sport psychology research reports on riders' physiological and psychological reactions during equestrian sporting events, but these have not been associated with particular factors related to the horse. Therefore, most of the information in the following review, regarding the relationship between horse and rider, originates from the observation and informed opinion of the referenced authors considered to be experts in the field. This is the main source of establishing hypotheses for empirical investigation. At best these writings are individual case studies, and at worst speculation from anecdotes that tend to anthropomorphise horse behaviour (Hausberger & Muller, 2002).

However, these writers do implicate the individual horse and human factors which have been studied, and as such they provide a context to understanding the selection of these individual factors for the dissertation.

The relationship that develops between a horse and its rider is an important consequence of equestrian activities. The quality of this relationship is described by different words depending on the discipline. The dressage rider describes a horse as being in harmony. An observer of the dressage horse and rider working together may be

reminded of two dancers or two ice skaters performing together with smooth and graceful flow of patterns of movement (Keaveney, 2008). In dressage this fluidity is apparent in the rhythm, suppleness, flexibility and impulsion of the horse, combined with the rider's subtle communication to the horse with riding aids. In this situation the rider reports great satisfaction with the responsiveness and willing behaviour of the horse (Game, 2001). It is further suggested that the rider's reported psychological state also reflects the horse's responsiveness and willingness to work during their interaction (Hama, Yogo, & Matsuyama, 1996). This may also suggest evidence that the horse is reflecting its own state of well-being in its willingness to work. However, any loss of communication or attention by horse or rider is a disruption in the harmony of the working relationship during the dressage test.

Whilst dressage riders talk of harmony, this working relationship is described by eventing riders as partnership (Wipper, 2000). Wipper discusses opinions on the interactive nature of the partnership between horse and rider from the perspective of elite level athletes. These elite eventing riders tend to blame themselves for poor outcomes during training and competitions. They do not consider the horse is at fault for any deficits in their performances (Wipper, 2000). They take responsibility for the partnership. This discussion next considers the horse's reactivity to human behaviour, and the implications of these factors for the working relationship.

It has been suggested that the projection of negative feelings from the rider to the horse seriously disturbs the development of the working relationship in training and competition (McGreevy, 2002; McGreevy, French, & Nicol, 1995). A rider's mood, attitude and related behaviour can determine the kind of information the rider gives to the horse. The calm, confident and focused rider gives consistent and clear direction to the horse through sensitive use of the riding aids. From this leadership the horse has a

sense of safety and trust which promotes the horse's positive attitude and calm consistent behaviour. This reciprocal interaction strengthens the working relationship between them. However, a rider's negative attitude and related behaviour can cause the horse to be confused in what it is being told to do. This may result in the horse's behaviour becoming more problematic and disrupting the working relationship.

It is thought that this reactivity to human behaviour is related to horses' keen observation of the body language of other species, including humans, and their sensitivity to touch (Williams, 1999). Horses may interpret the posture of the human and their direct eye contact similar to that of any other prey animal. Feh and de Mazieres (1993), McBride, Hemmings and Robertson (2004) and Ligout, Bouissou and Boivin (2008) have postulated from their empirical investigations that horses may perceive human contact such as stroking as positive. A horse may "sense" a rider's confidence, focus and emotional state through sensitivity to the rider's state of tension or relaxation in their posture in the saddle, in their contact with reins and tone of their voice (Williams, 1999). Williams suggests that the rider's physical appearance and behaviour can generate a response that some have called anxiety in the horse. This may activate the horse's natural flight response to escape the situation, impacting on the competition performance and the personal safety of the rider. Rees (1984) considers this to be evidence of the horse interpreting the riders' anxious tension and aggressive behaviour as threat, prompting their innate preparation for flight away from the anxiety-producing stimulus. This issue will be revisited later in terms of the relevance of assessing a rider's mood and anxiety in relation to the horse-rider working relationship

As suggested above, horse behaviours have been interpreted as indicative of a range of feelings. The research of Mills (1998a) showed that individual horses may behave differently in response to the same environmental stimulus. However, it is the

opinion of Williams (1999) that this diversity of responses is not so much related to different feelings as it is suggestive of anxiety that may be aroused by particular individual humans. For example, if a rider ignores the escape response behaviours displayed by their horse, it may increase the intensity of the behaviour by becoming hyper-reactive and flighty, looking to shy or bolt or pulling the reins through the rider's hands. Other misbehaviours in response to threat include bucking, baulking, not turning when asked, rearing and dismounting the rider, and bolting home (McGreevy, 2002). It is understandable that such behaviour from the horse arouses anxiety in the rider. Hence, there is a cyclical spiral of anxiety from one team member to the other. This can escalate to the point where it may affect the performance and safety of the equestrian team with increased possibility of serious injury to both horse and rider (Edgette, 1996).

On the other hand, calmness in the horse is one of the psychological dimensions that often determine the course of the working relationship between the horse and rider, which in turn impacts on their performance. Calmness is a state that is sought in competitive riding horses (Buckley, Dunn, & More, 2004). Kyra Kirkland, who is a world champion dressage rider, holds that in the dressage arena there is a fine line between having the horse aroused enough to produce the spectacular movement required, whilst remaining calm enough to respond to the rider's cues for particular movements (Apples, 2004). A rider encourages the horse to deliver the expressive forward flowing movement in a relaxed calm manner. However, many dressage horses display excitability or anxiety that impedes the team's harmonious performance. Thus, whether training or at competition, the rider needs to be alert to any changes in the horse to maintain calmness. It is important that both horse and rider be calm, regardless of what is going on around them and that they maintain a focus on the task. Williams (1999) suggests that a calm rider equates to a calm horse and vice versa. The anecdotal

literature gives the opinion that horses involved in different equestrian disciplines display varied levels of nervousness. For example, even with the extensive training of the elite dressage horse, it is inclined to spook and shy more than horses involved in the jumping disciplines. There is a little empirical evidence to support this assumption that dressage horses are more reactive than showjumping horses (Lundin, 2005/6). Lundin also suggested that the reactivity of dressage and showjumping horses is also influenced by age and environment.

Consideration of the horse's keen observation tendencies, sensitivity and hence reactivity to humans is especially pertinent to the sport working relationship, given that horses have a good memory of stimuli or actions encountered within their environment (Flannery, 1997). Hanggi, (2003) showed that horses learn and make judgments from encounters with novel stimuli and some of them use basic concepts to solve problems. Indeed, research is suggesting that the horse's learning ability is more sophisticated than was previously believed (Hanggi, 2003). Therefore, when the rider sets up training paradigms which implicitly reward the horse's negative responses to the rider's mood or anxiety-related behaviour, the working relationship may be compromised. For example, if a rider is not calm or confident in training, prompting the horse to respond to the rider's tense restraining hands by being evasive and disobedient, and if the rider either ignores the disobedience or subjects it to severe punishment, then the horse learns to be disobedient in training (Rees, 1984). Therefore, when dealing with equestrian teams, it is important to have a clear understanding of the learning capacity of the horse.

Another way of understanding the relationship between the horse's learning capacities and the working relationship is the appropriate and consistent use of positive and negative reinforcement in training. McLean (2004) suggests that each horse

responds to positive and negative reinforcement in a unique individual manner, and that dysfunctional behaviour could be a result of inappropriate training techniques for a particular horse. Therefore, reinforcement plays an important role in increasing the probability of a horse's behaviours reoccurring and in strengthening the association between events (Mills, 1998a). However, the more repetitious and undisciplined escape or avoidance behaviours become, the greater the probability of these behaviours reoccurring at inappropriate times (Rees, 1984). These behaviours tend to continue until an intervention interrupts the learned response (Mills & Nankervis, 1999). However, if the horse's innate social learning capacities and natural positive responses are utilised by calm confident riders, then training techniques can be gentler, more efficient and more effective (Krueger & Flauger, 2007; Sighieri, Tedeschi, De Andreis, Petri, & Baragli, 2003), thereby improving the working relationship.

It is obvious from the discussion above that rider experience and skill is a significant factor in the development of harmony and partnership (Weeks & Beck, 1996). Riders who have little horse experience and therefore less skill display less sensitivity in their riding aids and do not communicate clearly with horses (Weeks & Beck, 1996). Similarly, riders who are aware of how to use their body positioning to communicate to the horse, rather than speaking to the horse, tend to rely more on the horse's acute awareness of tactile senses (Brandt, 2004). Thus, these riders are more effective in relating to horses, allowing for better reciprocal communication and hence a better working relationship. In addition to tactile sensitivity, more experienced riders are more consistent in the application of positive and/or negative reinforcement so that the horse learns to become calm and obedient to the riding aids and submit to the task at hand (Brandt, 2004; McLean, 2003; McLean & McGreevy, 2004; Waring, 2003). Therefore, in competition the successful dressage horse is submissive and willing to

perform the movements of the dressage test when asked by the rider, because of the rider's tactile sensitivity and use of reinforcement in application of the communication aids. As a result, in consideration of the horse-rider interaction and their working relationship, communication is a significant aspect of that relationship.

Human communication can be influenced by many things, including anxiety. During horse interactions a rider may experience cognitive processes that result in performance inhibiting responses such as anxiety (Cumming & Harris, 2001). This may put the rider in an ever-increasing spiral of negative cognitive turmoil, as the horse reacts to the rider's negative communication, which promotes further anxiety and anger (Edgette, 1996). Indeed, when such a working relationship is observed, the performance may appear like two people arguing, with resistance from either the horse or rider blocking the flow of communication necessary for harmony and partnership. This highlights the fragility of the horse and rider working relationship dynamic.

The interactive nature of horse-human communication is evident when riders justify their reactions and feelings in terms of how the horse has responded to them, as if intentionally ruining the competition (Pretty & Bridgeman, 2005). Wipper (1999) also describes the subjectivity of elite eventing riders' perceptions of their horses and the difficulty in evaluating the relationship in an objective way. Thus, given the tendency of riders to project their own feelings onto the horse, and the subjective nature of their attributions to its behaviour, it has been considered difficult to conduct empirical studies that assess the working relationship in an objective way.

Here again, it is evident that the human must be aware of the sensitivity and reactivity of the horse, and of the importance of attending to whatever human factors may impede the human's ability to be calm, consistent and focussed on using riding aids with appropriate application of positive and negative reinforcers in training and

competition. In this dissertation the central human factor considered is components of anxiety. This discussion of horses' reactivity to human behaviour and body language-related anxiety will be considered later in more depth in relation to research regarding horses' temperament and misbehaviour.

This review now explores the literature regarding specific individual horse and rider factors implicit in the previous discussion, beginning with the horse.

1.3 Temperament of the equine team member (Equus caballus)

Riders consider three elements when selecting a horse: athleticism, conformation and temperament (Buckley, Dunn, & More, 2004; Paalman, 1998; Saunders, 1983; The German National Equestrian Federation, 1990). Riders prioritise these three elements depending on their personal perceptions, preferences and abilities. Athleticism and conformation are both physical elements of the horse which do not change without training or surgery. Therefore, this dissertation has selected the temperament of the horse to investigate. The rationale for this research is that the rider's perception of their horse's temperament is related to how they behave toward the horse, which in turn influences their working relationship.

Horses have many characteristics described as part of their temperament. Temperament characteristics identified in the literature include: anxiety", "novelty seeking" and "understanding" (Momozawa et al., 2003), "trainability", "affability", and "gate entrance" (Momozawa, Kusunose, Kikusui, Takeuchi, & Mori, 2005), and "gregariousness" (Lansade, Bouissou, & Erhard, 2008). However, it has been found that the temperament trait of gregariousness decreases with age and yet other research has shown that gregariousness can be identified from eight months of age (Lansade, Bouissou, & Erhard, 2008). Thus, this lack of consistency between studies suggests

some caution is necessary when attempting operationally to define psychological concepts within horse temperament research (Hausberger, Bruderer, Le Scolan, & Pierre, 2004).

To achieve the best performance from the equine athlete, its physical abilities and temperament must be considered by the rider (Visser, van Reenen, Schilder, Barneveld, & Blokhuis, 2003). The Federation Equestre Internationale for dressage is attempting to understand the horse's temperament and its impact during competition (Apples, 2004). Indeed, temperament in horses has been a field that ethologists have ignored until recently (Skipper, 1999; Waran, McGreevy, & Casey, 2002). Accurate determination of undesirable or dangerous behaviour related to temperament can be difficult, particularly if it may be attributable to an inappropriate environment, abuse or incompetent handling (Evans, Borton, Hintz, & Van Vleck, 1990). Distinguishing temperament from horse-rider interaction factors is therefore an issue. Fraser (1992) recommends that the horse's temperament be assessed before any handling occurs. Veterinarians and animal scientists have developed their own procedures for assessments that infer temperament. Thus, a good measure of the horse's temperament is still required to assist the rider in choosing a horse suitable for the equestrian discipline in which they intend to compete (Mackenzie & Thiboutot, 1997).

The term temperament is defined as an animal's distinct nature and character (Tulloch, 1995) and generally is used to describe the basic nature of a horse. This definition implies that the temperament of the horse has relative stability and is a psychological trait (Tulloch, 1995; Visser et al., 2001). However, the animal literature does not clearly articulate and distinguish between adjectives and adverbs used to describe horses' psychological states versus traits, as human research has done.

This review will describe and attempt to delineate the two constructs used to identify temperament in horses, psychological states and traits. The critical point here is whether measures used to determine the temperament of the horse in research to date are actually evaluating temperament (trait) or another psychological construct (state).

Human sports research has defined a psychological state as a response to a specific situation, whereas a psychological trait is defined as a person's general predisposition or nature to act in a predictable way (Martens, Vealey, & Burton, 1990; Spielberger, 1966; Vallerand & Celine, 2000). However, emotional traits also imply a longer period of time and more consistent expression than state reactive behaviours (Vallerand & Celine, 2000). However, indicators of emotion can also have a short-term expression reflecting psychological states which at times reflect trait- like qualities of temperament. State- based emotion displayed by the horse describes a different psychological construct from the temperament traits of a horse. Clarity of the psychological construct that is being investigated is essential (Endler, 1978; Martens, Vealey, & Burton, 1990; Spielberger, 1966; Trotter & Endler, 1999).

If one identifies temperament as a trait, then it could be identified from observation of behavioural responses expressed over time. However, this is not what appears in the equine research. For example, research with young horses in experimental conditions shows what researchers have called temperament traits observed from behavioural reactivity to stimuli that are not consistent over time (Lansade, Bouissou, & Boivin, 2007). Thus, reactive behaviours that are not consistent over time do not reflect the horse's temperament. However, these behaviours may be indicative of other psychological states being expressed by the horse. Research using reactivity of horses in experimental test situations has shown that horses classed as having a nervous temperament tend to eat less, be more active and have higher heart

rate and respiration rates than horses categorised as normal (McCann, Heird, Bell, & Lutherer, 1988a, 1988b).

When a horse with a particular temperament is located in certain types of environmental conditions, the horse's management can be difficult (Fraser, 1992). In these instances, the horse-rider relationship is challenged. For example, a horse raised in a large paddock away from people is likely to be more nervous, have a long flight distance response and be easily panicked when approached. In contrast, a horse raised in close proximity to humans has a shorter flight distance and will allow humans to approach and handle it (Fraser, 1992). It is evident that the temperament of the horse is a factor to be considered in determining how humans handle and manage them effectively and the optimal environmental conditions where a horse is competed, housed or trained. This is one reason why this dissertation considers temperament across two different environments.

The literature reveals a wide diversity in the measures used to determine a horse's temperament. It seems there is a lack of attention to the construct validity of the measures; hence, it is not surprising that the research does not show consistent results between studies. With the lack of construct validation some differences reported between studies may be more a measurement issue than actual difference in horse temperament. Furthermore, the content of some of the adjectives and adverbs used to describe temperament intuitively do not seem valid if temperament is defined as a psychological trait. This review will now consider the many methodological issues of measuring the horse's temperament.

1.3.1 Methodological issues in assessing horse temperament

The methodology of this dissertation required a horse temperament measure that could identify possible traits associated with equestrian skills. The temperament measure also needed to take a minimal amount of time to complete in the training and competition environments. Furthermore, this measure is to be a minimally intrusive tool. As no such measure exists, one challenge of this dissertation was to develop one to meet these requirements.

To give an understanding of the research methodologies used to investigate the horse's temperament, a search of the literary databases was conducted. It was assumed that if the word "temperament" was not in the article title or abstract, the research did not conceptualise "horse temperament" as the investigation focus. A few articles that are frequently cited as researching the horse's temperament are also included as part of the current literature investigating horse temperament. These articles conceptually investigate factors outside the horse's temperament, such as learning or reactive behaviour. However, these researchers discuss their finding in terms of horse temperament.

This search found 37 studies that focused on the horse's temperament (Table 1.1). Table 1.1 lists these and identifies the research focus, the construct investigated as part of horse temperament, assessment methodologies used, and significance of findings. The literature review reveals constructs perceived to be indicative of horse temperament to include; emotionality, learning ability, genetic heritability, imprinting effects, items used to identify temperament, horse reactivity to humans or other stimuli and horse personality. To observe these constructs of temperament, the studies describe four different methodologies, namely autonomic, behavioural observation, and personal interviews with handlers and/or self report questionnaire measures.

Table 1.1: Summary of research into horses' temperament and/or specific dimensions presented in chronological order

Researcher	Research Focus	Construct investigated	Significant Finding	Method
Williams (1974)	Imprinting at birth to reactions at 6 months of age	Reactivity	No	A B
McCann et al., (1988a)	Behaviour patterns associated with emotionality levels	Reactivity & emotionality	Yes	A B Q
McCann et al., (1988b)	Emotionality scores and heart rate	Emotionality in temperament	Partial	A B Q
French (1993)	Assess donkey temperament and questionnaires used	Temperament items	Yes	Q
Wolff & Hausberger (1996)	Learning ability and temperament	Learning & temperament	No	B
Weeks & Beck (1996)	Agitation behaviours	Emotionality in temperament	Partial	B
Le Scholan, Hausberger & Wolf (1997)	Behavioural observation concordance in riding teachers	Reactivity, emotionality & learning	Partial	B Q
Wolf, Hausberger & LeScholan (1997)	Aspects of emotionality in relation to age and sex	Emotionality & reactivity	Partial	B
Samore, Pagnacco and Miglior (1997)	Genetics of temperament	Heritability	No	
Mackenzie & Thiboutot (1997)	Assessing tests for measuring reactivity in horses	Reactivity	No	B
Mills (1998)	Assessing reliability of items used for personality	Personality	No	Q
Anderson, Friend, Evans & Bushong (1999)	Horse reactivity, temperament and agreement between instructors regarding temperament	Temperament reactivity	Partial	B Q
Molina, Valera, Dos Santos & Rodero (1999)	Heritability and relationship between genetics, movement and temperament	Temperament	No	B

A = Autonomic observation B = behavioural observation I = Interview Data Q = Questionnaire

Table 1.1: Continued

Researcher	Research Focus	Construct investigated	Significant Finding	Method
Jezierski, Jaworski & Gorecka (1999)	Ranking horse according to behavioural scores and heart rate	Reactivity	Yes	A B
Gosling (2001)	Review of animal personality	Personality	Yes	
Visser et al. (2001)	Quantifying aspects of horse temperament	Temperament	Partial	B
Hausberger & Muller (2002)	Reactions of horses to humans	Reactivity	No	B
Kusunose & Yamanobe (2002)	Differences in training outcomes	Learning	Yes	A B
Morris, Gale & Duffy (2002)	Human personality traits in horses and inter-judge reliability	Personality	Yes	Q
Morris, Gale & Howe (2002)	Factor structure and predictive validity	Personality	Yes	Q
Seaman, Davidson & Waran (2002)	Temperament assessment over time	Temperament	Yes	B
Visser, et al. (2002)	Heart rate and heart rate variability differentiate horses temperament	Temperament	Yes	A
Momoza, et al. (2003)	Behavioural observations concordance with riding teachers' ratings	Temperament	Yes	A B Q
Sondergaard (2003)	Reactions of horses to humans	Reactivity	Yes	A B
Visser, van Reenen, Engel et al. (2003)	Behaviour, personality and performance	Personality	Yes	A B
Visser, van Reenen, Rundgren, et al. (2003)	Behavioural observations concordance with riders' ratings	Temperament	Yes	A B Q
Visser, van Reenen, Schilder, et al. (2003)	Learning and emotionality	Learning & emotionality	Partial	A B

A = Autonomic observation B = behavioural observation I = Interview Data Q = Questionnaire

Table 1.1: Continued

Researcher	Research Focus	Construct investigated	Significant Finding	Method
Williams, Friend, Collins, Toscano, Sisto-Burt & Nevill (2003)	Imprint training	Imprinting and reactivity	No	B
Buckley, Dunn, & More (2004)	Understanding health and performance including temperament	Temperament	Yes	I
Hausberger, Bruder, Le Scolan & Pierre (2004)	Genetic factors of personality and temperament	Genetics, Reactivity and environmental conditions	Yes	B
Lansade, Bertrand, Boivin, & Bouissou 2004;	Temperament, its manageability reactivity and fearfulness during handling	Reactivity	Partial	A B
Momozawa, Kusunose, Kikusui, Takeuchi & Mori (2005)	Assessing questionnaire for temperament factors	Temperament	Yes	Q
Momozawa, Takeuchi, Kusunose, Kikusui, & Mori 2005	Association between temperament and the dopamine D4 receptor gene	Temperament and genetics	Yes	Q
McCall, Hall, McElhenney, & Cummins, (2006)	Assessing 4 measures for respects of temperament	heart rate, emotionality and reactivity	Yes	A B
Lansade, Bouissou, & Boivin (2007)	Development and stability of 3 temperament traits in foals	Reactivity	No	B
Zucca, Minero, Grignani, & Canali (2007)	Assessing differences between thoroughbred horses and other breeds	Reactivity	Yes	B
Lea Lansade, Bouissou, & Erhard (2008)	Stability of temperament traits across time and situations	Reactivity	Yes	B

A = Autonomic observation B = behavioural observation I = Interview Data Q = Questionnaire

Table 1.1 indicates if these studies reported statistically significant findings. As some studies used more than one methodology, a significant finding may not have occurred in all of them. Thus, this is referred to as a study reporting a partially significant finding.

Analysis of the literature in Table 1.1 reveals four types of data used to assess the horse's temperament. These are autonomic function data (A), behavioural observation data (B), interview data (I) and questionnaire survey data (Q). Autonomic function data is indicative of a measure of the horse's heart rate or respiration rate. Behavioural observation data is collected in a test arena, scoring the horse's reactivity to stimuli, human handlers and its behaviour in general. Interview data is collected from responses to questions asked of the rider or handler by the researcher at the competition. The questionnaire survey data considers the handlers' or riders' rating of their agreement or disagreement with the items or descriptors indicating the horse's temperament.

Of the 37 articles presented, only 19 show a significant statistical finding that supports the research hypotheses. Ten articles did not report a finding, and the remaining 18 articles reported a partial finding with one or more of the methodologies used. Thus, it would seem logical that the more methods used to collect data the greater the chance of confirming the hypotheses of the research.

Visser et al. (2002) use a method of comparing horse's levels of exertion with their emotional arousal which would be useful in analysing the horse when during equestrian sport such as a dressage test. As the movements in the dressage test are exactly the same and a baseline for exertion can be determined and furthermore, given that the movements are the same whether the test is ridden in a training or competition environment, it is possible to compare evidence of emotional arousal across environments. If the same test is performed by the same team and the physiological measure elevations are above the usual physical exertion, then another factor is influencing the measure. This is where one could propose one may see

evidence of reactivity (emotional arousal) to the rider and environmental factors, which in turn impact on the working relationship between horse and rider. However, this does not mean the researcher can assume it is evidence of a psychological trait such as temperament. Serious consideration is required when interpreting physiological responses and possible links to psychological traits such as "emotionality" or other psychological constructs. Any increase in psychological elevations requires a validation process to confirm the interpretation, usually by using another measure accepted to be evidence of physiological arousal.

One of the primary methods of determining a horse's temperament is behavioural observation (Table 1.1). These behaviours are mainly observed in a test arena where horses are placed with novel stimuli, or moved around a course, to determine reactions to different obstacles. These reactive behaviours are interpreted as evidence of the psychological descriptors of temperament. The review in Table 1.1 indicates that these reactive behaviours are often interpreted as indicative of emotionality. Emotionality inferred from reactive behaviour is considered to be evidence of the horse's temperament. However, these studies do not explain this inference of the reactive behaviours indicating temperament traits. While some kinds of behaviour are indicative of temperament, for example those behaviours associated with learning styles which remain constant across situation or environmental conditions, the behaviours indicative of emotionality appear to be more like psychological states, in that they change under different circumstances.

Therefore, reactive behaviours or behaviours indicative of emotionality may not be indicative of temperament if defined as a psychological trait. Thus, more evidence is required to support the presumption of the relationship between reactive behaviours, emotionality and the horse's temperament. This dissertation postulates that behaviours indicative of a horse's temperament are stable across environments, such that there is no change in the temperament of a horse when it interacts with new stimuli. If these behaviours are not stable, then

psychological variables other than temperament contribute to it. This, then, identifies the precision of observations as an issue. For example, a researcher's methodology must attempt to record the same number of observations during the same duration of observation.

The examination of the literature in this review highlights a weakness, in that equine researchers investigating horse temperament do not use consistent methodologies or describe the theoretical conceptual and psychometric properties of the ones they do use. These investigators do not use consistent items based on theory or a conceptual model to develop a valid list of items within these questionnaires. Sports psychology research has identified that participant responses to items are influenced by the language used for descriptors and interview questions, which are perceived as being positive or negative (Terry, Lane and Shepherdson, 2005). For example, questions like "how the horse feels now" or "how the horse has felt over the past week" leads the observer or rider to give very different answers, which may explain why not all researchers agree on the items in these different questionnaires to identify temperament traits.

Another issue of questionnaire construction is that items are often drawn from human literature, and appropriate validation and modification to apply to horses has not been done (Beauchamp & Whinton, 2005; Morris, Gale, & Duffy, 2002; Morris, Gale, & Howe, 2002; Nuff, 1988). Assessing emotion in the horse is one example. Unlike humans who can verbalise their emotions, the horse cannot iterate its emotive state to the researcher. Therefore, most methods used to assess emotionality in horses involve behavioural observation or measurement of physiological changes (Kavaliers, 2001). These are assumed to be indicative of an emotional state as ascertained from comparative the human analysis (Kavaliers, 2001).

When discussing descriptors of temperament, not all horse people have the same interpretation of the words used. Research has shown that even experienced riders do not always agree on the descriptors or their definitions when asked to evaluate the same horses

(Mills, 1998b). It seems that horse people are not consistent in attributing characteristics to horses. However, it could be argued that the words used by individuals would be consistent for their personal assessments of their own horses over time and in different environments. It is obviously a difficult task to construct a reliable horse temperament questionnaire, Hence the consistent use of horse behavioural observations to identify horse temperament.

Current research summarised in Table 1.1 indicates that behaviour observation methods are effective in distinguishing horses on the basis of temperament and can validate the questionnaire results. For example, the results of data gathered from a temperament questionnaire can concur with the results of behavioural observations of horses' reactivity to a balloon (Momozawa et al., 2003). This research reveals the reliability of temperament assessments by experienced handlers and observers. However, to further improve the validity of their interpretations, Momoza et al. (2003) and Visser, van Reenen, Engel et al. (2003) used heart rate as a physiological indicator of horse temperament. This use of behavioural, physiological and psychological measures to assess the temperament of the horse, results in a useful triangulation of the data. This can help to confirm the construct validation of methodologies.

The literature indicates that it is possible to develop a Horse Temperament Inventory to give a numerical temperament score for each horse. It is intended that this scale will identify the stability of the horse's temperament, regardless of the stimulus or environmental conditions. However, if the data is not consistent between training and competition environments, then the concept being measured would be questioned as being related to the horse's temperament. After consideration of the methodological issues revealed in the literature, it was decided that the rider and an external observer would rate the horse temperament in both training and competition environments. The use of a supporting

methodology of physiological testing by monitoring the horse's heart rate provides convergent validity to the rider and observer ratings on the Horse Temperament Inventory.

The understanding of the horse's temperament is an important issue because of its potential impact on the performance of the equestrian team (Table 1.1). Previous temperament investigations have only investigated the horse's reactions to handlers and novel stimuli. This study builds on this work in anticipation of uncovering horse factors that relate to the working relationship with their rider. It is predicted that if a poor horse temperament is reported by the rider or an observer, it is likely to impact negatively on the working relationship with the rider. Furthermore, it is predicted that riders and observers will report stability in the horse temperament across the training and competition environments, because it is a stable trait of the horse which over-rides its state reactivity. This brings the review to consider human factors related to working relationship.

1.4 Anxiety of the human team member

Over the last two decades psychological research has investigated the rider's anxiety within the context of sporting competition. Indeed, competition anxiety is a popular psychological construct evaluated in sport and exercise research (Terry, Lane, & Shepherdson, 2005). This dissertation includes anxiety as the primary psychological dimension to be investigated with regard to the rider. The rationale for this choice has been suggested earlier; if a rider is experiencing anxiety during equestrian activities it may impact on the ability to apply the communication aids to the horse and thus interfere with their working relationship. Here rider anxiety will also be recorded in a training environment, in an attempt to determine if differences in anxiety relate to parallel differences in the working relationship and horse behaviour. The review now gives a brief history of anxiety in the general sporting environment before addressing the equestrian sport in particular.

1.4.1 Anxiety in sport

Sport psychologists initially adopted traditional psychological anxiety theory to explain the impact of anxiety on an athlete's performance. In the early years sports psychologists adapted Drive Theory (Hull 1943, 1951; Spence, 1956, cited in Jones, 1995; Spence & Spence, 1966) and then the Inverted U hypothesis (Yerkes & Dodson, 1908) to conduct research for this purpose. These theories developed over time to include the Multidimensional Theory (Endler, 1978), the theory of Individual Zones of Optimal Functioning (IZOF) (Hanin, 2000) and the more complex Cusp Catastrophe theory (Fazey & Hardy, 1988).

Since the introduction of the Multidimensional Theory (Endler, 1978) it has had support at both a conceptual and an empirical level (Gould & Krane, 1992; Martens, Vealey, & Burton, 1990). The sports psychology literature reveals considerable research into competition anxiety based on the Multidimensional Theory evolving from the work of Endler (1978). This theory identifies five dimensions of trait anxiety and two of state anxiety (Martens, Vealey, & Burton, 1990). Trait anxiety is the athlete's personal predisposition to anxiety, which indicates how an athlete perceives the environmental demands and their responses to stimuli (Martens, Vealey, & Burton, 1990). State anxiety is more the momentary expression and an athlete's response precipitated by their level of trait anxiety and the environmental demands surrounding them (Martens, Vealey, & Burton, 1990).

This Multidimensional Theory is one conceptual framework represented in anxiety measures used within the equestrian sport (Fitzpatrick, 2004; Tompkins, 1999). This dissertation uses the Multidimensional Theory of state anxiety, defining state anxiety as "*a sense of uneasiness or concern about an imminent danger, difficulty or upcoming event*" (Martens, Vealey, & Burton, 1990; Woodman & Hardy, 2001). This is operationally defined as cognitive anxiety when there are "negative thoughts", "worries", "concerns", "fear" and

"apprehension", and as somatic anxiety when there are "physiological arousal symptoms" (Martens, Vealey, & Burton, 1990).

The Multidimensional Theory has been adapted into the sporting environment by Martens, Vealey, et al. (1990). They propose that cognitive and somatic anxiety have a negative relationship with performance, whereas self-confidence, another factor in the theory, influences performance in a positive manner. The Multidimensional Theory proposes that experiencing cognitive anxiety when competing will have a negative linear effect on performance. Thus, if an athlete displays an increase of cognitive anxiety, their performance deteriorates. The somatic anxiety and performance relationship can be described as similar to the inverted U curvilinear relationship between arousal and performance. Here, an athlete may have an optimal level of somatic anxiety that positively affects a good performance. However, if anxiety is above or below that level, a poorer performance may result. Martens, Vealey et al., (1990) propose a positive linear relationship between self-confidence and performance. When an athlete believes in their ability to perform and feels confident in what they are doing their performance levels increase.

Martens, Vealey et al. (1990) describe cognitive state anxiety as having a negative relationship with the athlete's expectations of performance and self-evaluation, due to precipitating worry and/or unsettling images. They also suggest that pre-competitive cognitive state anxiety tends to increase and is present until the onset of a competition event (Kais & Raudsepp, 2005; Martens, Vealey & Burton, 1990). However, some investigations later challenged these patterns prior to competition. They found similarities between somatic anxiety and cognitive anxiety, with increases between two hours and 30 minutes before competition begins (Hall, Kerr, & Mathews, 1998; Hanton, Thomas, & Maynard, 2004).

Somatic state anxiety is inferred from physiological and affective experiences which originate from autonomic arousal (Martens, Vealey & Burton, 1990). This is evident in the

increase of heart rate, shortness of breath, muscle tension, clamminess of hands and sensing butterflies in the stomach (Martens, Vealey, & Burton, 1990). It was believed that somatic anxiety remains low until around 24 hours before competition commences and then begins to increase (Cox, 1994). Current research reveals that the intensity of somatic anxiety increases two hours to 30 minutes before competition (Hanton, Thomas, & Maynard, 2004). Cox (1994) reported that in studies conducted by Fenz (1975), Parfit and Hardy (1987), and Ussher and Hardy (1986), the physiological indicators of heart rate, galvanic skin response and respiration display a similar response to somatic state anxiety scores when compared to the time until the event. However, there can be inconsistency in these perceived physiological states compared to the actual physiological states. Physical sensations may lead to misrepresentation of the experience as somatic anxiety, as the person seeks to explain their arousal (Hoehn-Saric & McLeod, 2000).

Another issue is whether the athlete's perceptions attributed to anxiety are considered negative (debilitative) or positive (facilitative) (Avramidou, Avramidis, & Pollman, 2007; Eubank & Collins, 2000; Fletcher & Hanton, 2001; Hanton, Thomas, & Maynard, 2004; Jones & Hanton, 2001; Jones, Swain, & Harwood, 1996). This dissertation acknowledges this debate and takes the position that the definition of anxiety as represented by the Multidimensional Theory is negative by nature. Any positive attributions of positive psychological arousal by the athlete would be researched within a different conceptual framework and not a psychological measure of anxiety. Furthermore, this dissertation acknowledges that if an athlete reports a high level of cognitive or somatic anxiety, a positive outcome may be achieved through interventions such as relaxation, self-talk and imagery used prior to and during the competition. What is of concern to this research is the rider's awareness of and report of an increased anxiety level, and its relationship to the harmony of the working relationship between horse and rider. Thus, this dissertation does not step into

this debate of possible debilitative or facilitative states, because increased levels of anxiety are associated with negative perceptions in terms of performance consequences (Kais & Raudsepp, 2005), and disrupt psychomotor skill sets of the sport.

Sport psychology research also considers self-confidence during performance. Two meta analyses have shown that the self-confidence of athletes has a stronger and more reliable association with performance than either cognitive or somatic anxiety (Craft, Magyar, Becker & Feltz, 2003; Woodman & Hardy, 2003). Self-confidence has shown better correlations to performance than competition anxiety (Covassin & Pero, 2004; Davis & Sime, 2005; Hassmen, Raglin & Lundqvist, 2004; Woodman & Hardy, 2003).

The position taken in this dissertation is that measuring the levels of state anxiety will give an indication of the rider's psychological circumstances at specific times of interaction with the horse. Furthermore, it may be sensitive to differences during training and competition. The use of state anxiety further provides a method to gain an understanding of the impact of the rider's cognitive anxiety, somatic anxiety and self-confidence on the working relationship with their horse. Past research has been conducted into state anxiety of equestrians so comparisons can be drawn with this study.

The review now focuses on state anxiety from the perspective of the Multidimensional Theory as it applies to the working relationship of the equestrian team.

1.4.2 State anxiety in equestrian sport

The application of the above research to equestrian sport has not been given much attention. However, it is considered important here as it is believed that a rider's cognitive and somatic anxiety may influence aspects of the working relationship with their horses and that in turn it influences the actual performance.

Cognitive anxiety may interrupt the intense concentration required to perform the complexities of the movements in the dressage test or jumping a fence on a cross country course. This intense focus on self and the horse puts considerable cognitive demands on the rider. For example, if this focus is centred on the horse only, the rider may have more errors of course, and if this focus is not attentive to the horse, lack of preparation for the execution of the movements may allow the horse to misbehave and lose rhythm or impulsion, thus affecting performance.

While cognitive anxiety influences mental preparation and skills, somatic anxiety affects the physical preparation and skills. The somatic aspects of anxiety may cause riders to become stiff and rigid, impeding the rider's effective use of the aids. This inhibits their ability to communicate clearly to direct the horse through the test and upsets the balance of the horse and rider (Reilly, 2000; Williams, 1999). Furthermore, a rider's tense body prevents the horse from relaxing and showing its artistic expressive paces and movement. In addition, with such tension, the horse may misbehave and prompt a spiral of somatic anxiety, prompting reaction from the rider, thereby further affecting the working relationship between the horse and rider.

However, research does not support this relationship between anxiety and equestrian performance. Fitzpatrick (2004) and Tompkins (1999) utilised the CSAI-2 with show jumping riders and dressage riders and found no relationship between anxiety and performance. It was found that state anxiety was higher in the competition environment compared to the training environment (Trotter & Endler, 1999). However, the increased state anxiety (CSAI-2) of dressage and showjumping riders did not correlate negatively with the actual competitive performance (Fitzpatrick, 2004; Tompkins, 1999). However, a negative relationship between cognitive and somatic anxiety (CSAI-2) and the rider's perception of their performance post competition has been found. Thus, if cognitive and/or somatic anxiety scores were high, then the riders' post competition perspective of their performance was low (Fitzpatrick, 2004;

Tompkins, 1999). No relationship was revealed between rider's self-confidence (CSAI-2) and the rider's post competition evaluation of their performance. The lack of significant results regarding competitive anxiety in the showjumping riders led Fitzpatrick (2004) to question the suitability of the CSAI-2 to investigate anxiety-competition performance in equestrian sports. However, further consideration of the nature of different equestrian sports and related anxiety may offer other explanations.

As described earlier in the chapter, the horse is a reactive animal. Hence, the riders experience these aspects of anxiety with intensity when they have the added antagonist of anxiety induced by the characteristics of their horse. Therefore, the level of anxiety may vary, depending on the character of their equine partner. Furthermore, not all riders become anxious in the same situations. A particular experience or event perceived as challenging to some riders may be threatening or neutral to others (Hoehn-Saric & McLeod, 2000; Raglin & Hanin, 2000). Thus, some riders may thrive as competitors in certain circumstances where others become anxious. It is the individual interpretation of stimuli and circumstances that makes competitive anxiety a complex subject related to the individual experience of each athlete.

The rider's anxiety response to stimuli is dependent on their perception of the events unfolding around them. This may be because anxiety is related to the rider's incentive for competing. An important factor that may impede competition success of the equestrian team is the perceived importance placed on the competitions by the rider (Martens, Burton, Vealey, Bump & Smith, 1990). For example, a rider's goal on the cross-country course is to complete the course in time without penalties, whereas in the sport of dressage riders attempt to attain the best possible score for the dressage test.

These goals lead to the incentive which may be intrinsic, such as increasing feelings of competency, personal satisfaction and self esteem, or it may be extrinsic, where financial

reward or external positive recognition and praise are received (Martens, Burton, Vealey, Bump & Smith, 1990). These intrinsic and extrinsic rewards are human needs that are not shared by the horse. Hence anxiety maybe related to anticipatory loss of the intrinsic or extrinsic reward.

The understanding of anxiety factors is an important issue for performance coaching (Avramidou, Avramidis & Pollman, 2007) despite considerable research to date. This study builds on previous work in anticipation of comparing results and expanding findings. The focus here is on state anxiety within the context of the horse-rider working relationship at training and in the moments before competition. It is predicted that if competition state anxiety is reported by the rider, it is likely to have a negative association on the working relationship with the horse. Furthermore, it is predicted that riders will report lower levels of state anxiety at the training environment compared to competition environment, because of less reactivity from the horse and less demand on the rider. The training environment is more familiar and more predictable to the horse and rider, compared to the competition environment. Hence, it is predicted that the horse-rider relationship will be more positive at training than at competition.

To test these hypotheses the dissertation includes the Competitive State Anxiety Inventory -2 (CSAI-2), which is based on the Multidimensional Theory of anxiety.

1.4.1.1 Competitive State Anxiety Inventory-2

The methodology for this dissertation required a state anxiety measure that could differentiate cognitive and somatic dimensions and self-confidence, because each has been hypothesised to have unique effects on equestrian skills. The anxiety measure also needed to take a minimal amount of time to administer in the training and competition environments. Furthermore, it had to be a minimally intrusive tool, so that the attention and focus of the

competitor are not disturbed (Krane, 1994). For these reasons the CSAI-2 developed by Martens et al. (1990) was chosen for the dissertation as it meets these requirements.

To date the CSAI-2 is one of the most used instruments to evaluate a group of symptoms considered to represent state anxiety in sports psychology research (Lane, Sewell, Terry, Bartram & Nesti, 1999; Lundqvist & Hassmen, 2005). It has been described as fundamental to sports psychologists' understanding of the anxiety-performance relationship (Cox, Russell & Robb, 1995; Cox, Russell & Robb, 1998). The CSAI-2 has been considered a reliable and valid measure of competitive anxiety (Martens, Burton, Vealey, Bump & Smith, 1990). Because of this, the impact of CSAI-2 within sports psychology research has been global, having been translated into many languages (Woodman & Hardy, 2001) and still in wide use.

Two major meta analyses (Craft, Magyar, Becker & Feltz, 2003; Woodman & Hardy, 2003) have reviewed the use of the CSAI-2 with respect to performance outcomes. Both suggested unequivocal findings. Craft et al, (2003) conducted a meta analysis of data from 29 published and unpublished sources up to 1999. This meta analysis investigated the relationships of cognitive and somatic anxiety, and self-confidence to performance, and concluded that the relationships are weak at best, with the strongest relationship being between self-confidence and performance. The results questioned whether the CSAI-2 could predict performance as originally proposed by Martens, Vealey et al. (1990). Woodman and Hardy (2003) also analysed data from 47 published and unpublished sources in their meta-analysis, investigating the relationships of cognitive anxiety and self-confidence to performance. They concluded that a significant relationship did exist between cognitive anxiety, self-confidence and competition performance.

The considerable use of the CSAI-2 has allowed more rigorous testing regarding its construct validity and factor structure. Craft et al. (2003), as described above, also examined

the psychometric properties of the CSAI-2. It is inferred that the CSAI-2 does not have sound construct validity in terms of anxiety, questioning the structure of the inventory as well as the wording of some items, such as using "concerned" as opposed to "worried" as an expression of cognitive anxiety (Cox, Russell & Robb, 1995; Craft, Magyar, Becker & Feltz, 2003; Lane, Sewell, Terry, Bartram & Nesti, 1999). This was confirmed with a poor overall model fit using multisampling factor analysis (Lane, Sewell, Terry, Bartram & Nesti, 1999).

It is concluded from this review of the above literature that there are weaknesses in the factor structure and construct validity of the CSAI-2. However, it is noted that Martens, Vealey et al. (1990) initially used an exploratory factor analysis that lacked the statistical methodological rigour available today (Lane, Sewell, Terry, Bartram & Nesti, 1999). A stronger three factorial structure is required to validate the three-factor model of competitive state anxiety presumed to underlie the CSAI-2 (Lane, Sewell, Terry, Bartram & Nesti, 1999). However, it appears that regardless of the construct validity and factorial structure of the CSAI-2, it is still an instrument of choice to determine the cognitive, somatic and self-confidence experience of an athlete.

During the development of this dissertation a revised version of the CSAI-2 was published. It is also considered in this dissertation's methodology. Current research recommends that this new CSAI-2R be used in preference to the original version (Lundqvist & Hassmen, 2005). The further development of the CSAI-2R will therefore be described next.

1.4.1.2 Competitive State Anxiety Inventory-2 Revised

The re-evaluation of the original CSAI-2 has resulted in the CSAI-2 Revised (CSAI-2R) (Cox, Martens & Russell, 2003). Whilst the original CSAI-2 displayed good reliability and internal consistency, Cox, Martens and Russell (2003), as discussed above, acknowledged its limitations, as well as the factor structure concerns raised by researchers (Lane, Sewell,

Terry, Bartram & Nesti, 1999; Tsorbatzoudis, Varkoukis, Kaissidis-Rodafinos & Grouios, 1998). They then sought to revise the scale. A sample of 575 university athletes was used to calibrate the scale and 331 participants were used to test the validity of the CSAI-2R. To further address the factor structure, four items of the scale were removed from the cognitive subscale, two items were removed from the somatic subscale and four items were removed from the self-confidence subscale. Thus, the CSAI-2R has 17 items with five items for cognitive anxiety, seven items for the somatic anxiety and five items for self-confidence.

The Cronbach alpha for the CSAI-2R displayed good internal consistency in the calibration data for cognitive anxiety (.83), somatic anxiety (.88) and self-confidence (.91) and in the validation data for cognitive anxiety (.81), somatic anxiety (.81) and self-confidence (.86) (Cox, Martens & Russell, 2003). This reliability was confirmed in part by a study conducted by Terry, Lane and Shepherdson (2005) using 585 athletes. It revealed an internal consistency ranging from fair to good for cognitive anxiety (.75), somatic anxiety (.85) and self-confidence (.83).

The indicators for the goodness of fit and factor structure for the CSAI-2R displayed a good fit and a sound factor structure in the study of Cox et al. (2003). However, when Terry, et al. (2005) similarly tested the factorial validity of the CSAI-2R, the goodness of fit was marginal. The statistics were not as strong as Cox et al. (2003) reported and in their opinion did not meet the threshold for a good fitting model.

Another study evaluated a Swedish version (Lundqvist & Hassmen, 2005), using both the CSAI-2 and the CSAI-2R on the same data set of 969 student athletes. The findings were similar to those of Terry et al. (2005). The CSAI-2 was weak in model fit, even though the chi square statistics were significant on the three factors correlated model. The model fit statistics showed a weak goodness of fit for the original CSAI-2 (Lundqvist & Hassmen,

2005), whereas the statistics for CSAI-2R were much improved with a good chi square statistic and an acceptable model fit.

However, this debate regarding the psychometric soundness of the original CSAI-2 has now been extended to the CSAI-2R. Cox et al. (2003) recommend that researchers use this revised version of the CSAI-2R instead of the CSAI-2. Given the CSAI-2R is a shortened version of the original scale; it was possible to conduct an analysis of the CSAI-2 data in this dissertation using the CSAI-2 structure.

Research indicates that the psychological construct of state anxiety is more complex than the Multidimensional Theory describes. Emotion and mood are both aspects within the anxiety experience (Beedie, Lane & Terry, 2001; Beedie, Lane & Terry, 2004; Beedie, Terry & Lane, 2005; Lane & Terry, 2000; Lazarus, 1994, 2000). This review now investigates the distinctions between emotion and mood aspects of anxiety experience, and how they may be relevant to understanding the horse-rider relationship.

1.4.3 Distinctions between the emotion and mood experience of anxiety

In the past decade numerous researchers have investigated the emotions of athletes while competing in their sporting environments (Beedie, Lane & Terry, 2001; Bono & Ilies, 2006; Cerin, 2003; Desire, Boissy & Veissier, 2002; Hagtvet & Hanin, 2007; Hanin & Charles, 2004; Kerr, Wilson, Bowling & Sheahan, 2005; Lazarus, 1994). The empirical literature also indicates that a majority of researchers choose to place their efforts into exploring the mood states of athletes (Beedie, Lane & Terry, 2001; Lane, Beedie & Stevens, 2005; Lane, Terry, Stevens, Barney & Dinsdale, 2004; Legrand & LeScanff, 2003; O'Connor, 2006; Terry, 2004; Terry et al., 2000; Weinstein, Deuster & Kop, 2007). These researchers all demonstrate the importance of exploring emotion and mood as an individual psychological

construct within a sporting context. However, research to date has not investigated the rider's emotion during equestrian sport in relation to the horse or the working relationship.

The mood state of equestrian riders has been investigated using the Profile of Mood States (POMS) (Fitzpatrick, 2004; Meyers, Bourgeois, LeUnes & Murray, 1999; Meyers, LeUnes, Elledge, Tolson & Sterling, 1992; Meyers, Sterling, LeUnes, Elledge & Tolson, 1990) and the Incredibly Short Profile of Mood States (ISP) (Tenenbaum, Lloyd & Pretty, 2002) which is based on the POMS.

Research shows rodeo riders reported no difference between baseline mood states and pre-competition mood states (Meyers, Sterling, Le Unes, Elledge & Tolson, 1990). Furthermore, rodeo riders reported no differences in mood states between competition events (Meyers, Bourgeois, LeUnes & Murray, 1999). Meyer's research suggests that the mood states of some equestrians are stable, regardless of environment stimulus. However, research has been unable to determine a significant relationship between the rider's general mood state and performance (Fitzpatrick, 2004; Tompkins, 1999; Trotter & Endler, 1999).

Fitzpatrick (2004) found a positive relationship between showjumper performance and the tension subscale of the POMS. This tension-performance relationship for showjumping riders was also found to be curvilinear in nature, suggesting that levels of tension may assist or hinder performance. The other subscales of the POMS did not reveal such a relationship with performance; thus, no general mood state-performance relationship was inferred in showjumping riders (Fitzpatrick, 2004).

The research suggests that psychological states, such as anxiety, can be experienced as emotion or mood state (Lazarus, 1994). This suggests that the emotional state of the rider may offer some explanation for the lack of rider mood-performance relationship. However, there is a lack of conceptual clarity in the research on emotion or mood experience of athletes when examining the anxiety construct. This is partly because of the overlapping nature of the

two, which makes it difficult to label in such a way for respondents to distinguish between them in self report check lists. This lack of theoretical clarity and the operational definition confusion of emotion and mood constructs is evident in the use of these words by researchers as if they were synonymous (Beedie, Terry & Lane, 2005). Therefore, more precision in the identification of the antecedents, experience and consequences of arousal and sensations during the experience of state anxiety is paramount in distinguishing between the emotion and mood experience of this construct (Terry, 2004). This will assist researchers to develop comprehensive theory based operational definitions for these psychological states (Lane, Beedie & Stevens, 2005). Emotion and mood are defined in this review as follows. Emotion is brief and intense, resulting from, and focused on, specific environmental events. The consequences of emotion are mostly behavioural. Mood is relatively enduring and unfocused, varying in intensity and duration, and does not result from a specific event that the individual is aware of. The consequences of mood are mostly cognitive (Beedie, Lane & Terry, 2001; Beedie, Lane & Terry, 2004; Beedie, Terry & Lane, 2005).

This literature generally concludes that the most common distinction between emotion and mood is the intensity and duration of arousal (O'Connor, 2006). However, 16 emotion and mood distinctions have been proposed by people outside academia (Beedie, 2003; Beedie, Lane & Terry, 2005) namely cause, duration, control, experience, consequences, display, intentionality, anatomy, intensity, timing, function, physiology, stability, awareness of cause, clarity and valence. Academics identify eight distinctions of cause: duration, consequences, intentionality, intensity, function, physiology and awareness of cause. Beedie, Terry & Lane, (2005) suggest that folk psychology theoretically proposes distinctions between emotion and mood that may enhance future scientific research.

O'Connor (2006) and Terry (2004) use an analogy of climatic conditions to explain the emotion-mood relationship. They suggest that emotional traits are similar to the climate

pattern of the four seasons that repeat over time, whereas, a mood state is more like the hot or cold fronts that take days or weeks to move across the country. They suggest that an emotion state is similar to the cloud that moves in front of the sun, or a rainstorm that quickly passes. Like the overlapping conditions between these weather descriptions, the division between the nature of emotion and mood is challenging to discern clearly (Lane & Terry, 2000).

This analogy clearly demonstrates how two related experiences, such as emotion and mood, could be considered experiences of an athlete's competition state anxiety. Furthermore, it demonstrates the difficulties in drawing distinct boundaries between emotion and mood conceptually and operationally, within the psychological construct of anxiety (Beedie, 2003; Terry, 2004). This is also evident in the current assessment of these experiences, which uses similar assessment protocols and items within a sporting context (Lane & Terry, 2000; Lazarus, 1994, 2000).

Researchers agree that emotional or mood state can be categorised as anxiety, only if a threat is perceived. However, if there is no perceived or potential threat, then the psychological experience is not anxiety (Cerin, 2003). Beedie, Lane and Terry (2001) took a major step to determine items that distinguish between the emotion and mood experience of anxiety (Beedie, Lane & Terry, 2001). On the basis of this work they developed and tested a measure to assess and distinguish both factors, the Emotion and Mood Components of Anxiety - Questionnaire (EMCA-Q). The new EMCA-Q measure has been shown to have good construct validity and reliability during its development for each of the emotion and mood components of anxiety (Beedie, 2003; Beedie, Lane & Terry, 2001). The authors have confirmed the validity of this measure in more recent studies (Beedie, Lane & Terry, 2004; Beedie, Lane & Terry, 2005).

As earlier described, distinguishing between emotion and mood experience of anxiety is important in uncovering human factors associated with the horse-rider working

relationship. The use of the EMCA-Q in this dissertation assists in determining if the rider's self reported anxiety (CSAI-2) is focused on the specific events of the competition (emotional state) or unfocused and generally concerned about life issues other than the competition (mood state). Furthermore, the use of the CSAI-2 and the EMCA-Q may give an indication as to the relationship between the cognitive and somatic anxiety, and emotion and mood experience of anxiety reported by riders. Comparisons in training and competition environments will further uncover the stability of these dimensions.

The items used to measure somatic anxiety have psycho-physiological characteristics. Items used to measure somatic anxiety such as "I feel jittery", "My body feels tense", "My hands are clammy" and "My heart is racing" are asking athletes about their awareness and their mental perception of physiological changes within their bodies. Thus, while psychological measures imply psycho-physiological components, these are often just self report without objective evidence of the actual physiological arousal. However, sports psychologists are beginning to use technological improvements to capture and compare psychological self report and physiological data (Davis & Sime, 2005). This dissertation follows this best practice. The physiological measure of heart rate is used as an indicator of emotional arousal in the understanding of the working relationship within the equestrian team.

In summary, this dissertation proposes the importance of identifying these experiences within a rider's anxiety. As the rider experience of anxiety as emotion or mood is very different, the impact on the working relationship with the horse may change as a consequence. Therefore, investigating the emotion and mood experiences of anxiety may be an important component of understanding the association between rider anxiety and the working relationship with the horse, and add to the cognitive and somatic anxiety associations.

1.5 Heart rates in the equestrian team

The following review demonstrates that little is known about heart rate of either horse or rider during equestrian sport. Prior to the research for this dissertation, Hama, Yogo and Matsuyama (1996) are the only researchers who published findings into the heart rate of horse and human within the same study. Hama et al. (1996) recorded the heart rates of horse and human during a 90 second interaction where the human stroked the horse. The humans were students who were classified into three groups from their score on the pet attitude scale: the first group of students had a negative attitude towards companion animals, the second group had a positive attitude towards companion animals, and the third group were riding school students who were confident handling horses. It was found that all human heart rates significantly increased during the first 10 seconds across all groups. Furthermore, the horse's heart rate also increased significantly during the first 20 seconds when being stroked by a human classified as having a negative attitude. There was no significant increase in horse heart rate over the time period when stroked by humans classified as having a positive attitude or by a riding student (Hama, Yogo, & Matsuyama, 1996).

This work of Hama et al. (1996) suggests an association between the psychological orientation of the rider and the heart rate of both horse and rider. While anxiety, emotion and mood were not measured, the study offers reason to further investigate psychological factors in the working relationship between them.

Other studies into horse heart rate also indicate that stroking by humans appears to be associated with a decrease in horse heart rate (Feh & De Mazieres, 1993; McBride, Hemmings & Robinson, 2004). This has been interpreted as humans having a positive and calming effect. However, other studies have not replicated this positive association (Henry, Richard-Yris & Hausberger, 2006). An overview of this research shows that the horse's response to different kinds of human contact is variable (Ligout, Bouissou & Boivin, 2008).

Jezierski, Jaworski and Gorecka (1999) considered the extent to which horse-human contact revealed that interaction on a daily basis reduced their heart rate. Horses handled early (12h to 12 days after weaning) showed lower heart rates than horses handled late (21 to 33 days after weaning) or non-handled horses (minimum human contact) in reaction to the sudden presentation of a novel object (a surprise test) (Lansade, Bertrand, Boivin & Bouissou, 2004).

Sondergaard and Halekoh (2003) have shown the impact of environmental conditions on how quickly horses respond to a handler. They found that previously handled horses had lower heart rates in a novel environment and sought human contact sooner than non-handled horses. This confirms the work in an earlier study, which showed stabled horses had lower heart rates compared to forest raised horses (Jezierski, Jaworski & Gorecka, 1999). However, other research indicates no significant difference in heart rate due to environmental conditions (Rivera, Benjamin, Nielsen, Shelle & Zanella, 2002).

Interpretations of increases or decreases in heart rate vary in sport research. This dissertation considers heart rate an interesting factor in uncovering dynamics within the working relationship between horse and rider. Heart rate can indicate the degree of physiological synchronisation between horse and rider. This horse-rider heart rate synchronisation gives a physiological perspective to their working relationship. However, the degree of heart rate synchronisation in a harmonious working relationship is not known at this time. It is proposed on the basis of the research above that environmental conditions will impact on the degree of heart rate synchronisation between horse and rider during equestrian sports. To further support the hypothesis for a link between heart rate and psychological factors, this review now considers factors related to the heart rates of horses and humans.

1.5.1 Horse heart rate

As discussed earlier, work by Hama, Yogo & Matsuyama (1996) revealed that the horse's heart rate increases during interaction with humans who have a negative attitude, whereas heart rates do not increase in the horse when the handler had a positive attitude or was a skilled rider. Similarly, exposure to novel objects or changes in environment is shown to increase heart rate in horses without any change in its physical activity (Visser et al., 2002). Thus, heart rate could indicate the quality of the physiological interaction within the working relationship between horse and rider.

Some researchers have suggested links between psychological constructs and physiological indicators. Heart rate has been used as a measure of reactivity in horses to infer their possible emotional states (Kusunose & Yamanobe, 2002; McCann, Heird, Bell & Lutherer, 1988a, 1988b; Sondergaard & Halekoh, 2003; Visser et al., 2002). For example, the anticipation of work, excitement or fear is associated with raising the resting horse's heart rate rapidly to over 100 bpm (Evans, 1994). Clayton (1990) suggests that an individual horse's mental arousal level in the competition environment is associated with increased heart rate. She proposes that this may be due to working in an unknown arena, and the presence of a number of spectators and their physiological activities. In the home training environment, which is familiar to a horse, there are fewer distracting external stimuli during work and so the horse has a more consistent heart rate.

Visser et al. (2002) proposed that an increase in a horse's heart rate can be indicative of emotionality, especially if the physical activity or work intensity of the horse has not changed. Emotionality in horses is becoming a subject of great interest to researchers in the equestrian field, particularly in relation to the horse and rider working relationship. As discussed earlier, researchers (Kusunose & Yamanobe, 2002; McCann, Heird, Bell &

Lutherer, 1988a, 1988b) sometimes assess the horse's temperament through behavioural observation and heart rate.

McCann et al. (1988 a, 1988b) have conducted a program of research and have determined two categories that they identify as nervous and normal (non nervous) horses. Their investigations suggest that nervous horses have a higher metabolic activity than normal horses, and that this is reflected in higher heart rates for nervous horses. This is supported by Momoza et al. (2003) who also found horses rated as highly anxious by caretakers displayed higher heart rates when confronted with strange or novel objects.

In addition, nervous horses took longer to adapt to strange and novel objects and sustain a higher than normal heart rate. Thus, heart rate has been found to be a good physiological measure of reactivity in horses (McCall, Hall, McElhenney & Cummins, 2006). They further indicate that combining the physiological variable of heart rate and more than one behavioural variable better indicates the reactivity of the horse. Increases in the heart rate of horses have been shown to be in response to encountering auditory and visual stimuli (Christensen, Keeling & Nielsen, 2005; Hedman, 2003). Christensen et al. (2005) suggest that heart rate reactions simply reflect a non-discriminant instigation of the sympathetic nervous system, whilst their behavioural responses are correlated to the nature of stimulus. Again, this implies some dimensions of temperament, but temperament specifically has not been investigated in relation to heart rate durability.

Researchers also use heart rate as a measure of calmness in horses. Calm horses display lower heart rates during handling than nervous horses (Kusunose & Yamanobe, 2002; McCann, Heird, Bell & Lutherer, 1988a, 1988b). This is also indicative of the recovery phase where the heart rate of the calm horse falls rapidly after exercise, whereas a nervous horse maintains a higher heart rate for a longer period after exercise (Echer, 1994).

Based on this research, this dissertation includes behavioural observation of the horse and heart rate as a measure of physiological and psychological arousal. It also addresses the role of temperament in the degree of physiological arousal. It will assess whether changes in the horse behaviour and heart rate across the training and competition environments are associated with the working relationship between horse and rider.

Evidence of heart rate variability has been reported in the two equestrian sports investigated in this dissertation. Elite eventing horses have shown lower heart rates during training sessions than in the competition environment (Serrano, Evans & Hodgson, 2002). It is postulated that this is due to the intensity of the competition compared to training demands. However, it can be demonstrated that increases of heart rate over 150 beats per minute (bpm) can occur without exercise and can be a result of anxiety or excitement of the horse, rather than physical demand (Evans, 2000). Here again, the role of temperament may be implicated.

Dressage horses also have a wide range of heart rate during activity. Clayton (1990) revealed in her study of the grand prix dressage horse that heart rates can range from 62 to 141 bpm during a grand prix test even in the training environment. She suggested that low heart rates are indicative of the dressage horse using predominantly aerobic metabolic pathways. However, this is dependent on each individual's fitness and training level (Echer, 1994). Motor skill level also affects the horse's heart rate because of the technical movements required of the dressage horse. The less fit or unskilled horse exerts even more physical effort, and more mental arousal, during the complex dressage movements (Clayton, 1990).

Overall, research shows the heart rate of each horse is influenced by its fitness and its emotionality/reactivity. Therefore, horse heart rate will highlight factors impacting on the performance of the equestrian team during competitive sports. This review shows heart rate is an indicator of physical exercise, mental or psychological arousal, reactivity to novel stimuli and handling, and that environmental conditions are among the many factors influencing the

horse's heart rate. The impact of these factors on heart rate suggests that it is a good physiological indicator which may reveal information regarding the horse-rider working relationship and changes for the individual horse due to the environmental conditions. This review will next consider the human member of the equestrian team and how heart rate is an important indicator of physiological and psychological factors.

1.5.2 Rider heart rate

Heart rate variability in human athletes is indicative of many things, such as fitness, training regimes, exercise intensity, lactate threshold, cardiac drift, maximal oxygen uptake and overtraining (Jeukendrup & Van Diemen, 1998; Kuipers & Keizer, 1988; Lambert, Mbambo & St Clair Gibson, 1998). However, there appears to be some ambiguity or confusion in this literature surrounding the terminology of heart rate variability and its impact on athletes. Heart rate variability is the beat to beat variations in heart rate and not heart rate variation. Although these factors are not investigated in this dissertation, a brief acknowledgement of the research in this area indicates the usefulness of heart rate as a research tool in sports.

This dissertation seeks to investigate the physiological relationship between horse and rider using their actual heart rates (bpm) during the training and competing in equestrian sport. Some studies suggest there may be differences in heart rate (bpm) athletes between training and competition environments associated with psychological factors, which are also of specific interest to this dissertation.

An athlete's heart rate can suggest overtraining (Jeukendrup & Van Diemen, 1998; Kuipers & Keizer, 1988). Heart rate changes during interval training, which consist of a short period of intense activity followed by a rest period and repeated for a number of cycles, indicate when overtraining occurs (Jeukendrup & Van Diemen, 1998). It has been shown in

the training of Taekwondo that different physical activities stress the cardiovascular system to different degrees (Bridge & Jones, 2004; Bridge, Jones, Hitchen & Sanchez, 2007). This is confirmed in the different heart rate responses revealed in the swim, cycle and running phases of an ultra-endurance triathlon (Laursen et al., 2005). However, other factors may also explain these changes in heart rate. For example, Jeukendrup and Van Diemen, (1998) suggest that when a cyclist works at a given intensity, the heart rate may alter if the body position on the seat is changed. Another explanation is cardiac drift, where the longer the athlete works, the greater the increase in heart rate (Jeukendrup & Van Diemen, 1998). Thus, heart rate can be interpreted to indicate many different physical aspects of a sport. Some researchers conclude that because heart rate is a measure of cardiovascular activity or stress, it is also a strong indicator of total body stress (Armstrong, 1998; Jeukendrup & Van Diemen, 1998). Postulating similar processes to equestrian sport of eventing and dressage, it is obvious that changes in heart rate of the rider may be due to many factors.

If a cyclist's movement in the seat can increase their heart rate, then a rider's movements in the saddle might also affect their heart rate. Research can also explain patterns in heart rate changes in the demands of the activity being undertaken. For example, athletes competing in Olympic sail boarding displayed heart rate patterns during the race that indicated whether they were travelling upwind or downwind (Guevel, Maisetti, Prou, Dubois & Marini, 1999). Upwind legs resulted in race competitors' lowered heart rates compared to the downwind legs. Thus, the interpretation of heart rate is more complex than only the direct relationship between intensity of the sport and cardiovascular activity. It can also reflect the athlete's emotional state (Armstrong, 1998). Research also shows heart rate is related to cognitive processing (Egloff, Wilhelm, Neubauer, Mauss & Gross, 2002). Strong correlations between heart rate, blood pressure and implicit anxiety has been demonstrated (Ricarte, Salvador, Costa, Torres & Subirats, 2001).

Sports psychology researchers utilise the athlete's perception of increased heart rate as an indicator of somatic anxiety (Endler, 1978; Martens, Burton, Vealey, Bump & Smith, 1990; Martens, Vealey & Burton, 1990). Martens, Vealey et al., (1990) discuss how an athlete's actual physiological arousal is not necessarily represented by the athlete's self report. Athletes' rating of the statement "my heart is racing" in the CSAI-2 (Martens, Vealey & Burton, 1990) to assess somatic anxiety may not be consistent with their actual heart rates (Karteroliotis & Gill, 1987; Yan Lan & Gill, 1984). Consequently, physiological and psychological measures have been promoted as the best indicators of heightened arousal in athletes (Landers & Boutcher, 1986). While increasing anxiety has been associated with increasing heart rate, physical activity including non-locomotive functions should be taken into account, before psychological interpretations of heart rate patterns are inferred (Major, 1998).

In applying this research to the equestrian sport investigated in this dissertation, it is anticipated that the rider's heart rate will increase on the cross-country course when approaching and jumping a fence. In dressage, this change of heart rate would be evident in the increased engagement of the horse through the use of the rider's aids to undertake the more complex movements such as tempi changes or canter pirouettes. However, given the additional stress with the reactive horse, changes in heart rate at competition for the rider might also be expected to occur due to environmental conditions.

The above research indicates that heart rate is a valid instrument to investigate both physiological and psychological phenomena of horses and riders. Today heart rate is not difficult to measure with portable coded heart rate monitors. The polar heart rate monitors are a non-invasive meter able to be used successfully on human athletes and horses ridden or in harness (Holopherne, Hodson & Rose, 1999). Holopherne et al. (1999) shows that the accuracy of the polar heart rate monitors are comparable to a telemetric ECG with

correlations of .995 under 200 bpm and .847 over 200 bpm. There are over 400 scientific studies using polar heart rate monitors (Laukkanen & Virtanen, 1998). Laukkanen and Virtanen (1998) state that since 1973 polar heart rate monitors have been documented as the most accurate instrument for monitoring heart rate. Current research has shown that the recording intervals of commercial monitors offer valuable data for comparisons. It is shown that heart rate data averaged over a 5 second interval avoids spectral distortion and diminishes the frequency content of the heart rate signal and excludes the indications representing rapid changes in heart rate (McCarthy & Ringwood, 2006). However, McCrathy and Ringwood (2006) conclude that the 5-second interval is sufficient for recording heart rate at all exercise intensities.

The coded polar heart rate monitors provide a non-invasive method for this research to investigate horse and rider heart rate simultaneously in both the training and competition environments. This permitted analysis to determine physiological relationships as an aspect of horse and rider working relationships.

1.6 Developing a measure of the equestrian working relationship

There have been a few attempts to analyse the harmony in a working relationship objectively. Peham et al. (2001) introduced a method of motion analysis using high-speed 3D video to analyse the gait of a horse and the simultaneous movement of the rider in synchrony as repetitive sets of rhythmical patterns of motion. The study showed that a rider must reach and maintain a relaxed physical and psychological state, so that the horse's rhythmical pattern of motion is not inhibited (Largarde, Peham, Licka & Kelso, 2005; Peham, Licka, Kapaun & Scheidl, 2001; Peham, Licka, Schobesberger & Meschan, 2004). Given that the brain and movement systems of horse and rider are vastly different, the development of coordination (harmony) between the two needs much practice and training. The rider aims to develop skill

and sensitivity to anticipate the horse's motion (Largarde, Peham, Licka & Kelso, 2005). This reflects the practice of riders to spend hours in the training environment, turning the resistant movements of the horse into fluid and flexible flowing movement for the competition environment. The researchers conclude that harmony exists between horse and rider when there is an optimum adaptation to each other's movement, such that there is a consistent motion cycle. They suggest that gaining harmony in the working relationship is about the rider's feel for the horse. Consistent with the opinions described earlier (Brandt, 2004; McLean, 2003; McLean & McGreevy, 2004; Waring, 2003; Weeks & Beck, 1996), findings from the studies showed that the professional horse and rider teams had more significant correlations in their motion cycle patterns than the less experienced riders and recreational horse and rider teams (Largarde, Peham, Licka & Kelso, 2005; Peham, Licka, Kapaun & Scheidl, 2001). Furthermore, when the motion patterns were correlated with the dressage scores, a higher correlation was found for professional teams than for the recreational teams. So despite difficulties in quantifying horse-rider partnership, Peham et al. (2001) and Largarde et al. (2005) indicate that it is possible to measure the harmony that is subjectively observed between horse and rider.

However, given the highly specialised use of such technical equipment and method of data analysis, the subjective rating of a trained judge continues to provide the assessment of harmony in a working relationship during a dressage competition. This relies on the experience of the dressage judge to identify the technical quality of the horse's paces, patterns of movement, positioning of rider and application of aids to the horse, to determine the harmony between them. However, this score is still subject to the biases of each individual judge (McGreevy, 2002).

This dissertation sought to develop a reliable and valid rating scale for assessing working relationships. The dressage guidelines of the Equestrian Federation of Australia

rulebook provided a list of specific observable behaviours considered to be indicative of harmony. In addition, the synchronicity of physical exertion of horse and rider, as suggested by the research of Peham et al. (2001) and Largarde et al. (2005), was also assessed by monitoring the simultaneous heart rate of horse and rider in training and competition environments

1.7 Summary

Humans have built a unique working relationship with horses over the past 6,000 years. However, this working relationship is challenged by many aspects of physiology and psychology of horse and rider. This challenge originates from the natural instincts of each horse, which is a prey animal predisposed to fleeing from the rider, who is a predator (Rees, 1984). These instincts imply different psychologies which challenge the human to lead and direct the horse as its rider, and the horse to follow this direction, even though it may be contrary to its natural impulses. Implicit in such a relationship are psychological dimensions of anxiety of the rider and the temperament of the horse, and the physiology of the physical interaction of horse and rider.

The stability of these factors and the working relationship, reflected in horses' temperament, and heart rate, and in riders' cognitive and somatic anxiety, emotion and mood experience of anxiety and heart rate is investigated in training and competition environments (Clayton, 1990; Fraser, 1992; Martens, Vealey & Burton, 1990; McCann, Heird, Bell & Lutherer, 1988a, 1988b; Williams, 1999). A successful working relationship between the horse and rider is of the utmost importance for a successful performance in equestrian sport.

In investigating these factors, it is anticipated that the relationship will be reciprocal between horse and rider. An anxious rider is restricted in the ability to communicate with the horse. At worst the anxiety can impact on the horse's survival instincts if the rider's

communication is interpreted as demanding dangerous action or threatening behaviour, prompting a flight response from the horse (Rees, 1984). The literature shows that emotion and mood states can be distinct components of this anxiety, and therefore investigating both will give an enhanced understanding of how aspects of the rider's anxiety relates to the working relationship with their horse. Conversely, a nervous or bad tempered horse may incite anxiety in the rider, but a calm rider may equate to a calm horse and vice versa (Williams, 1999).

Heart rate is shown in the literature to be a beneficial tool to uncover both physiological and psychological differences as aspects of the working relationship. The use of heart rate also enables further investigation of relationships between this physiological measure and self-reported psychological measures. The literature indicates that the increased heart rate of the horses and riders may be due to psychological or physiological arousal (Clayton, 1990; Evans, 1994; Martens, Vealey & Burton, 1990). Research showing that humans' positive or negative attitude when interacting with a horse may be associated with heart rates of each of them (Hama, Yogo & Matsuyama, 1996) prompt further questions about the physiological-psychological link of both species. These investigations will be conducted to permit triangulation of data for both horse and rider using self-report measures and behavioural observation and physiological indicators.

Chapter 2. The working relationship between horse and rider during the cross-country phase of eventing

Abstract

This study sought to develop methods for assessing the horse-rider working relationship, to determine factors related to this relationship and to assess its stability in training and competition environments during the cross-country phase of an eventing competition. Factors assessed were horse behaviour, the psychological measures of horse temperament and rider anxiety, and physiological measures of horse and rider heart rates. These factors were analysed in relation to the horse-rider relationship as indicated by the rider's assessment on the Working Relationship Inventory (WRI-R) and the Heart Rate Synchronisation (HRS) between rider and horse. The horse behaviour was measured by an observer who recorded occurrences of specific behaviours on a Behaviour Check List (BCL). The horse temperament was rated by the rider and an observer, using a Horse Temperament Inventory (HTI-R; HTI-O respectively). The rider anxiety was assessed through self-report, using the Competitive State Anxiety Inventory – 2 (CSAI-2) and the Emotion and Mood Components of Anxiety - Questionnaire (EMCA-Q). The horse and rider heart rate was assessed using coded polar s610 monitors simultaneously during training and competition. Due to the limited number of participants volunteering in this study, the data were analysed using the Cohen's *d* test for independent means to determine differences in factors in the training and competition environments. The WRI-R and the HRS revealed small to large effect size (respectively) between environments, with higher scores in the competition environment. The rider's somatic anxiety and the emotional experience of this anxiety showed a moderate effect size with higher anxiety scores in the competition environment. However, cognitive anxiety, self confidence and the mood experience of anxiety did not differ between

environments. The HTI-R showed a large effect size for the better temperament score in the competition environment. The HTI-O without the rider also showed a large effect size for the poorer temperament score in the competition environment. The HTI-O with the rider showed no environmental differences. Analysis of the horse and rider's heart rate data revealed small to large effect sizes with higher heart rates in the competition environment.

Discussion describes the methodological challenges of equestrian research. However, this study demonstrates some sensitive and useful measures and procedures suitable for future studies into the stability of horse-rider working relationship during equestrian sport. The findings provide a good foundation for further investigation of related psychological and physiological factors in a different equestrian discipline which provides trained judges to assess the working relationship.

2.1 Introduction

This study examines the working relationship between horse and rider during the cross-country phase of eventing in both the training and competition environment. It investigates particular horse behaviour, temperament and heart rate, and the rider's psychological state from the components of cognitive and somatic state anxiety, and the emotion and mood experience of this anxiety, and heart rate. This introduction firstly outlines the sport of eventing and some of the issues in the sport. It then presents the questions and hypotheses that will be investigated in the study.

Eventing is the triathlon of equestrian sport, combining three different disciplines in one competition. Thus, it is assumed here that the horse and the rider each impact on their working relationship to meet the demands of these different types of training. Eventing competitions are conducted as one-day or three-day events. The first eventing competition that resembles the current competitions was held in 1902. It was introduced into the Olympic games in 1912 (Wikipedia contributors, 2007). The current Olympic competition includes

dressage, cross-county and showjumping phases, which are held over three days. This study investigated the equestrian teams involved in competition at a one-day event, which includes dressage, cross-country and show jumping. The cross-country phase was used for data collection.

The cross-country phase of eventing requires both horse and rider to be exceptionally fit and responsive to each other. The cross-country phase consists of approximately 12-20 fences (lower levels), or 30-40 fences (higher levels), situated on an outdoor course. These fences are solid objects with various obstacles such as water, ditches, drops and banks. The rider is required to complete the course within a specified time frame. If a team finishes outside this set time, a penalty is imposed for each second. At the lower levels of eventing there is also a speed time fault which incurs penalties for teams completing the course too quickly. If the horse refuses to jump a fence, or if the rider falls, it incurs penalties. Refusal on the cross-country course is penalised severely, relative to the other phases of eventing, to emphasize the importance of obedience, courage, endurance and athleticism (The Equestrian Federation of Australia Ltd, 2007).

The cross-country phase tests horse and rider stamina, skill and courage to jump obstacles over difficult terrain. The levels of eventing range from introductory to advanced. International competitions are rated in level by stars from one (CCI*) being the lowest level, to four being the highest (CIC****) (The Equestrian Federation of Australia Ltd, 2007). In this study competitions were introductory to advanced levels at a local club events, with one event being graded a CNC* competition.

Eventing is a considered a demanding and dangerous equestrian sport (Cripps & Pagano, 2002; Federation of Equestrian International, 2002).Australia has had much success at international eventing competitions, so the sport has gained increased popularity nationally. However, this enthusiasm has been tempered by the deaths of riders and horses from

beginners to the elite. The accident data for Australia prior to 2002 shows that on average 20 riders die and a further 3000 riders are hospitalised per year, with serious injuries across all equestrian sport and recreational riding (Cripps & Pagano, 2002). In the case of eventing, deaths and injuries occur on local, national and international competition circuits. A study of the cross-country phase of the eventing course in England has revealed that one in three horses injure themselves in falls with one in one hundred being fatal (Murray, Singer, Morgan, Proudman & French, 2006). There have been 172 falls during the cross-country phase of 29 eventing competitions in NSW and SA in 2001, or five serious falls per event in NSW and SA (Cripps & Pagano, 2002).

Australian officials are currently debating possible causes of the deaths and injuries to horses and riders during eventing. The statistics for Queensland are not yet available for equestrian accidents. There is some research into the causes of these accidents, focussing on rider error, unsafe riding practices and course design (Cripps & Pagano, 2002). Indeed, eventing is in jeopardy of expulsion from the Olympic program for safety reasons. One of the Federation of Equestrian International's longstanding eventing committee members, and eminent historian, Max Amman states:

> *Eventing has been half dead several times. When Iller was killed across country at the Stockholm Olympics in 1956 it killed the sport in Sweden for the next twenty years. When a horse died at Boekelo the sport became an issue for the Dutch Parliament. Then Fontainebleau followed by Badminton when three horses died caused further uproar, and finally in the last year or so when so many riders lost their lives. Unfortunately every time, there was a reaction but never an action (Federation of Equestrian International, 2002).*

Unfortunately, there is little empirical study to give informed explanations for these accidents and to advise on methods of prevention. Even though aspects of human and horse error during the cross-country phase of eventing are described in the literature, specific factors contributing to this error have not been researched. This dissertation purports to contribute to this by researching one possible aspect of the problem, namely the horse-rider relationship.

Any deficiency in this working relationship caused by horse or rider is certain to have an impact on safe performance during the cross-country phase of eventing, particularly as the horse's temperament and rider's anxiety impacts on communication, decision making of the rider and obedience of the horse. Anecdotal information indicates that the temperament of the horse is an important factor to be considered when competing in equestrian sport. Investigations conducted with horses outside the sporting environment show that the temperament of the horse is related to their learning and obedience (McCann, Heird, Bell & Lutherer, 1988a, 1988b). Therefore, the horse's temperament is an important contributor to the risk surrounding the cross-country phase of eventing. For this reason, temperament is assessed in this study in relation to the working relationship.

In the limited empirical literature the research of Hutson and Haskell, (1997) and Hutson (2002) indicated that horse behaviour can be an indicator of future performance on the race track. This study adapts horse behaviours from the 60 behaviour variables used by Hutson and Haskell, (1997) and Hutson (2002) to observe 10,509 horses in their studies, attempting to identify pre-race behaviour as a predictor of race finishing order. The present study adopts their methodology of observing the horse's behaviour with and without the rider. This study extended the contexts for observation by comparing horse behaviour in both the training and competition environments. The horse behaviours selected to be observed here included ear position, head and nose position, mouth position and moisture, eye blinking,

sweating, pawing, tail position, defecating and vocalising. The details specific to these behaviours will be described later in the methods section.

On the cross-country course the rider may experience anxiety due to the personal risk of the sport, with the added anxiety induced by any negative characteristics of their horse's behaviour and/or temperament. However, there is little empirical data regarding the psychology of riders that may contribute to explanations of accidents. Terry (1989) suggests that regardless of sporting discipline, athletes encounter many situations that contribute to their state anxiety. As defined earlier, anxiety develops when an athlete is concerned or worried about an impending danger or performance outcome (Martens, Vealey & Burton, 1990; Woodman & Hardy, 2001). There are implications of rider anxiety in compromising their abilities to manage the horse through the dangers of the cross-country course, as anxiety is associated with an ability to focus, and execute skills and judgement (Davis & Sime, 2005; Janelle, 2002).

In summary, the literature demonstrates the safety issues and dangers in the equestrian sport of eventing. Furthermore, psychological and physiological factors of both horse and rider are seen to impact on their relationship and hence on safety in the competition environment.

2.1.1 Objectives and hypotheses

This study has two purposes. Firstly, it aims to establish methodologies to investigate the horse and rider working relationship and behavioural, physiological and psychological factors related to it. Secondly, it explores the stability of this relationship and the related factors across training and competition environments. This study tests the following hypotheses:

Hypothesis 1: There will be significant differences in the ratings of the working relationship and heart rate synchronicity of horse and rider between the training environment and competition environment with lower scores in competition.

Hypothesis 2: There will be significant differences in the ratings of the horse and rider heart rate, and rider's cognitive anxiety, somatic anxiety and self confidence, and emotion and mood experience of anxiety and heart rate between the training and competition environments, with higher scores in competition.

Hypothesis 3: The horse's temperament will indicate trait characteristics by showing no significant differences between training and competition environments.

2.2 Methods

This study has two phases: the first phase investigated horse-rider pairs during their usual training routine which included jumping some rail or cross-country fences. The second phase investigated horse-rider pairs during the cross-country phase of an eventing competition.

2.2.1 Participants and research sites

Five adult riders volunteered to participate in this study. These riders met the following selection criteria: at least 18 years of age, registered with the Equestrian Federation of Australia for insurance purposes, and training and competing in the equestrian sport of eventing from introductory to advanced levels.

There were three female riders and two male riders. Riders ranged in age from 23 to 52 years. Their riding experience ranged from 2 to 30 years, with 1 to 20 years of experience competing in the equestrian sport of eventing. Further background information of the horse-rider pairs is presented in Table 2.1.

Table 2.1: The demographic information and competition data summary of riders and horses

Demographic Information	Team 1	Team 2	Team 3	Team 4	Team 5
Gender	Female	Male	Female	Female	Male
Age	24	52	23	33	37
Years riding	20	2	18	30	2
Years eventing	6	2	15	20	1
Training level	Novice	Preliminary	Advanced	Intermediate	Introductory
Levels competing	Introductory Preliminary	Introductory	Novice	Introductory to Intermediate	Introductory
Assistance from	Horse Trainer Riding Coach	Riding Coach Sports Psychologist	Riding Coach	Horse Trainer Riding Coach	Riding coach
Horse age	4	10	8	5	12
Horse sex	Stallion	Gelding	Mare	Gelding	Gelding
Competition data					
Period horse eventing	7 months	Not competed	3yrs	2 months	5yrs
Years horse has competed	7 months	1st competition	3yrs	2 months	1 yr
Competitions per year	10	16	3	10	6
Horse training level	Preliminary	Preliminary	Pre-novice	Introductory	Preliminary
Level competing today	Introductory	Introductory	Novice	Introductory	Introductory
How important is the X country Phase	Above average	Above average	Extremely	Average	Above average
How well do you think you will perform	As Usual	As usual	Better than usual	Better than usual	As usual
How well did you go in today's X country	As Expected	As expected	Greatly above expectation	Above expectation	As expected
How well did your horse go today's X country	As expected	As expected	Greatly above expectation	Above expectation	As expected
Placing	1st	No place	5th	4th	Eliminated
Jumping Penalties	0	0	0	0	Missed 2 fences
Time Penalties	0	0	4	1.2	0

The first stage of data collection was conducted at the rider's usual training environment during the week leading up to the competition. The second stage of data collection was conducted at the competition environment nominated by the participant. These competitions were located throughout Southeast Queensland, Australia. The only research requirements for the nominated competition location were: the organisation conducting the competition was affiliated with the EFA; the competition was conducted under the EFA rules; and organisers were agreeable to the requirements of the researcher and the use of heart rate monitors on both horse and rider.

2.2.2 Measures

The first part of the survey (Appendix A) for the training environment collected demographic information about the horse and rider as above. The surveys included the questions as recommended by Martens, Vealey et al. (1990) to determine the importance of the competition and the rider's performance expectation at competition. The questions regarding the performance of riders were modified from the work of Martens, Vealey et al. (1990) and Fitzpatrick (2004) to suit the equestrian sport of eventing. Before the competition started riders were required to rate: "How important is your result in the cross-country phase of the competition?" For this question a 5-point Likert scale was employed ranging from 1 (of little importance) to 5 (extremely important), "How well do you think you and your horse will perform during the cross-country phase of today's competition?" This question also utilised a 5-point Likert scale ranging from 1 (greatly below our usual) to 5 (greatly above our usual). After the competition, riders rated the questions: "How well do you think you went in today's cross-country phase of the competition?" using a 5-point Likert scale ranging from 1 (greatly below expectation) to 5 (greatly above expectation). "How well do you think

your horse went in today's cross country phase of the competition?" employing a 5-point Likert scale ranging from 1 (greatly below expectation) to 5 (greatly above expectation).

The data collected from riders' ratings on the above questions showed that at competitions, all riders perceived the cross-country phase to be important. Three riders perceived above average importance and reported they would perform as usual. The rider competing at the novice level perceived the competition as extremely important and believed they would perform better than usual. The remaining rider reported an average importance and perceived they would perform above expected. After the competition the riders who perceived they would perform as usual, reported that both they and their horses performed as expected. However, it can be seen that their results ranged from winning to being eliminated from the competition. The most experienced riders perceived a better than usual performance. They also perceived a performance above or greatly above expectation after the cross-country phase resulting in a 4th place and no place respectively (Table 2.1).

The competition score and placing were also recorded at the competition (see Table 2.1).

2.2.2.1 Working relationship between horse and rider

There is no empirically established methodology to evaluate the working relationship between horse and rider during the cross-country phase of eventing. When assessing the working relationship on the cross-country course, the following factors are considered; the horse is required to move forward freely in regular rhythm of gait, paying attention to the rider's aids for speed and direction to the fences. Thus, the horse must listen to the seat, leg and hand aids of the rider, accept the contact on the bit and respond quickly. The horse needs to engage the hindquarters to develop the power (impulsion) to jump the cross-country fences from these aids.

The Working Relationship Inventory (WRI) developed for this study was developed from behaviours listed in the EFA guidelines for judging harmony in dressage tests. As described in the previous paragraph, these are considered to be necessary to jumping disciplines as well as dressage. A list of these descriptors was compiled, drawing from official dressage manuals (National Dressage Committee, 2008) (Appendices A & B). They comprise four categories of criteria, reflecting overall performance of horse and rider, all of which are implicated in the working relationship or harmony between horse and rider and are required in jumping a cross country course.

1. Paces (freedom and regularity)
2. Impulsion (desire to move forward, elasticity of the steps, suppleness of back and engagement of hindquarters)
3. Submission (attention and confidence; harmony, lightness and ease of movements; acceptance of bridle and lightness of the forehand)
4. Rider's ability to use aids, position and seat; correctness and effect of the aids (National Dressage Committee, 2008).

Twelve items were derived from criteria for the above four categories. These items included: "responding to aids", "engaging hindquarters", "willing to go forward", "working as part of a team", "paying attention", "feeling at ease", "accepting the bit", "soft in hand", "making snappy transitions", "good rhythm in all gaits", "submitting to work" and "working with impulsion".

Two forms of the working relationship inventory were developed, one for the rider (WRI-R) and one for an observer (WRI-O). As an observer is unable to have hands-on contact with the horse, four items, "responding to aids", "feeling at ease", "soft in hand", "making snappy transitions" were excluded from the observer's inventory. These items were replaced in the Observers' WRI with two items, "fighting rider" and "working with rider".

Observers and riders were asked to rate each item of the WRI in training and competition environments, using a 5-point Likert scale ranging from 1 (not at all) to 5 (extremely). The riders completed the WRI after they had ridden their horses during the warm-up period and before they started their training regime, or before they entered the starting box for the cross-country phase of the competition. The rating for each item was summed to give a total score. Scores ranged from a poor working relationship of 12 to an excellent working relationship of 60.

The observers were asked to complete the WRI during the warm-up period and before the team started their training regime, or before they entered the starting box for the cross-country phase of the competition. The rating for each item was summed to give a total score, with score for the item "fighting with the rider" being reversed before adding. Scores ranged from a poor working relationship of 10 to an excellent working relationship of 50.

2.2.2.2 Competitive State Anxiety Inventory-2

The CSAI-2 consists of 27 self-report items, which represent three subscales of cognitive state anxiety, somatic state anxiety and self-confidence. Each subscale had nine self-report items. To enable a possible comparison of data between equestrian sports, the five-point Likert scale used by Fitzpatrick (2004) was adopted for this study. The scale ranged from 1 (not at all) to 5 (extremely). As the CSAI-2 was used for both training and competition, the items were altered in wording to make appropriate reference to each event. For example, the cognitive state anxiety subscale items were worded as, "I am concerned about this training session [or competition]" or "I am concerned that I might not do as well in this training session [or competition] as I could". However, most items such as "I have self-doubts", "I am concerned about performing badly" were worded the same at both the training and competition environments.

Nothing was altered in the wording for the somatic state anxiety items. Examples of the somatic anxiety items are, “My body feels tense”, “I feel jittery” and “My heart is racing”. The self-confidence items also remained unchanged. For example, “I feel mentally relaxed”, “I’m confident about performing well” and “I feel secure”. These items from the CSAI-2 are shown in full in Appendices A and B.

The responses for each of the nine items for each subscale were summed to calculate a total subscale score. However, the score for item 14 in the somatic state anxiety subscale was reversed as outlined (Martens, Vealey & Burton, 1990). The possible scores for each subscale ranged from a low of 9 to a maximum of 45. This study did not have enough participants to determine the reliability of this inventory. Thus, this aspect of the CSAI-2 will be discussed later in the dissertation. However, Martens, Vealey et al., (1990) have reported acceptable reliability for each CSAI-2 subscale with Cronbach alpha coefficients for cognitive state anxiety ranging from .79 to .83, somatic state anxiety ranging from .82 to .83 and self confidence ranging from .87 to .90. Previous reliability testing of CSAI-2 subscales in equestrian sports by Fitzpatrick (2004) also found data from showjumping riders to have good internal reliability, with Cronbach alpha coefficients for the three subscales as follows: cognitive state anxiety (.78) somatic state anxiety (.88) and self-confidence (.85).

During the progress of this research a revised CSAI-2 (CSAI-2R) scale (Cox, Martens & Russell, 2003) superseded the original CSAI-2. The CSAI-2R is an edited version of the CSAI-2 where some of the 27 items have been removed from the original scale, giving the revised version a better factor structure. As the exclusion of some items is the only difference between these scales, this dissertation was able to consider outcomes from both the original and revised scales.

The CSAI-2R removes the following items from the original cognitive subscale: Item 1 “I am concerned about this competition”, Item 4 “I have self doubts”, Item 19 “I’m

concerned about reaching my goal" and Item 24 "I am concerned I won't be able to concentrate". Items removed from the somatic subscale were, Item 2 "I feel nervous" and Item 14 "My body feels relaxed". Items removed from the self-confidence subscale were: Item 3 "I feel at ease", Item 6 "I feel comfortable", Item 12 "I feel secure" and Item 21 "I feel mentally relaxed". The CSAI-2R utilises 17 self-report items, still representing three subscales of cognitive state anxiety, somatic state anxiety and self-confidence. This now reduces the items in each subscale to five items for cognitive state anxiety, seven items for somatic state anxiety and five items for self-confidence. Items for the revised subscales are worded in a manner similar to the items listed above for the CSAI-2.

Evaluation of anxiety factors used in the CSAI-2 was expanded by the evaluation of the emotion and mood experience of anxiety, using the Emotion and Mood Components of Anxiety –Questionnaire (EMCA-Q) (Beedie, Lane & Terry, 2001) to identify the anxiety experienced by the eventing riders (Appendix A and B).

2.2.2.3 Emotion and Mood Components of Anxiety Questionnaire

The EMCA-Q consists of 10 self-report items, which represent the two subscales of emotion and mood components of anxiety. Each subscale has five self-report items within the questionnaire.

As the EMCA-Q was used for training and competition environments in this study, the items for emotion components were altered in wording to make appropriate reference to each event. For example, the emotional component of anxiety subscale items were worded; Item 1 "I am nervous when I think about this training session [or competition]", Item 3 "I am worried that pressure of this session [or competition] will make me perform poorly", Item 5 remained the same "I have doubts about achieving my goals", Item 7 " I feel apprehensive about this session [or competition]" and Item 9 "I feel anxious about not performing as well

as I could in this session [or competition]". The items for the mood components of anxiety remained the same for both environments. For example, Item 2 "At the moment I seem to be worried about a lot of things", Item 4 "At the moment I keep remembering occasions when I failed to achieve my goals", Item 6 "I am anxious at the moment, but not for any one particular reason", Item 8 "I believe some of my goals are unachievable at the moment" and Item 10 "At the moment I feel anxious about several unrelated things". Riders responded to each item using a four-point Likert scale ranging from 1 (not at all) to 4 (very much so). Beedie et al. (2003) tested the reliability of this inventory using student athletes, students sitting their final exams and rugby players. Their findings show good factor loadings of ($p < 0.01$) with Cronbach alpha coefficients ranged .75 to .82 for emotion and .70 to .74 for mood.

2.2.2.4 Physiological assessment of rider

The heart rate of riders was assessed using a Polar S610 coded receiver (Figure 2.1) and a T61 coded transmitter (Figure 2.2). This device was chosen because it has been shown to be an accurate device suitable for measuring and analysing heart rate in the sporting arena (Laukkanen & Virtanen, 1998). It is also a coded device that has the ability to operate in close proximity with another coded heart rate monitor. This coding reduces the incidence of interference between the heart rate monitor and transmitter on both the horse and rider simultaneously. The heart rate data were downloaded to a computer using Polar Horse Trainer SW 3.0 and were then transferred to an Excel file and prepared for analysis.

The heart rate transmitter was placed around the chest of the rider with a thin film of electrode gel for more effective contact to the rider's chest (Figure 2.2). The receiver was placed on the rider's wrist (Figure 2.1).

Figure 2.1: Polar S610 coded receiver

Figure 2.2: Polar T61 coded transmitter

2.2.2.5 Horse Temperament Inventory

This dissertation drew items to measure the temperament of the horse specifically from the work of Mills (1998b) and Fitzpatrick (2004). Riders were asked to rate observed temperament characteristics of their horse on the day. The descriptors derived from Mills (1998b) were: affectionate, alert, bold, flighty, honest, intelligent, laid back, moody, and sensitive. The items of mood states originating from Fitzpatrick (2004) were: alert, anxious, bad-tempered and nervous. The remaining items are common descriptors from anecdotal writings used by equestrians to describe their horse's temperament: calm, enthusiastic, excitable, exhausted, fighting, hot, lazy, sharp and willing.

The Horse Temperament Inventory-Rider (HTI-R) was given to riders after they had ridden their horse in the warm-up period and before they began jumping fences at training or entered the starting box for the cross-country phase of the competition. Riders rated each descriptor on a "5-point" Likert scale ranging from not at all (1) to extremely (5). This temperament inventory was assessed as consisting of eleven positive descriptors and eleven negative descriptors. Thus, reversing the values of the negative items allows a single numerical score to reflect the horse's temperament. The scores ranged from 110 (positive temperament) to 22 (poor temperament).

A Horse Temperament Inventory-observer (HTI-O) was also designed for an observer to rate the horse's temperament with similar descriptors used by the rider. This inventory was a shortened version of the rider's inventory to reduce the observation time and the need for direct interaction with the horse, in order to rate the horse's temperament. The inventory was reduced to 9 items: alert, anxious, calm, excitable, fizzy, flighty, fighting, nervous and relaxed. Observers rated the horse before it was tacked up and when the rider was mounted in the warm-up period. Observers responded to each descriptor item using a "5-point" Likert scale ranging from not at all (1) to extremely (5). These items were also evaluated as positive (3 items) or negative (6 items) to give a temperament score ranging from 45 (positive temperament) to 9 (poor temperament).

2.2.2.6 Behavioural observation of the horse

This study selected 11 horse behaviours, which, as part of the Behaviour Check List (BCL) included ear position, head and nose position, mouth position and moisture, eye blinking, sweating, pawing, tail position, defecating and vocalising. These behaviours were selected from the 60 behaviours used by Hutson and Haskell, (1997) and Hutson (2002). The study also adopted their methodology of recording a single occurrence of the horse's behaviour with and without the rider. This study extended the contexts for observation by recording any variation of the behaviour and comparing horse behaviour in both the training and competition environments.

The observers recorded the variations of horse behaviour listed on the BCL (see Appendix C and D). The BCL required the observers to identify if: the horse's ear position was "forward, middle, back or sideways"; the horse's head position was "up, normal, down or stargazing"; the horse's nose position was "forward, vertical or bending towards chest"; the horse's mouth was open or closed "normally, clenched shut, teeth bared, top lip curled or

tight bottom lip"; the horse's mouth moisture was "dry, wet, foaming or excessive frothing"; the horse's eye was blinking "not at all, occasionally or frequently"; if the horse was standing "quiet and dozing, looking around, fidgeting"; if the horse was sweating "normally, abnormally or not sweating"; if the horse was pawing "yes or no"; if the horse's tail position was "up, normal, down, tight between its legs, bent in any directions, switching"; if the horse was defecating "normally, not at all, sloppy, frequently, frequently and sloppy"; if the horse was vocalising "yes or no".

The occurrence of the listed behaviours during the observation period was then compared for the training and competition environment. Data was summarised in terms of what variation of the behaviour listed in the previous paragraph occurred and whether it had changed (C) or not (S) from the training to the competition environments.

2.2.2.7 Physiological assessment of the horse's heart rate

The heart rate of the horse was monitored with a Polar S610 coded receiver (Figure 2.1) and a T52H coded transmitter (Figure 2.3). This monitor has been shown to be an accurate non-invasive measure of heart rate in the horse when it is ridden (Holopherne, Hodson & Rose, 1999). Both receiver watch and transmitter are coded to stop the cross talk or interference with the heart rate monitor and transmitter on the rider. The heart rate data were downloaded to a computer using Polar Horse Trainer SW 3.0 and were then transferred to an excel file for analysis.

Figure 2.3 Polar T52H coded heart rate transmitter

2.2.3 Procedure

Approval for the project was sought from the University of Southern Queensland Animal Ethics and Human Ethics Research Committees (Appendices E and F, respectively). Permission was also sought from the Chairman of Eventing Queensland to conduct this research during competitions in south east Queensland. Permission to use heart rate monitors in official competitions was sought from Eventing Queensland. The Eventing Queensland Committee gave approval. Organisers of competitions where research might be conducted were contacted by telephone. Subsequently, the event organisers were notified of each rider involved, so consideration could be given to scheduling competition times to allow for fitting of heart rate monitors on both horse and rider. The organisers were cooperative with understanding in time allocation for the competitors in the research program.

Once approval was granted from the Ethics Committees and Eventing Queensland, participants were sought by advertising through the EFA Queensland eventing magazine, newsletters of local eventing clubs in South East Queensland and by personal contacts of the researcher and supervisor in competitive eventing. The researcher interviewed each rider who expressed interest in the study.

Each requirement and procedure of the project was explained to the prospective participant. They were informed that they would be asked to complete surveys concerning

general information about themselves and their horses, their thoughts and feelings about their performance and their horse in training and competition environments. They were advised they would be video recorded during their training regime and the cross-country phase of a competition. The use and purpose of the heart rate monitors was also explained. After this induction each rider willing to participate was asked to sign a consent form (Appendix F) to confirm their acknowledgement of the requirements and procedures in this research. They were advised that they could cease participation at any stage in the project if they so chose.

2.2.3.1 Training environment

Data collection began during the week prior to the competition nominated by the rider. The researcher met with the rider at their training site. Each rider was given the survey instrument and asked to read each section carefully. They were reminded to answer the statements in relation to how they felt (right now) at the time. Riders completed the initial demographic section of the survey after tacking up the horse and they then completed the CSAI-2 and EMCA-Q inventories.

As they filled out the CSAI-2 and EMCA-Q inventories, the researcher fitted the heart rate monitor on the horse. The heart rate transmitter was fitted on the D ring on the front of the saddle on the nearside, and the receiver was fitted to the D ring on the offside. The positive electrode was fitted under the girth on the near side and the negative electrode was fitted under the saddle flap on the opposite side of the horse.

After the riders completed the CSAI-2 and EMCA-Q inventories, they were then asked to fit their own heart rate monitor. The riders were asked to fit the heart rate transmitter around their chest. Female riders were asked to place the transmitter under their bra strap below the breast to hold the transmitter in place. The receiver was placed on the wrist. The rider was asked to stand about 3 – 4 metres away from the horse when they started their heart

rate monitor and began recording heart rate data. The researcher started the heart rate monitor on the horse simultaneously. This allowed each heart rate monitor and transmitter to be set to a coded frequency to stop cross talk between monitors operating in close proximity of each other.

The rider then proceeded to warm up the horse according to their normal routine. Once the rider had ridden and warmed up the horse, they completed the HTI-R and the WRI-R. Immediately after completing the survey, they rode the fences of the cross-country course or showjumping fences used in training environment. The training session was videotaped for later assessment.

The researcher and an assistant used the BCL to rate the horse behaviours before the warm up period. They also rated the horse behaviours using the BCL with the rider during the warm-up period, before the training session. The observers further rated the horse's temperament with rider mounted and without the rider, using the HTI-O. The riders also reported their perceptions of the horse's characteristics using HTI-R.

For the purposes of hygiene, the heart rate monitors were cleaned between riders and horses, using chlorhexidine and distilled water mixture in 10 percent solution.

2.2.3.2 Competition environment

The competition environment procedure was slightly different from the procedure at the training environment, as some riders competed at a number of different competition levels on different horses during the same day. The researcher liaised with the competition organisers so riders would not be penalised if they were late to compete due to delays caused by data collection. A research assistant managed the equipment changeover from rider to rider and completion of the survey. All riders had ridden their horses in dressage tests prior to

the cross-country phase, so they completed the whole survey before warming up for the cross-country course.

The riders also reported the importance of the competition result to them, and how they thought they would perform. At the end of the competition riders rated how they thought they performed in the competition, and how well the horses performed in competition, their scores and their placing.

The observers rated the working relationship between horse and rider, using the WRI-O. They used the BCL to rate the horse behaviours when the horse was tied to the float without the rider and during the warm up period with the rider.

2.3 Results

2.3.1 Data preparation and analysis procedures

All survey data from riders and observers was entered into an Excel spreadsheet. Heart rate data for horse and rider were downloaded using the Polar software, transferred to Microsoft Excel and added to the rider and observer data.

Due to the small sample size inferential statistics are unable to be used. Thus, a Cohan's *d* analysis was calculated to address hypotheses regarding differences in measures due to environment. This study used the test of m_A Vs m_B for independent means calculating the effect size index using the formula of $d = \frac{\mathrm{mA}-\mathrm{mB}}{\sigma}$ (Cohen, 1992). The interpretation of the effect size resulting from this formula is as recommended by Cohen (1992) that a value of .20 = small effect, .50 = moderate effect, .80 = large effect.

To determine if a physiological relationship existed between the horse and rider's heart rate, a Pearson correlation was calculated to determine the Heart Rate Synchronisation (HRS) between horse and rider. The accuracy of the heart rate synchronisation data taken was +/- 2 bpm between horse and rider when data were combined for the Pearson analysis. These

HRS data were also analysed using the Cohen *d* test of effect size to determine if there were any differences in heart rate synchronisation between environments.

2.3.2 Analysis of the measures

A primary purpose of this study was to develop and test measures of the WRI-R and WRI-O to rate the working relationship between horse and rider, the HRS to score heart rate synchronisation between horse and rider, horse behaviour observation using the BCL, and the HTI-R and HTI-O to rate horse temperament.

Due to the small n of this study the psychometric properties of these measures could not be tested. However, the sensitivity, functionality and methodology for using these measures appear to be good.

The rider's ratings on the WRI-R showed no missing items and the methodology of its administration during training and competition appears to be sound. The observers' ratings on the WRI-O had missing items and there appears to be little agreement in the ratings between the observers. This lack of consensus between observers is cause for doubt about the clarity of items for observers (Appendix H, Table A.1). Thus, the observers working relationship data was removed from further data analysis.

The coded s610 Polar monitors proved to be an effective and reliable tool to collect data from horse and rider simultaneously, even over obstacles at the gallop. The use of the Pearson statistic proved a suitable analysis to determine the relationship between heart rate of the horse and rider, which became the HRS indicator.

The participant numbers did not allow for the analysis of the psychometric properties of the HTI-R or the HTI-O. However, riders and observers reported no problems identifying the behaviours on the inventory, and as presented in Table 2.4 the measure was sensitive to differences in environments. The data collection for the HTI-R had no difficulties in the

training and competition environments. There was missing data for the second observer rating on the HTI-O (Appendix H, Table A.2) and this data was removed from further analysis in this study.

2.3.3 The environmental impact on the horse-rider relationship

To test the hypothesis that the working relationship score and heart rate synchronisation score would be lower in the competition environment, the Cohen's *d* statistical procedure was used. Analyses revealed a small effect size in the data (Table 2.2). This indicates that the rider's ratings of their working relationship are stronger in the competition environment compared to the training environment.

The HRS also shows a large effect size for the differences between environments (Table 2.2). This data shows that the HRS scores of this group of riders improved from the training environment to the competition environment. It was therefore concluded that the hypothesis was rejected here as the means for the WRI-R and the HRS show higher scores in the competition environment. However, due to the small *n,* inferential statistics could not be undertaken to confirm the significance of this finding.

Table 2.2: The WRI-R scores and HRS means, σ standard deviations and Cohen's *d*

Source	Mean Training	Mean Competition	σ SD	d
WRI-R	51.80	55.80	10.30	-0.39
HRS	.52	.74	.26	-0.84

2.3.4 Psychological and physiological assessment of the rider

To test the hypothesis that the rider's self report of cognitive anxiety, somatic anxiety, emotion and mood experience of anxiety, and heart rate would be lower in the

training environment compared to the competition environment and that self-confidence would be higher, the Cohen's *d* statistical procedure was used. Analyses revealed no mean differences in cognitive anxiety in the original CSAI-2 between environments (Table 2.3). However, a moderate effect size was revealed for the mean differences in somatic anxiety and self-confidence between the training and competition environments as hypothesised (Table 2.3). When testing the same hypothesis using the CSAI-2R means there were no effect sizes for the mean differences for cognitive anxiety and self-confidence. However, a moderate effect size was evident in the mean differences for the somatic anxiety subscale of the CSAI-2R (Table 2.3).

Analysis of the emotion experience of anxiety showed that a moderate effect size was found for the differences between the training and competition environments. However, the differences of the mood experience of anxiety showed no effect due to the environments (Table 2.3).

The riders' heart rate means of maximum and mean heart rate data also showed a large effect size for the environmental differences. These large effect sizes also indicate that the difference between the training and competition environment is more than one standard deviation of the normal distribution of the data. However, the riders' minimum heart rate means showed a moderate effect size due to environmental differences.

It was therefore concluded that overall from the CSAI-2 and CSAI-2R data, the hypothesis can only be accepted for the rider's somatic anxiety, emotion experience of anxiety and heart rate measures and is rejected for all other rider variables.

Table 2.3: Means, σ standard deviations, and effect sizes, for the rider CSAI-2, CSAI-2R, EMCA-Q, and heart rate.

Source	Mean Training	Mean Competition	σ SD	d
CSAI-2				
Cognitive anxiety	18.6	18.6	10.30	0.00
Somatic anxiety	14.2	22.2	10.32	-0.78
Self confidence	33.6	30.6	5.43	0.55
CSAI-2 revised				
Cognitive anxiety	10.60	10.40	7.70	0.03
Somatic anxiety	10.80	16.20	9.53	-0.57
Self confidence	18.80	18.80	5.30	0.00
EMCA-Q				
Emotion anxiety	6.80	9.60	5.17	-0.54
Mood anxiety	7.80	8.20	3.91	-0.10
Heart rate				
Maximum	162.00	189.80	23.21	-1.20
Minimum	88.00	96.40	28.30	-0.30
Mean	116.80	146.69	17.87	-1.67

df = 4

2.3.5 Psychological and physiological assessment of the horse

To test the hypothesis that the horse temperament score would be stable across environments and the horse's heart rate would be significantly lower in the training environment compared to the competition environments, the Cohen's *d* statistical procedure was used. Analyses revealed a small effect size in the mean differences of the riders' rating of horse temperament between the training and competition environments (Table 2.4). The mean differences of the observer's rating of the horse temperament without the rider revealed a large effect size across environments. Their rating of the horse temperament with the rider showed no effect size across environments (Table 2.4).

The mean differences for the training and competition environments of horse's maximum heart rate and minimum heart rate has a moderate effect size. A large effect size was found in the differences of the horse's mean heart rate for the two environments (Table 2.4).This large effect size for the horse's heart rate mean shows a shift of more than one standard deviation in the normal distribution of the population.

It was therefore concluded that the hypothesis was rejected for the riders' and observers' rating of the horse's temperament and the horse heart rate measures.

Table 2.4: Means, standard deviations, and effect size across training and competition environments for horse temperament and heart rate scores.

Source	Mean Training	Mean Competition	σ SD	df	d
HTI-R	83.00	86.00	12.17	4	-0.25
HTI-O without rider	40.60	37.20	4.22	5	0.81
HTI-O with rider	37.50	38.25	3.86	4	-0.19
Maximum heart rate	163.20	191.40	51.30	4	-0.55
Minimum heart rate	60.40	78.40	28.50	4	-0.63
Heart rate mean	95.99	138.90	33.44	4	-1.28

2.3.5.1 Horse behaviour without the rider

On inspection of the raw data for the horse behaviour without the rider, it is apparent that each horse displayed unique patterns of differences between the training and competition environments (Appendix H, Table A.3). Overall, one or both observers recorded changes in all the behaviours except mouth position and pawing (Table 2.5).

Table 2.5: A comparison of the horse behaviours without rider in training and competition

	Team				
Behaviours	1	2	3	4	5
Ear position	C	C	C	S	C
Head position	S	C	C	S	S
Nose position	C	S	S	C	C
Mouth position	S	S	S	S	S
Mouth moisture	S	C	S	C	S
Eye blinking	S	C	S	S	S
Standing	S	S	C	C	S
Sweating	C	C	S	S	S
Pawing	S	S	S	S	S
Tail position	S	C	C	C	S
Defecating	C	C	C	S	S
Vocalising	S	C	C	S	S

C = Change in the behaviour

S = Same behaviour

If the changes in horse behaviour without the rider between environments are compared to the performance of each team in Table 2.1, it is evident that there is no consistent pattern in the data to link horse behaviour to performance. There are not enough data to analyse this relationship. Furthermore, there is not enough data to compare the horse behaviour with the working relationship in this study.

2.3.5.2 Horse behaviours with the rider

Inspection of the raw data for the horse behaviour with the rider again reveals that each horse displayed a unique pattern in the training and competition environments

(Appendix H, Table A.3). One or both observers recorded changes in all but the mouth position, pawing, defecating and vocalising (Table 2.6).

Table 2.6: A comparison of the horse behaviours with the rider in training and competition

	Team				
Behaviours	1	2	3	4	5
Ear Position	-	C	C	S	S
Head Position	-	C	C	S	S
Nose Position	-	C	C	S	C
Mouth Position	-	S	S	S	S
Mouth moisture	-	S	S	C	C
Eye blinking	-	S	C	S	S
Standing	C	-	C	C	S
Sweating	S	C	S	S	C
Pawing	S	S	S	S	S
Tail Position	S	S	S	C	C
Defecating	S	S	S	S	S
Vocalising	S	S	S	S	S

C = Change in the behaviour.

S = Same behaviour.

If the changes in horse behaviour with the rider between environments are compared to the performance of each team, it is evident that there is no consistent pattern in the data to link horse behaviour to performance. Furthermore, there is not enough horse behaviour data to determine relationships with the working relationship or the rider variables.

2.4 Discussion

The main purpose of this study was to develop methods and to investigate the working relationship between horse and rider, and individual factors that may be related to

this working relationship. The primary hypothesis being investigated postulated that the working relationship would not be as strong and heart rate synchronisation would be significantly lower in the competition environment than in the training environment, due to the additional stressors of competition for horse and rider. This hypothesis was rejected as both the working relationship and heart rate synchronisation were higher in the competition environment. The second hypotheses postulated that the horse's heart rate, and rider's cognitive anxiety, somatic anxiety, and emotion and mood experience of anxiety and heart rate would show significantly higher scores in competition and the rider's self confidence would be significantly lower in competition. This hypothesis was accepted for the horse's heart rate and the rider's somatic anxiety, their emotion experience of anxiety, and rider heart rate factors. The hypothesis was rejected for the rider's cognitive anxiety and self-confidence. It was hypothesised that the horse's temperament score would be stable across environments indicating a trait. However, a significant effect size in the differences in temperament between environments resulted in this hypothesis also being rejected.

This discussion will now consider these findings from the perspective of the anecdotal, theoretical and empirical literature presented earlier, and comment on the overall implications for the working relationship. This is followed by a critical review of the new methodologies developed for this study. The discussion will conclude with a preview of how the findings and methods from this study will inform the next study in the dissertation.

2.4.1 Environmental influences on the working relationship between horse and rider

As stated earlier, there is considerable anecdotal information that describes the working relationship between horse and rider and its implications in equestrian sports. Until now there has been no empirical evidence to support these opinions. The improvement found in both the WRI-R and the HRS measures at the competition environment is not consistent

with the literature, which suggests the horse-rider working relationship would be compromised at a competition, because of the additional stresses put on the rider for performance and the horse's reactivity to much novel stimuli.

Williams (1999) has suggested that rider anxiety and the horse's behaviour impact on each other, and that this will be implicated in their overall performance in competition. However, this has not been supported in the data pattern in this study, which demonstrates that while rider anxiety was higher in the competition environment, the working relationship and heart rate synchronisation is improved in the competition environment compared to training. This could be a reflection of the warm-up program that was conducted prior to the competition, which may have been responsible for the improved working relationship.

As the horse and rider have different neurological and physiological systems, it requires much practice and training to develop harmony within their working relationship (Largarde, Peham, Licka & Kelso, 2005; Peham, Licka, Kapaun & Scheidl, 2001; Peham, Licka, Schobesberger & Meschan, 2004). These researchers found an optimum adaptation in the horse and rider movement patterns that allows harmony within the movement cycles of some equestrian teams. Even though the physiological systems of the horse and rider are different, the HRS in this study showed that a physiological relationship can exist between them at both training and competition environments. Furthermore, the HRS appears sensitive enough to identify physiological changes related to these environmental conditions. In addition, this study was able to demonstrate that individual teams display different degrees of heart synchronicity in both the training and competition environments. This suggests that the HRS is identifying the physiological differences between individual teams reflecting the harmony within their motion cycles (Largarde, Peham, Licka & Kelso, 2005; Peham, Licka, Kapaun & Scheidl, 2001; Peham, Licka, Schobesberger & Meschan, 2004). The findings here

also suggest that not all equestrian teams attain a synchronisation within their physiological relationship.

The findings in this study are suggestive and not conclusive, as the number of participants is not large enough for inferential statistics or the psychometric testing of the Working Relationship Inventory. However, the effect sizes reported here for the working relationship and heart rate synchronisation suggest they are sensitive to rider's perceptions and experiences, and hence support a second study to be conducted using the same methodology.

2.4.2 Environmental influences on the individual horse-rider factors considered to be implicated in the relationship.

Gaining knowledge of individual horse and rider factors that relate to this working relationship is important to improve the dynamics that surround eventing competition and can make them a safer sporting environment. It was considered that horse temperament and rider anxiety may be such factors. However, this study lacked the participant numbers to draw inferences regarding these individual factors and the working relationship. However, the environmental impact on these factors is suggested from patterns within the data.

The findings for the riders' and the observers' rating of the horse's temperament suggest that this measure of the horse's temperament is identifying psychological states and does not fit with the definition of temperament as a trait which should not change across environments. This suggests that the items in the temperament inventory used here may be identifying "state-based" parameters of the horse's psychological dimensions, rather than the "trait- based" factors that are considered to be indicative of temperament.

As discussed earlier, few empirical studies (Table 1.1) that used check lists or inventories as a methodology to classify horse temperament have clearly differentiated the

items as temperament traits or psychological states. The items selected from the previous research for use in this study are tending to depict psychological states which change over time. This may in part be due to the small number of riders with wide ranges of experiences with their competition horses, and who also ranged from young to experienced. Another possible reason for the lack of stability in the HTI-R between environments is a lack of agreement as to what horse behaviour is indicative of these items, a concern expressed earlier by Mills (1998). Therefore, further consideration of the content of this inventory is required to determine whether it reflects a horse's traits or state characteristics.

The horse temperament measure did identify environmental differences that follow the same directional pattern as the working relationship and heart rate synchronisation of improved scores in the competition environment. Thus, the concurrence between the horse temperament and the working relationship factors suggests a possible relationship between the two may exist.

The horse's heart rate was higher in the competition environment and does not reflect the patterns found with the working relationship and horse temperament. As mentioned earlier in the literature review, increases in the horse's heart rate are indicative of the change of physiological exertion in the different environments. The equestrian research (Table 1.1) has also implied that increases in heart rate can be indicative of the emotional state of the horse. However, the riders here did not report a poor temperament or poor working relationship, which one might expect if the increase in heart rate was indicative of an aroused emotional state. In the absence of data supporting an emotive interpretation, it is considered that the horse worked harder physically in competition which parallels the rider's reports that the working relationship was more positive at competition.

The horse behaviour was observed before the warm-up period, without the rider mounted, and with the rider mounted during the warm-up period in the training and

competition environments. It was anticipated from the work of Hutson and Haskell, (1997) and Hutson (2002) that if a horse was observed displaying behaviour listed on the BCL before beginning the cross-country course, it would predict a poor performance. However, this study was unable to replicate their findings in terms of eventing performance.

No study to date has examined relationships between horse behaviour prior to equestrian sport other than racing. As the participant numbers were too few, it was not possible to calculate a correlation coefficient for the relationship between this single assessment of horse behaviour and its subsequent poor performance in this study. Therefore, it can only be assumed that the expressions of the behaviours listed on the BCL before a cross-country are of different consequences to that on race day, as the cross-country phase of eventing has different performance requirements compared to the sport of racing. Further study is needed to determine horse behaviours during equestrian sport.

This study has identified that the observation of horse behaviour requires more than a once-off observation to establish the reliability of the displayed behaviour. Furthermore, if these behaviours could be observed during the competition, a relationship may be uncovered with performance in equestrian sports.

In summary, this study showed that horse behaviour, temperament and heart rate were different between environments. However, the participant numbers did not allow for statistical analysis of associations and comparisons with the working relationship variables. A visual examination of these variables and the working relationship and heart rate synchronisation shows some parallel trends across the environments, but not always in the directions hypothesised. Therefore, more investigation into the horse behaviour, temperament and heart rate is required, to determine if there are links between them and the working relationship with the rider as proposed by many experts who advise in the field.

A challenge in this study was choosing a rider psychological factor that logically and empirically could be expected to be associated with the working relationship with the horse. Anxiety was chosen, given the extensive literature on how anxiety impacts on psychological and physical skill factors in sport performance, and the anecdotal speculation on horse's and rider's sensitivity to each other's anxiety. This study investigated the rider's experience of anxiety by investigating emotion and mood aspects.

Inspection of the data patterns does not support speculation that higher levels of anxiety would be associated with poorer working relationships or horse temperament. This study was able to identify moderate effect sizes for the rider's somatic anxiety and their emotional experience of this anxiety being higher in competition than training. This increase in somatic anxiety and emotional experience of the anxiety parallels increases in the rider's heart rate. This pattern suggests that the rider's reported psychological experience is their physiological reality and concurs with the literature, discussed earlier, that somatic anxiety is reflective of physiological experiences (Martens, Vealey & Burton, 1990). However, it is reported that without actual physiological data, this relationship between somatic anxiety and perceived physiological sensations should be treated with caution, as the perceived physiological sensations can misrepresent the actual physiological sensation as exertion (Hoehn-Saric & McLeod, 2000). While it has been suggested that a rider's somatic anxiety may prevent the horse from relaxing, causing the horse to be more reactive and to misbehave, thereby stressing the working relationship between them (Williams, 1999), there are no patterns of anxiety, temperament and working relationship data in this study that support this.

The findings here regarding the differences in the rider's emotion experience of the anxiety followed the same pattern as the somatic anxiety data. As the emotion experience of anxiety is focused on specific environmental events, this suggests that the rider's emotion experience of anxiety is more focused on the task of riding the cross-country course than

when they are working with the horse in the training environment. Furthermore, it implies that rider anxiety experience in this study is more about the task at hand than other general aspects of their life. However, the mood experience reported in this study suggests that other activities outside of riding the horse are consistent across environments and do not increase the rider's anxiety levels when riding in different environments.

In summary, riders reported more somatic anxiety and stronger emotion experience of anxiety as expected, and less self-confidence as expected, at competition. They also rated their horses' temperaments as more positive at competition. This pattern does not support an association between rider anxiety, and working relationship, whether it is assessed by self report or indicated by physiological indicators of arousal. Thus, these findings warrant further study and provide a good rationale to continue investigating rider anxiety.

2.4.3 Methodological considerations

The only empirically developed method for measuring the relationship between horse and rider requires elaborate equipment of high speed cameras to record the motion cycles between horse and rider. This equipment was neither suitable nor accessible, to investigate the working relationship between horse and rider on the cross-country course. As an alternative, this study developed two inventories (WRI-R and WRI-O) to assess this horse-rider working relationship. The method required the rider to complete the inventory after they warmed up the horse, and just before the commencement of the training session, or entering the starting box of the cross-country course. To support these inventories a physiological measure of heart rate synchronicity was devised. This involved the correlation of the horse and rider's heart rate by calculating a Pearson coefficient to give a synchronisation score (HRS).

Evaluating the use of these measures in this study shows that the WRI-R and the HRS measures were sensitive enough to detect changes in the working relationship between horse and rider in the training and competition environments. However, due to the extra activities of data collection in the busy environment of equestrian competition, the WRI-O was not practical. Thus, observers using the WRI-O were sometimes unable to collect a full data set in this study. Therefore, it was excluded from analysis and due to the time constraints of the observers in the training and competition environments, it is to be dropped from use in future studies. However, due to the ease of data collection and the ability of the WRI-R to detect changes within the horse-rider working relationship, it was considered useful for future studies.

An important requirement for recording heart rate data on the cross-country course was that the transmitters and receivers for the horse and rider are able to function in close proximity to each other. The coded Polar heart monitors used in this study maintained a connection on both horse and rider while they jumped fences at full gallop on the cross-country course. As stated earlier, the polar heart rate monitors are shown to have an accuracy of +/- 1 bpm or 1 percent (Evans & Rose, 1986; Holopherne, Hodson & Rose, 1999). This study shows the Polar heart rate monitors are a very effective method for collecting heart rate data reliably, with no loss of data in either the training or competition environments.

The heart rate data from both horse and rider was analysed using the Pearson statistic to determine heart rate synchronisation. The heart rate synchronisation measure was sensitive to environmental changes. Differences in heart rate synchronisation were the largest effect size in this study. Therefore, the heart rate synchronisation measure is highly recommended for future study into the horse- rider working relationship.

This study also evaluated the individual psychological characteristics of the horse, to determine possible relationships to the working relationship with the rider. The literature

review revealed that one of the main criteria for selecting horses is their temperament. Previous research used four methods of measuring the horse's temperament. These methodologies, outlined earlier in Table 1.1, provided the basis for the observation of the horse in this study. An inventory of descriptors was developed for the horse's temperament that gives a specific temperament score for a horse, with items from Mills (1998) and Fitzpatrick (2004).

There appears to be a lack of inter-observer reliability of observations from the two non-rider observers. Given the lack of participant numbers and the concerns of Mills (1998) regarding the lack of consistency in defining these descriptors, this study is unable to comment on its construct validity, or evaluate the psychometric properties adequately. Also the HTI-O had missing data, and had the same practical problems as the WRI-O, so it will not be used in the next study. However, the riders' HTI-R did not have missing data, and riders indicated they could evaluate all descriptors without question. Further development of the HTI will be addressed in the next study, only studying riders.

This study also observed the behaviours of the horse and examined relationships with the team's performance at competition. This study applied the methodology of Hutson and Haskell, (1997) and Hutson (2002) and to select behaviours for the BCL. One observation period was made with and one without the rider. This method proved not to be satisfactory for several reasons. Horses typically displayed variations of these behaviours as they reacted to the different phases of the warm-up period and entering the start box in the competition environments. Thus, monitoring these behaviours may require more observations to determine a relationship between behaviour and performance. Secondly it was difficult to schedule these observational assessments with the other methods in the study. Practically, it was very demanding for two observers to be present in addition to the experimenter, fitting heart monitors and collecting other survey data. Due to the scheduling pressures of

competition start times, some observations were hurried or not completed. Mackenzie and Thiboutot (1997) recommend that observing horse behaviour is reliable if the observation period is videotaped and viewed at a later date to assess the behaviours of interest. Thus, the collection of horse behavioural data will be conducted via videotape, and with modifications to the behaviour observation checklist.

The heart rate assessment of the horse and rider proved to be practical and was a sensitive measure, to depict physiological differences related to environmental conditions. Environmental differences in heart rate for both horses and riders had small to large effect sizes. The correlation of horse and rider scores to create the HRS was useful, to show the level of physiological harmony between training and competition. For these reasons heart rate measure was retained in the next study.

To investigate the relationship of rider anxiety to the working relationship with their horse, the CSAI-2 was used. The CSAI-2 & CSAI-2R has been psychometrically assessed by many researchers (Cox, Russell & Robb, 1995; Craft, Magyar, Becker & Feltz, 2003; Lane, Sewell, Terry, Bartram & Nesti, 1999). It was not in the scope of this study to analyse the properties of this measure, or contribute to the debate regarding its validity compared to the revised version. One reason for the use of this measure was to differentiate between cognitive and somatic anxiety, as each is believed to impact differently on the horse and rider team; in particular somatic anxiety is believed to be detrimental to the rider's ability to use the riding aids to communicate with the horse. The patterns of data in this study suggest that further exploration of cognitive and somatic anxiety with equestrians will be fruitful. This study also showed that the data collected from four of the five riders using the CSAI-2 was consistent within the ranges of anxiety reported by show jumping riders (Fitzpatrick, 2004). This included data collected in the training as well as competition environments. However, as findings here reveal, the effect sizes of the environmental differences calculated comparing

the CSAI-2 and the CSAI-2R data were not consistent. It was concluded that analysis of both versions of the CSAI-2 would be useful in the next study, to further explore its relevance to equestrian sport.

The rider's experience of anxiety was also assessed using the EMCA-Q to examine the emotion and mood components of anxiety to enhance the assessment of the environmental impact on the rider's anxiety. As this measure has previously established validity and reliability (Beedie, Lane & Terry, 2001), and proved to be sensitive to differences in emotion and mood outcomes within the rider's experiences in the training, compared to competition environments, it was decided to continue its use in conjunction with the CSAI-2 to assess anxiety.

In conclusion, this study showed that the methodology for using the WRI-R, CSAI-2, EMCA-Q and the HTI-R appears to be sound. However, only the CSAI-2 and the EMCA-Q have previous psychometric testing to confirm the construct validity. The WRI-R and HTI-R are new measures, and need further research to determine the psychometric properties required to validate their suitability. Therefore, a challenge for further study is to gain a suitable number of participants to conduct such testing. A further complicating factor is the education of observers, with respect to identifying criteria for a working relationship, as well as the horse temperament. Therefore, trained EFA Judges will be used in the next study.

A final consideration is recruiting the riders. Conducting research into the working relationship between horse and rider poses many challenges when attempting to use repeated measures designed to explore the horse and rider simultaneously in their working relationship. One of the main critical issues is retaining riders for the competition phase of the study, especially given the nature of the sport, where horses are not able to compete and weather influences the safe ride of the competition course. For this study, the participant numbers were insufficient for a different reason. Prior to the commencement of this study,

Australia had much success in eventing competition at the Olympic level, and it was a popular equestrian sport. This study had sourced a larger number of volunteers from the sport to be part of the research. However, during the year of the development of this dissertation research, the sport of eventing had several accidents that resulted in the serious welfare issue of injury and death to both horses and riders. Resolution of this issue caused significant negative financial costs to riders and sporting clubs, to cover the increased insurance costs. One result was that many competitions were cancelled and most of the volunteers that pledged to be part of the research withdrew from the sport just prior to commencement of the data collection year of this Doctoral research program. Indeed, the remaining competitors were very hesitant to volunteer; for fear that being part of the research would invalidate their insurance coverage, even though the research was endorsed by Eventing Queensland. Only five participants remained in the study. A consideration for the next study was to engage a sport which had fewer problems in sourcing riders and horses that were likely to maintain a more consistent training and competition regime, fewer problems with inclement weather, and had a larger number of registered members.

2.4.4 Preview of the next study

For reasons described earlier, further investigation of the horse-rider working relationship factors with eventers was not practical. In choosing another equestrian discipline, consideration was given to the anecdotal comments from these eventing riders, regarding their concern with the dressage phase of eventing. Dressage is the first phase of the eventing competition and errors accumulated in this phase set the personal advantage or disadvantage for the jumping and cross-country phases in the eventing competition. Given that there was a notable increase in numbers participating in dressage competitions in Queensland, this discipline was chosen for further investigations in this dissertation.

There are several other advantages to the sport of dressage, as a research site. The same dressage test can be ridden in the training and competition environments. Furthermore, the dressage test is ridden in a standard 60 X 20 arena, which can easily be replicated in both environments. Hence, the same dressage test can be videotaped at both the training and competition environments. Another major advantage is the availability of highly trained judges to evaluate the criteria for the working relationship.

The second study in this dissertation, using the dressage team, is developed to further empirically investigate the patterns of the findings from this current study. It also investigates the working relationship between horse and rider in the training and competition environments. The WRI-R, HRS, HTI-R, CSAI-2, and EMCA-Q measures used in this study are retained without modification. The heart rate for both horse and rider is assessed as an individual measure, as well as to calculate Heart Rate Synchronisation (HRS). Instead of using an observer's WRI in this study, the working relationship will be assessed by an A level dressage judge from videotape footage. The EFA criterion for judging dressage tests, and the guidelines on which the WRI-R is based, is used as the non-rider measure. Furthermore, the horse behaviours on the BCL are revised, to include behaviours that can be assessed from the videotape. Thus, the methodology of this eventing study is modified for two measures. The following chapters describe the dressage study and discuss the findings.

Chapter 3. The working relationship between the dressage horse and rider during training and competition

Abstract

This study evaluated the stability of the dressage horse and rider working relationship across training and competition environments, and related individual horse and rider psychological and physiological factors. 30 pairs of horses and riders participated. Working relationship measures included the Rider Working Relationship Inventory (WRI - R) completed by the rider, the Judge's Working Relationship Inventory (WRI -J) completed by the dressage judge, and the correlation between the rider's and horse's heart rate, Heart Rate Synchronisation (HRS). Individual rider measures included the Competitive State Anxiety Inventory – 2 (CSAI-2), Emotion and Mood Components of Anxiety Questionnaire (EMCA-Q) and heart rate. Individual horse factors included rider's rating of horse temperament (Horse Temperament Inventory –HTI-R) and horse heart rate. Data were collected for each rider at their nominated training session and competition. Level A dressage judges rated riders and horses (WRI-J) from video-tapes of these training and competition sessions.

The results indicate that the riders' and judges' WRI scores did not differ significantly between training and competition. However, the HRS analyses show some significant differences between training and competition, at both the individual team level and overall group level. There was no significant correlation between the HRS and the WRI – R and WRI-J for either environment.

In terms of individual factors, riders reported significantly higher levels of cognitive and somatic state anxiety (CSAI-2) in the competition environment compared to the training environment. Their levels of self-confidence (CSAI-2) were significantly lower in the

competition environment compared to the training environment. The rider's heart rate in the training environment was significantly lower than the heart rate in the competition environment. Analyses of the horse factors showed the HTI-R and the horse's heart rate were not significantly different between training and competition environments.

The individual psychological variables of the horse and rider were not significantly correlated to any of the working relationship measures. However, there were some trends suggestive of relationships which may not have been statistically significant, due to the small number of participants and restricted ranges of anxiety measures. The discussion considers the findings in light of methodological challenges in equestrian research, and suggests parameters for future research to further comprehend the performance dynamics of the equestrian team.

3.1 Introduction

The sport of dressage is the equestrian discipline considered to put the most emphasis on the horse's development and training of submission and athleticism, engaging both psychological and physiological dimensions of horse and rider. Therefore it is an excellent choice of equestrian discipline to further pursue the findings from the eventing study.

The etymology of dressage is derived from the French word 'dresser', meaning to train. From the 16th century, the English term 'to dress' means to place, to direct, to set in position or to put into alignment (Game, 2001). Dressage is defined in this study from the international standards of the Federation Equestrian Internationale as the mental and physical training of the horse to perform gymnastic movements upon the command of the rider. The dressage competition requires riders to demonstrate the trainability, suppleness and athleticism of their horses. Quality performance of a dressage test requires the containment

and direction of the horse's power under the influence of the rider's artistic ability to perform the set of prescribed movements contained in the test. One of the underlying challenges in dressage, and one of the central requirements for excellence in the dressage performance, is the harmony within the working relationship between horse and rider. Therefore, the working relationship is appropriate as the focus for a study of dressage equestrians.

The National Australian Dressage Committee of the Equestrian Federation of Australia (2004) gives a comprehensive description of requirements and standards in the sport of dressage. Dressage is conducted in a 60 X 20 metre arena, where an equestrian team performs a test of a prescribed series of movements that are assessed by a judge or judges. Each dressage test contains a set of movements in walk, trot and canter to be performed at specific positions around the arena.

These movements range in difficulty from the simple circles and loops of the preliminary test to the more advanced movements of passage and canter pirouettes in the elite grand prix test. To perform these movements on command, the dressage rider communicates to the horse through a combination of aids, including hand contact with the reins, seat position in the saddle and leg movements on the horse's sides. At the preliminary level, these aids may be visible to the judges, whereas at the grand prix level the aids should be invisible, giving the appearance that the rider is doing very little work to achieve the horse's performance. The judges score this relationship as part of the collective marks for the overall performance of the dressage test.

The performance of each dressage team is evaluated in real time by one to five qualified judges, depending on the level of the test. Judges are certified to assess particular levels of tests and they require extensive training, supervised practice, and yearly workshops to retain their qualification. Judges range from F to A level and O level for Olympic competitions. In this study A level judges were used to assess the working relationship.

Each test movement is scored on a scale from 0 (not executed) to 10 (excellent). Judges assign a score with this 0 –10 scale to each movement for the quality, rhythm and freedom of the horse's paces. The degree of harmony of relationship between horse and rider is scored on the effort and smoothness of flow in each movement, including the timing of the aids by the rider and the immediate response of the horse. Thus, the final score reflects the communication between horse and rider during each test movement. Each of the movements should flow effortlessly from one to the next, like a dancing couple displaying a continuous flow of motion. Nevertheless, as with all sports there are many physiological and psychological factors that impact on the horse and rider, to influence the equestrian team's harmony in their working relationship. These are evident in the mistakes or errors made by riders. Errors incur penalties of two points per error and three errors result in elimination from the competition.

In Study 1 there was evidence of riders making errors on the cross country course. It can be seen in Table 2.1, that team 4 was eliminated from the competition because the rider missed jumping 2 of the obstacles on the cross-country course. Therefore, given the exceptional complexity of coordinating and integrating riding aids, where the slightest unnecessary tension on the rein or movement of the leg can disrupt the horse's performance, and, given the precision with which riders must perform movements at specific letters, it is arguable that anxiety can be even more detrimental to dressage performance than cross country performance.

As reviewed in Chapter 1, cognitive components of anxiety are operationally defined as "negative thoughts", "worries", "concerns", "fear" and "apprehension" (Martens, Vealey & Burton, 1990). Thus, the cognitive components of anxiety can affect the rider's concentration, memory and focus during a dressage test. This affects the rider's ability to lead the horse through the complex movements of the dressage test. Furthermore, if cognitive

anxiety is influencing the decision- making ability of the rider, it will impact on the rider's ability to correct movements or misbehaviour displayed by the horse (Reilly, 2000; Williams, 1999). Thus, if a rider experiences increased levels of cognitive anxiety, their mental performance may decrease during a dressage test.

The somatic experience of anxiety tends to be expressed as symptoms of physiological arousal (Martens, Vealey & Burton, 1990). Thus, the physical components of anxiety can be highly detrimental to the sensitivity and consistency of the riders' aids and communication with the horse. However, the experience of somatic anxiety is a curvilinear relationship between arousal and performance. Thus, a rider can have an optimal level of somatic anxiety, which impacts positively towards a good performance (Martens, Vealey, & Burton, 1990; Woodman & Hardy, 2001).

It is also evident that the attention, submissiveness and calmness of the horse is required in order to perform such complex movements, and under some challenging environmental conditions. How individual horses cope with these challenges can be assessed through consideration of the horse's temperament (McCann, Heird, Bell & Lutherer, 1988a, 1988b). As discussed earlier, some riders attribute traits to the horse which are indicative of the horse's temperament. The traits attributed to the horse's temperament that are of interest in this study were selected from the anecdotal literature and the research of Fitzpatrick, (2004) and Mills (1998b), and include: affectionate, alert, anxious, bad-tempered, bold, calm, enthusiastic, excitable, exhausted, fighting, flighty, honest, hot, intelligent, laid back, lazy, moody, nervous, sensitive, sharp and willing. These indicators of temperament are chosen in this study, in order to determine whether they are important to the overall working relationship with the rider, whether they are associated with the psychological state of the rider, and whether this tends to fluctuate between the familiar training environment and the competition environment. As discussed earlier, while research points to the sensitivity of

horses to unfamiliar stimuli and distractions (Flannery, 1997; Hanggi, 2003), it is unclear whether this plays an important role in the working relationship in equestrian sport.

In addition to these psychological factors, dressage also demands a high level of fitness and stamina. To the observer it often appears that neither the rider nor the horse are particularly physically active and, indeed, if it is a high quality performance, the rider appears to be just sitting passively on the horse. However, the physical exertion of the horse to carry its weight on its hindquarter, and of the rider to stay still and relaxed in the saddle, is quite demanding. As discussed earlier, heart rate is a good indicator of physical exertion (Armstrong, 1998; Jeukendrup & Van Diemen, 1998; McCall, Hall, McElhenney & Cummins, 2006)**,** and one would expect to see a synchronisation of horse and rider levels of physical effort when they are working together. What is unclear is whether elevations in heart rate might be partly attributable to levels of anxiety in horse and rider. It is also unclear whether there are differences in patterns of these physiological indicators between training and competition. On the one hand, one might expect both horse and rider to be giving their all in competition, showing elevations in heart rates and synchronisation. On the other hand, if anxiety is aroused more in competition, then perhaps this is associated with elevations in heart rate.

These are all empirical questions being examined in this study, as all of these associations are intuitively related to the quality of the working relationship. In this study, the ratings of the rider and expert judges will provide a window on these relationship dynamics. Dressage riders continually strive for perfection in their sport, which is difficult to accomplish, given the reactive nature of their equine partners. Even at the Olympic level, attaining a score above 68 percent is a remarkable achievement. This study explores the working relationship between horse and rider, and the specific physiological and psychological factors implicated in the challenging performance of dressage.

3.1.1 Hypotheses

This study tests the following hypotheses:

Hypothesis 1: There will be significant differences in the riders' and judges' working relationship scores, and in heart rate synchronicity of horse and rider, in the training environment compared to competition environment. Indicators will be higher and more positive for the training environment than the competition environment.

Hypothesis 2: The horse-rider working relationship is significantly and positively correlated with their heart rate synchronisation.

Hypothesis 3: There will be a significant difference between horse's heart rate in the training and competition environments, in that they will be higher during competition than training.

Hypothesis 4: The horse temperament is stable across the training and competition environments and is indicative of a psychological trait.

Hypothesis 5: There will be significant differences between rider's cognitive anxiety, somatic anxiety, self confidence and emotion components of anxiety, and mood components of anxiety and heart rate in the training and competition environments. All anxiety indicators will be higher in the competition environment than training environment. Self confidence will be lower in the competition environment than training environment. Riders' heart rates will be higher during competition than during training.

Hypothesis 6: Riders' anxiety will be significantly and positively correlated with their heart rate.

Hypothesis 7: There will be significant positive relationships between the working relationship indicators and the horse's temperament score.

Hypothesis 8: There will be a significant negative relationship between the working relationship indicators and the rider's cognitive and somatic anxiety, and emotion and mood components of anxiety.

Hypothesis 9: There will be a significant positive relationship between riders' self confidence and the working relationship indicators.

Hypothesis 10: There will be a significant negative relationship between horses' temperament scores and riders' anxiety indicators. There will be a significant positive relationship between horses' temperament scores and rider's self confidence.

3.2 Methods

3.2.1 Participants and Research Sites

Thirty equestrian teams participated in this study, which consisted of 29 female riders and one male rider. The descriptive statistics of riders reveal a mean age of 31.2 years and a mean of 19.9 years of riding (Table 3.1). The riders' dressage competition levels ranged from preliminary to intermediate 1. The equine partners of these riders consisted of 21 geldings, 8 mares and 1 stallion. These horses had a mean age of 9.4 years and the mean number of years competing was 4.7 (Table 3.1).

The selection criteria for riders were as follows: riders were at least 18 years of age, were registered with the Equestrian Federation of Australia or Pony Club Australia for insurance purposes; and were training and competing in dressage at levels from Preliminary to Grand Prix. The sample included 5 professional riders, with the remaining 25 riders having amateur status. Participants were located throughout Southeast Queensland, Australia.

Table 3.1: Descriptive statistics of participants' characteristics

	Mean	SD	Minimum	Maximum
Rider's age (years)	31.2	12.8	18.0	63.0
Years riding	19.9	11.0	7.0	50.0
Years rider competing	9.4	6.9	1.0	30.0
Highest competition level	4.2	2.1	1	8
Horse's age (years)	9.4	3.8	3.0	16.0
Years horse competing	4.7	3.0	1.0	12.0

Competition environments nominated by the rider had to meet the following criteria: the organisation conducting the competition was affiliated with the EFA or PCA; the competition was conducted under the EFA and PCA rules; and the organisation was agreeable to the requirements of the researcher and the use of heart rate monitors on both horse and rider. The level of competition ranged from local pony club to regional dressage championship events.

3.2.2 Measures

Two surveys were compiled for distribution in the training and competition environments. The first survey (Appendix I) for the training environment collected demographical data about the horse and rider. Demographics collected about the horse consisted of name, age, sex, number of years competing in dressage, the period the horse and rider have competed in dressage together, the number of competitions competed in during the season, and the horse's training level. The demographics collected about the rider were age, number of years riding, number of years competing in dressage, whether they engaged a riding instructor, engagement of horse trainer or sports psychologist, levels of training and levels of competition this season.

Each rider gave a self-report of their anxiety, using the Competitive State Anxiety Inventory -2 (CSAI-2) (Martens, Vealey & Burton, 1990). They further reported on the

emotion and mood components of their anxiety, using the Emotion and Mood Components of Anxiety Questionnaire (EMCA-Q) (Beedie, Lane & Terry, 2001). Both measures are described earlier in Section 2.3.2 of this dissertation.

Riders gave a report on their observations of their horse on the day, using the Horse Temperament Inventory (HTI-R). This measure was constructed for the eventing study as described in Chapter 2. They also gave their perceptions of their relationship with their horse, using the Rider's Working Relationship Inventory (WRI-R) which was also constructed for the eventing study and described in Chapter 2. Descriptions of the development of these measures are presented earlier in Section 2.3.2 of this dissertation.

The second survey (Appendix J) was compiled for the competition environment. It collected information regarding the level of competition, the importance of the competition result to the rider, and how they thought they would perform. Riders also completed the CSAI-2, EMCA-Q, the HTI-R and the WRI-R as in the first survey. At the end of the competition riders rated how they thought they performed in competition, and how well the horse performed in competition, their dressage score for the test and their placing in the competition.

3.2.2.1 Working relationship and synchronicity between horse and rider

Three measures of the working relationship were used in this study. The riders completed the Rider's Working Relationship Inventory (WRI-R) as described in Chapter 2 (see Appendix I and J). Riders rated each statement using a 5-point Likert scale ranging from 1 (not at all) to 5 (extremely) after they had ridden their horses during the warm-up period and before the rider entered the dressage arena. The rating for each statement was added together to calculate a total score. The Cronbach alpha statistics indicate that the WRI-R is reliable at both training (0.82) and competition environments (0.89) (Table 3.2).

The judge's rating of the working relationship was made from observed performances on the training and competition video tapes. The Judge's Working Relationship Inventory WRI-J) was constructed from the collective scores given on the dressage test score sheet. Each collective mark is scored on an 11-point scale, ranging from 0 (not executed) to 10 (excellent). These four collective marks were added to calculate the WRI-J. The Cronbach alpha statistics indicate that the working relationship inventory is internally reliable in both training (0.91) and competition environments (0.91) (Table 3.2).

Table 3.2: Summary of the Cronbach alpha statistics for the psychological measures for the rider, the horse, and the working relationship rating measures

Measure	Training environment α	Competition environment α
Rider		
CSAI-2		
Cognitive anxiety	0.89	0.93
Somatic anxiety	0.88	0.93
Self confidence	0.94	0.90
CSAI-2_Revised		
Cognitive anxiety	0.91	0.93
Somatic anxiety	0.86	0.91
Self confidence	0.92	0.89
EMCA-Q		
Emotion component	0.83	0.84
Mood component	0.76	0.72
Horse		
Temperament Inventory	0.73	0.86
Working relationship		
WRI-R	0.82	0.89
WRI-J	0.91	0.91

The correlation of the heart rates from each horse and rider was utilised as the physiological indicator of synchronicity for that pair. This correlation was calculated using the Pearson statistic.

3.2.2.2 Rider psychological assessments

To assess aspects of riders' anxiety and self confidence, the measures utilised in the eventing study were replicated here, to enable comparison between disciplines. They are the Competitive State Anxiety Inventory – 2 (CSAI-2) and the Emotion and Mood Components of Anxiety Questionnaire (EMCA-Q) (see Appendix I and J). The reader is referred to Section 2.3.2 Measures of Chapter 2 for details on the construction, scoring and psychometric properties of these measures.

Analyses show that the CSAI-2 subscales had good internal consistency at both the training and competition environments, with Cronbach alpha coefficients for cognitive state anxiety (.89 and .93) somatic state anxiety (.88 and .93) and self-confidence (.94 and .90) in the training and competition environments respectively (Table 3.2). This is a good result when compared with the findings of Fitzpatrick (2004), who revealed Cronbach alpha coefficients as follows: cognitive state anxiety (.78) somatic state anxiety (.88) and self-confidence (.85). These are also higher than those reported by Martens, Vealey et al., (1990), with cognitive state anxiety ranging from .79 to .83, somatic state anxiety ranging from .82 to .83 and self confidence ranging from .87 to .90.

As the exclusion of some items is the only difference between the CSAI-2 and the CSAI-2R scales, this dissertation was able to examine internal reliabilities of both scales. The internal reliability analyses for the CSAI-2R are also excellent and compare favourably with those reported by Cox et al. (2003), being .81 for cognitive state anxiety, .81 for somatic state anxiety and .86 for self-confidence and Terry et al. (2005), which show .75 for cognitive state

anxiety, .85 for somatic state anxiety and .83 for self-confidence. This study also followed the recommendations of Martens, Vealey et al. (1990) to determine the importance of the competition and the rider's performance expectation at competition, as reported in the eventing study in Chapter 2.

The internal reliabilities for the EMCA-Q in training and competition environments are also good (see Table 3.2). They compare favourably to those reported by Beedie et al. (2003), being .75 to .82 for emotion and .70 to .74 for mood.

Overall, it was concluded that the psychological measures used in this study demonstrate good internal reliability consistent with previous studies.

3.2.2.3 Physiological assessment of rider's heart rate

The heart rate of riders was monitored using a polar S610 coded receiver (Figure 2.1) and a T61 coded transmitter (Figure 2.2). This device was chosen because it has been shown to be accurate for measuring and analysing heart rate in the sporting arena (Laukkanen & Virtanen, 1998). It is also a coded device that has the ability to operate in close proximity with another coded heart rate monitor, as found in the eventing study of this dissertation. The heart rate data were downloaded to a computer using Polar Horse Trainer SW 3.0 and were then transferred to an Excel file where it was prepared for use in SPSS statistical program for analysis.

The heart rate transmitter was placed around the chest of the rider with a thin film of electrode gel for more effective contact to the rider's chest (Figure 2.2). The receiver was placed on the rider's wrist (Figure 2.1).

3.2.2.4 Psychological assessment of the horse

Psychological assessments of the horse are conducted through behavioural observation, using the same Horse Temperament Inventory (HTI-R) as described in Section 2.3.2.5 of Chapter 2. Riders were asked to rate their horse's temperament using the HTI-R, after they had ridden their horse in the warm-up period, which was directly before they started the test at training or entered the dressage arena in competition.

The Horse Temperament Inventory (HTI-R) has acceptable internal reliability (see Table 3.2). However, the Cronbach alpha score is lower for measures complete in the training environment (.73) than in the competition environment (.86).

3.2.2.5 Physiological assessment of the horse

The heart rate of the horse was monitored using a Polar s610 coded receiver (Figure 2.1) and a T52H coded transmitter (Figure 2.3). This monitor has been shown to be an accurate non-invasive measure of heart rate in the horse as it is ridden (Holopherne, Hodson & Rose, 1999). It was retained in this study because of its sensitivity and reliabiity in collecting data from the horse on the cross-country course in the previous eventing study. The heart rate data were downloaded to a computer using Polar Horse Trainer SW 3.0 and were then transferred to an Excel file for analysis.

3.2.3 Procedure

Participants were sought by advertising through the EFA Queensland Dressage magazine Salute, newsletters of local dressage clubs in South East Queensland, and by personal contacts of the researcher and supervisor in competitive dressage. The researcher and an assistant interviewed each rider who expressed interest in the study. Each requirement and procedure of the project was explained to the prospective participant. They were

informed that they would be asked to complete surveys concerning general information about themselves and their horse, their thoughts and feelings about their performance and their horse in a training and competition environment. It was explained that they would be videoed as they rode the dressage test in the training and competition environments, and that this videotape would be judged by an A level dressage judge. The use of the heart rate monitors was also explained. After this induction each participant who indicated interest was asked to sign a consent form (Appendix K) to confirm their acknowledgement of the requirements and procedures in this research. They were advised that they could cease participation at any stage in the project if they so chose.

Permission to use heart rate monitors in official dressage competitions was obtained from the National Dressage Committee of the EFA (Appendix L). Permission to conduct this study was also received from the USQ Animal Ethics Committee and Human Ethics Committee.

3.2.3.1 Training environment

Data collection began during the week prior to the competition nominated by the rider. The researcher met with the rider at their training site. Each rider was asked to read each section carefully and reminded to answer the statements in relation to how they felt (right now) at the time. Riders completed the initial demographic section of the survey after tacking up the horse and they then finished the CSAI-2 inventory.

As they completed the CSAI-2 and the EMCA-Q the researcher fitted the heart rate monitor on the horse. The heart rate transmitter was fitted on the D ring on the front of the saddle on the nearside, and the receiver was fitted to the D ring on the offside. The positive electrode was fitted under the girth on the left side and the negative electrode was fitted under the saddle flap on the right side of the horse.

After the riders completed the CSAI-2 and the EMCA-Q they were then asked to fit their own heart rate monitor. The riders were asked to fit the heart rate transmitter around their chest, with female riders asked to place it under their bra below the breast, to hold the transmitter in place. The receiver was placed on the wrist. The rider was asked to stand about 3 – 4 metres away from the horse when they started their heart rate monitor and began recording heart rate data. The researcher started the heart rate monitor on the horse simultaneously.

The rider then proceeded to warm up the horse in their normal routine. Once the riders had ridden and warmed up the horse, they completed the HTI-R and WRI-R. Immediately after completing the survey the riders rode the same test as they would later ride in the competition. This was videotaped for later assessment by the EFA accredited A level judges.

For the purposes of hygiene the heart rate monitors were cleaned between riders and horses, using chlorhexidine and distilled water mixture in 10 percent solution.

3.2.3.2 Competition environment

The competition environment procedure was slightly different from the procedure at the training environment. Some riders competed in a number of different tests on the same horse as well as on different horses during the same day. The researcher liaised with the competition organisers, so riders would not be penalised if they were late to compete due to delays caused by data collection. A research assistant managed the equipment changeover from rider to rider and completion of the survey. If some riders had ridden their horses in dressage tests prior to the research test, they completed the whole survey before warming up for the research test. If they had not competed earlier the same procedure was used as in the training environment.

3.3 Results

The analysis of the working relationship and the individual psychological and physiological characteristics of horse and rider teams in training and competition environments are presented next. This begins with a description of how the data were prepared for analysis to address each research hypothesis. The descriptive statistics of demographic information and dependent variables are given for horses and riders at training and competition environments. This is followed by analyses to address the research hypotheses and the research question.

3.3.1 Preparation and descriptive analysis of data

A total sample of 30 horse and rider teams participated in the study. However, there are some cases which have incomplete data, resulting in some analyses using a reduced sample. However, this does not exceed the ten percent inclusion rule, and no evidence of a non-random pattern in the incomplete data exists. Hence, these cases were not deleted (Tabachnick & Fidell, 2007).

The videotape of the dressage tests for each of the training and competition environments were dubbed to a single tape, so that the same judge evaluated the training and competition performance. Each video was evaluated by an EFA accredited A level dressage judge. Each judge was asked to review the dressage test and score each dressage movement using standard test sheets. No estimates were made of missing data, as there were insufficient participants to calculate such estimations. Examples of missing data include the omission of an item on a survey, omission by the video judges of some scores for some movements in the dressage test.

Heart rate data from horse and rider were downloaded using the Polar software, and then were transferred to Microsoft Excel. The data were edited for this study, to include only the duration of the dressage test at the training and competition environment. No estimates were made for the missing data, as there were insufficient participants to calculate such estimations. An example of missing heart rate data is the loss of data due to electrodes accidentally dislodging from the horse or rider at the training or competition environments.

The survey data were scanned into Microsoft Excel and prepared to an appropriate format for analysis in SPSS analysis program. The data were analysed using SPSS (V10.0) for windows computer software package. Means and standard deviations for all dependant variables are displayed in Table 3.3. The specific management of the data during analysis is discussed in detail in the appropriate section of the results.

Each dependant variable was assessed for skewness and kurtosis (see Appendix M, Table A.1), which revealed that the variables did not exceed acceptable ± 3.0 limit (Tabachnick & Fidell, 2007).

Table 3.3: Means and standard deviations of all variables

Variable	Training environment		Competition environment	
	Mean	SD	Mean	SD
Working relationship				
Rider assessed	39.52	5.51	38.07	7.39
Judge assessed	22.00	5.06	22.72	2.79
Rider				
CSAI-2				
Cognitive anxiety	19.4	7.06	21.8	8.19
Somatic anxiety	14.5	4.75	19.7	7.02
Self confidence	30.4	7.29	24.9	7.19
CSAI-2R				
Cognitive anxiety	11.27	4.91	12.90	5.36
Somatic anxiety	10.03	3.61	13.93	5.46
Self confidence	17.53	4.08	13.60	3.89
EMCA-Q				
Emotion component	8.37	2.72	10.53	3.35
Mood component	8.73	3.13	9.27	3.21
Heart rate mean	151.26	14.90	166.15	12.12
Heart rate at test entry	153.36	19.41	167.88	12.17
Horse				
Horse temperament	57.93	7.49	55.89	8.61
Heart rate mean	104.12	15.19	108.16	16.15
Heart rate at test entry	106.41	20.08	109.59	14.58

Note. Heart rate mean = mean of the heart rate during the complete dressage test.

3.3.1.1 Variability of horse and rider demographics

As evident in Table 3.1 there is considerable variability in the characteristics of horses and riders participating in this study. The heterogeneity of horse and rider demographics is representative of any sample of riders competing in any competition. For example, there are young riders competing on horses with which they have little experience,

but yet compete at the highest level of dressage. Similarly, there are older riders competing on young horses at the lowest levels of dressage. Therefore, it was not possible to categorise and analyse the data on the basis of any one of these characteristics, as it completely misses the complexity in the profiles of each team's rider and horse age, experiences, length of relationship and years competing (see Table 3.1).

3.3.2 Riders' perception of competition

The commitment to training for the sport of dressage is evident from the demographic data where 90 percent of riders in the sample reported regularly working with a coach or trainer. They indicated the importance of the competition as follows: 13 (43.3 %) riders perceived the competition to be of moderate importance; nine (30 %) perceived the competition as above average importance; five (16.7 %) perceived the competition of little importance and two (6.7 %) perceived the competition to be of less than average importance. Only one (3.3 %) rider viewed the competition as extremely important.

Riders' expectations for competition performance indicated that 16 (53.3 %) believed that they would compete as usual, with eight (26.7 %) believing they would compete better than usual. Five (16.7 %) riders believed they would compete below their usual level and one (3.3 %) felt that she would compete greatly below her usual standard.

Riders' judgements of performance after the competition revealed that 10 (33.3 %) riders believed they performed above their expectation, eight (26.7 %) performed as expected, seven (23.3 %) performed below expectation, with remaining groups of two (6.7 %) and three (10 %) riders performing greatly below expectation and greatly above expectation respectively. There was no significant relationship between riders' expectation of competition and their judgments of their performance (r=.07, p = .69).

After completing the dressage test at the competition, riders were asked to report on how they viewed their horse's performance during the test. The data revealed that two (10 %) riders believed that their horse performed greatly above expectation, 14 (46.7 %) felt their horse performed above expectation, four (13.3 %) felt their horse performed as expected, six (20 %) felt their horse performed below expectation with remaining three (10 %) greatly below expectation.

3.3.3 The working relationship between horse and rider

3.3.3.1 Rider's rating of the working relationship

To test the hypothesis that the working relationship between horse and rider would be higher in the training environment than in the competition environment, a paired t test statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that the *SD* of the riders' rating of the WRI (Table 3.3) indicates that riders were more consistent in assessing working relationship in the training environment than in the competition environment. No significant difference ($t = 1.19$, $p = .25$) was revealed between the training and competition environments, indicating that riders viewed the working relationship the same in the training and competition environments. It was therefore concluded that the hypothesis was rejected.

3.3.3.2 Judge's perception of working relationship

To test the hypothesis that the working relationship of the horse and rider would be higher in the training environment than in the competition environment, a paired t test statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that the *SD* of the means for the judges' rating of working relationship showed more

variability in scoring at the training environment (Table 3.3). The judges' rating of working relationship showed no significant difference (t = -.80, p = .43) between the training and competition environments. It was therefore concluded that the hypothesis was rejected.

3.3.3.3 Heart rate as indicator of synchronicity between horse and rider

To test the hypothesis that there would be synchronicity between heart rate of horses and riders during a dressage test and this heart rate synchronisation would be higher in the training than in the competition environment, a Pearson correlation statistical procedure with a level of significance for a one tailed test was used, followed by a t-test of paired means. Unfortunately, of the 28 equestrian teams that recorded heart rates at training, 12 did not have a heart rate recorded at the competition environment, due to equipment malfunction. At a group level the correlation between the mean of individual horse heart rate and rider mean heart rate showed a significant positive relationship in the training environment (r = .46, $p \leq$ .01), but not in the competition environment (r = -.02, $p >$ .05). There was also a significant correlation (r = .54, $p \leq$ .01) between horse and rider heart rates when entering the test arena in the training environment. However, once again, no significant heart rate correlation (r = .32, $p >$ .05) existed at the beginning of the test in the competition environment.

To investigate further the correlation of heart rate of horse and rider in the competition environment, correlations for the mean heart rate of the group of horses and riders at each .05-second interval were calculated for the duration of the dressage test, and compared with those in the training environments. In the training environment, mean heart rate correlations between the group of horses and riders were significant during the first 4 minutes and 15 seconds of the dressage test (Appendix N, Table A.6). Analysis in the competition environment revealed it was in the last 2 minutes of the dressage test that this

group of horses and riders displayed significant mean heart rate correlations (Appendix N, Table A6).

Correlations of heart rate for each individual equestrian team showed some teams had a significant relationship in both the training and competition environments. In the training environment 25 teams showed significant correlations of heart rate at $p \leq .01$, one team displaying significance at $p \leq .05$, with the remaining 2 teams showing no significant relationship of heart rate (Table 3.4).

Of the 17 teams that recorded heart rates in the competition environment, 14 teams showed significant relationships with the remaining 3 teams, showing no significant heart rate relationship. However, these three teams previously showed synchronization of heart rate in the training environment. Of the two teams that did not show a relationship in the training, one did not record heart rates in the competition environment and the other showed a significant relationship (Table 3.4).

It is concluded that heart rate correlations of horse and rider can demonstrate physiological differences in synchronization between horses and riders during a dressage test. It is difficult to uncover differences between individual teams, and between training and competition environments (See Table 3.4). However, the synchronisation of heart rates over the duration of the dressage test shows that heart rate synchronisation levels change over time. Hence, the hypothesis can be only partially supported at both an individual team and group level

Table 3.4: Pearson correlation coefficients indicating the heart rate synchronisation of each horse and rider team during dressage tests in training and competition environments

Rider Code	Training environment		Competition environment	
	n	*r*	*n*	*r*
YAV	64	.36**	60	.54**
AAO	61	.79**	59	.70**
HAP	66	.48**	66	.45**
JKM	71	.43**	52	.14
KJH	75	.67**	77	.72**
KSR	65	.70**	67	.61**
LAM	58	.66**	61	.18
SER A	86	.79**		
SER B	81	.49**	77	.88**
SYM	80	.65**		
TND	52	.95**	53	.97**
AJE	77	.76**	82	.81**
AJS	86	.44**	86	.44**
ASB A	93	.06		
ASB B	66	.53**	82	-.20
BAE	89	.67**		
CB	69	.89**		
GDO	39	.87**	62	.68**
JEM	73	.34**	69	.11
JRR A	52	.94**	88	.33**
JRR B	87	.69**		
LGS	62	.47**	67	.86**
NPM	76	.72**		
PMP	68	.81**		
RJW	83	.45**		
SCG	28	.14	48	.61**
ALH	52	.35*		
JJG	82	.79**		

Note; *n* = the number of data points in each analysis

* $p \leq .05$ ** $p \leq .01$

3.3.3.4 The relationship between the rider's and judge's rating of working relationship, and heart rate synchronisation of horse and rider.

To test the hypothesis that the observational measures of working relationship significantly and positively correlated with the physiological synchronisation, a Pearson coefficient statistical procedure with a level of significance for a one tailed test was used. Analyses revealed a significant negative relationship between the judges' rating of working relationship and heart rate synchronisation of the horse and rider in the competition environment (r = -.53, $p \leq .01$). All other correlations between working relationship and synchronisation measures were not significant (Table 3.5). Therefore the hypothesis is rejected, as the only relationship is negative.

Table 3.5: The Pearson correlation coefficients for the WRI-R, WRI-J and the HRS in the training (T) and competition (C) environments

		1	2	3	4	5
1	WRI-R T					
2	WRI-R C	.51**				
3	WRI-J T	-.21	-.02			
4	WRI-J C	.05	.35	.35		
5	HRS T	.08	-.15	.26	-.23	
6	HRS C	.22	-.14	.44	-.53*	.36

* $p < .05$ ** $p < .01$

3.3.4 The rider psychological factors

To test the hypotheses regarding riders' psychological factors, a repeated measures multivariate analysis of variance (MANOVA) was performed. The means and standard deviations of these factors are presented in Table 3.3.

3.3.4.1 Rider anxiety reported in the CSAI-2

To test the hypothesis that the rider's cognitive and somatic state anxiety reported in the training environment would be significantly lower than in the competition environment, the MANOVA statistical procedure was used. Analyses revealed a significant effect for environmental conditions (F [3, 26] = 11.49, $p \leq .000$). The univariate F test was as predicted in cognitive (F [1, 28] = 4.34, $p \leq .05$) and somatic state anxiety (F [1, 28] = 30.72, $p \leq .001$) between the training and competition environments (Table 3.6). It was therefore concluded that the hypothesis was accepted.

To test the hypothesis that the rider's self-confidence reported in the training environment would be significantly higher than in the competition environment, the MANOVA statistical procedure was used. Analyses revealed a significant effect for environmental conditions (F [3, 26] = 11.49, $p \leq .000$). The univariate F test was as predicted in the riders' self-confidence (F [1, 28] = 22.65, $p \leq .01$). It was therefore concluded that the hypothesis was accepted.

Table 3.6: MANOVA results of the rider CASI-2 subscales scores in the training and competition environments.

Source	F	p
Cognitive	4.34	.05
Somatic	30.72	.00
Self confidence	22.65	.00

N -= 28 df = 1

If this hypothesis was tested using the subscales from CSAI-2R data, the hypotheses would be accepted for somatic anxiety and self-confidence, and rejected for the cognitive anxiety (Table 3.7). Analyses revealed a significant effect for environmental conditions (F [3,

27] = 15.49, $p \leq .000$). The univariate F test showed no significant effect in scores on the cognitive anxiety subscale (F [1, 29] = -1.92, $p \leq .06$). However, somatic anxiety (F [1, 29] = -5.18, $p \leq .001$) and self confidence (F [1, 29] = -5.32, $p \leq .001$) subscales revealed significant effect as predicted between environments.

Table 3.7: Means and standard deviations and MANOVA results of CSAI-2R subscales

Source	F	*p*
Cognitive	-1.92	.065
Somatic	-5.18	.000
Self confidence	5.32	.000
$N = 29$	$df = 1$	

3.3.4.2 Emotion and mood experience of rider anxiety

To test the hypothesis that the emotion and mood experience of anxiety reported by riders at the training environment would be significantly lower than at the competition environment, the MANOVA statistical procedure was used. Analyses revealed the predicted difference in the emotional component of their anxiety (F [1,29] = 23.45, $p \leq .001$) between environments, with the emotion component of anxiety being higher at competition. However, the mood component of the riders' anxiety showed no differences (F [1,29] = 1.38, $p \leq .25$) between the training and competition environment (Table 3.8). It was therefore concluded that the hypothesis was partially accepted.

Table 3.8: Means and standard deviations and MANOVA results of EMCA-Q subscales

Source	Training		Competition			
	Mean	Std Dev	Mean	Std Dev	*F*	*p*
Emotion	8.37	2.72	10.53	3.35	23.45	.000
Mood	8.73	3.13	9.27	3.21	1.38	.250

N = 30

3.3.5 Rider heart rate

To test the hypothesis that the heart rate of riders in the training environment would be lower than the heart rate of riders in the competition environment, a paired t-test statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that the mean heart rates and the test entry heart rates were significantly ($p \leq .01$) higher in the competition environment than in the training environment (Table 3.9). It was therefore concluded that the hypothesis was accepted.

Table 3.9: The t statistics for rider heart rates during the dressage tests

	Training		Competition		
	Mean	Std Dev	Mean	Std Dev	t
Heart rate means	151.29	14.96	166.15	12.12	-6.93**
Test entry	154.08	17.15	167.88	12.17	-4.39**

N = 25 ** $p < .001$

3.3.6 The relationship between the rider's cognitive and somatic anxiety and heart rate

To test the hypothesis that a significant and positive relationship exists between the self-report of cognitive and somatic anxiety, and rider's heart rate, a Pearson correlation statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that there is no relationship evident between the self reported experiences of cognitive and somatic state anxiety and the physiological arousal of heart rate in this group of riders, in either training or competition environments (Table 3.10). Therefore the hypothesis was rejected.

Table 3.10: Pearson coefficients between the riders' cognitive and somatic anxiety, their heart rate mean and their heart rate entering the arena at A during a dressage test in the training and competition environments

	1	2	3	4	5	6	7
Training							
1 Cognitive anxiety							
2 Somatic anxiety	.76**						
3 Heart rate mean	.00	-.22					
4 Heart rate enter A	.03	-.23	.64**				
Competition							
5 Cognitive anxiety	.68**	.47**	.64	.20			
6 Somatic anxiety	.45*	.67**	-.18	-.14	.37*		
7 Heart rate mean	-.03	-.11	.71**	.37	.09	-.17	
8 Heart rate enter A	-.04	-.12	.49*	.47*	.14	-.08	.58**

* $p < .05$ ** $p < .01$

3.3.7 Assessment of the horse in the training and competition environments

3.3.7.1 Riders' assessment of the horse's temperament

To test the hypothesis that the horse's temperament is stable across the training and competition environment, which is indicative of temperament traits, a paired t-test statistical procedure was used. Analyses revealed that the *SD* of the HTI-R in the training environment was more consistent than in the competition environment. There was no significant difference ($t = 1.68$, $p = .11$) in the way riders viewed their horse's temperament in the training and competition environments. It was therefore concluded that the hypothesis was accepted.

3.3.7.2 Heart rate observations

To test the hypothesis that the heart rate of horses would be lower in the training environment than in the competition environment, a paired t-test statistical procedure with a level of significance for a one tailed test was used. Analyses revealed no significant difference in the horses' mean heart rates between the training and competition environments ($t = -.95$, $p = .36$). Furthermore, no significant difference was found in the horses' mean heart rates at the entry into the dressage arena in the training, compared to the competition environments ($t = .91$, $p = .37$). It was therefore concluded that the hypothesis was rejected.

3.3.8 Relationships between horse and rider psychological factors, and working relationship indicators

To test the hypothesis that there would be negative relationships between the riders' self-report of cognitive and somatic anxiety and with their working relationship and heart rate synchronisation scores in the training and competition environments, a Pearson coefficient statistical procedure with a level of significance for a one tailed test was used. Analyses

revealed that there were no significant correlations between cognitive and somatic anxiety with the rider and judges' rating of working relationship and heart rate synchronisation (Table 3.11). It was therefore concluded that the hypothesis be rejected.

To test the hypothesis that there would be negative relationships between the riders' rating of the horse's temperament with their working relationship and heart rate synchronisation scores in the training and competition environments, a Pearson coefficient statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that a significant negative relationship is identified between the horse's temperament in the training environment and heart rate synchronisation at competition. It was further found that the horse's temperament is significantly and positively related to the rider's perception of their working relationship in the competition environment (Table 3.11). It was therefore concluded that the hypothesis be partially accepted.

Once again due to the small N and the number of correlations conducted these two significant correlations should be considered with caution.

Table 3.11: Shows the Pearson correlation coefficients between rider anxiety variables and heart rate synchronisation in the training (T) and competition environments (C).

	Cognitive anxiety T	Cognitive anxiety C	Somatic anxiety T	Somatic anxiety C	Horses Temperament T	Horses Temperament C
Heart rate synchronisation T	-.21	-.11	-.30	-.10	-.25	-.14
Heart rate synchronisation C	-.25	.37	-.27	-.22	-.54*	-.32
Riders working relationship T	-.25	.14	-.16	.04	.32	.32
Riders working relationship C	-.28	-12	-.10	-.33	.35	.73**

* $p < .05$ ** $p \leq .01$

3.3.9 Post hoc consideration of the CSAI-2 subscales comparing dressage and showjumping riders at competition.

To assess possible differences between show jumping riders and dressage rider's anxiety and self-confidence, a t-test for equal means $t = \frac{y_1 - y_2}{\sqrt{\frac{s1^2}{n1} + \frac{s2^2}{n2}}}$ was conducted. The CSAI-2 subscales from training and competition in this study were compared to data of showjumping riders sampled by Fitzpatrick (2004), cognitive state anxiety (M = 15.54; SD = 4.48), somatic state anxiety (M = 14.85; SD = 5.01) and self-confidence (M = 22.54; SD = 5.12).

This analysis identified that the cognitive state anxiety reported by dressage riders at training was significantly higher than that reported by showjumping riders ($t = 2.78$, $p \leq 0.01$) at competition. The somatic state anxiety reported by dressage riders showed no difference from the somatic anxiety reported by showjumping riders ($t = 0.317$, $p > 0.05$) at competition. The level of self-confidence reported by dressage riders at training was significantly higher than the self-confidence reported by showjumping riders at competition ($t = 3.69$, $p \leq 0.01$).

This analysis identified that the cognitive state anxiety reported by dressage riders at competition was significantly higher than that reported by showjumping riders ($t = 3.96$, $p \leq 0.01$) at competition. The somatic state anxiety reported by dressage riders was also significantly higher than showjumping riders ($t = 3.44$, $p \leq 0.01$) at competition. The level of self-confidence reported by showjumping riders was significantly higher than the self-confidence of dressage riders at competition ($t = -1.61$, $p \leq 0.05$).

3.4 Discussion

This study was designed to extend the exploration into the horse-rider working relationship, their heart rate synchronisation and the individual horse and rider factors that

may be implicated within this relationship. It also assessed the stability of this relationship across two very different environments. Given the specific requirements of psychological and physical factors in the development of a harmonious relationship in dressage, this sport was considered a good testing ground for patterns of association and differences as seen with eventing riders in Study 1.

The following discussion begins with consideration of the working relationship indicators and heart rate synchronisation between horse and rider, followed by individual horse and rider dynamics as they appear in the training and competition environments. It then examines the methodological issues, limitations of this particular study and directions for further analysis of data collected in this study.

3.4.1 The working relationship and heart rate synchronisation between horse and rider

The literature reveals little research on the evaluation of both members of the equestrian team at the same time, in other words, the actual working relationship. However, anecdotal evidence has been described, which prompts this empirical investigation. Since the beginning of this decade, more focus has been put on what makes a harmonious working relationship between horse and rider. The phrases commonly used to describe this working relationship include: being at one with the horse, being in harmony with the horse, having unity with the horse, having a working relationship with the horse and being ‘in synch’ with the horse.

In this study, riders and judges assessed the working relationship between horse and rider, based on the criteria contained in the guidelines of the EFA Dressage Judge’s Handbook (National Dressage Committee, 2008). The heart rates of horse and rider were correlated to determine whether physiological synchronisation existed between them in an attempt to identify physical indicators of the working relationship. This dissertation is the

first to use heart rate synchronicity as a method of assessing the relationship between horse and rider during performance.

The group data for these equestrian teams displayed overall heart rate synchronisation at training, but not at competition. Varying degrees of heart rate synchronisation were demonstrated in all but two teams in the training environment and in all but three teams in the competition environment. Furthermore, all except one team displayed different levels of heart rate synchronisation between training and competition. This study has established heart rate synchronisation to be a sensitive measure for identifying physiological patterns of relationships between horse and rider. As considered earlier in this dissertation, the interpretation of this correlation is not conclusive here as to whether it refers to physical exertion or emotional accord. However, further exploration is required to uncover what influences this physiological synchronisation between horse and rider. Suggestive findings from this study are discussed below.

The riders' and judges' appraisal of the horse-rider working relationship allowed this study to compare the perceptions of the person who was directly interacting with the horse and a trained observer, the dressage judge, who has been educated to assess the harmony between horse and rider. However, no relationship was identified between the rider and judge's perceptions of the working relationship in this study. This lack of concurrence between the judge and the riders, suggests that what the judge is observing as a harmonious working relationship is different from the working relationship the rider believes they are training to achieve. Furthermore, the lack of association between all the working relationship inventories also extended to their heart rate synchronisation. Therefore, it is possible that these measures are all identifying with different aspects of the horse-rider interaction. As has been suggested, the heart rate synchronisation may be indicative of the physical effort of both members, which is not then psychologically experienced or interpreted as an aspect of the

working relationship. However, there are associations with the working relationships measures and individual factors such as horse temperament, and patterns of stable ratings between training and competition environments that are suggestive of convergent validity. Clearly further investigation with a focus on the construct validity of working relationship measures and heart rate synchronisation is required to advance research in this area.

3.4.2 Horse and rider factors related to the working relationship

It is important that horse temperament be considered when attempting to get the best possible performance from the equine athlete, (Visser, van Reenen, Schilder, Barneveld & Blokhuis, 2003) as different training tactics have been suggested for individual horses (McLean, 2004). Therefore, a suitable measure that identifies characteristics of the horse's temperament is required to assist the rider in selecting a suitable horse to compete in their chosen equestrian sport (Mackenzie & Thiboutot, 1997).

This study used the HTI-R as developed in Study 1 to further assess the temperament of the dressage horse. Findings were that the rider's perception of the horse's temperament has a positive association with the rider's perception of their working relationship. This association may be due to the bonds that have been built between horse and rider as suggested by Fraser (1992). The horse temperament-working relationship association discovered in this study demonstrates the importance of selecting the appropriate horse for performance success in the desired equestrian sport that is outlined in the equine science research (Visser, van Reenen, Schilder, Barneveld & Blokhuis, 2003)

Expert opinion and anecdotal reports suggest that the rider's cognitive and somatic anxiety may influence the working relationship between horse and rider. It is proposed in the literature that cognitive anxiety influences the mental preparation and skills of the rider, while somatic anxiety affects the physical preparation and skills of the riders. Furthermore, it is

suggested that anxiety inhibits the rider's ability to communicate with the horse, thereby compromising their relationship (Reilly, 2000; Williams, 1999).

As this association has never been empirically tested, this dissertation focused on the relationship between rider anxiety and the working relationship with the horse. There were no significant statistical associations between any aspect of rider anxiety and the working relationship with the horse in either the training or competition environment. However, while the working relationship did not show changes due to the environment, the rider's anxiety did show a significant increase from the training to the competition environment. This increased anxiety reported in the competition environment reflects direction of anxiety outlined in the multidimensional theory (Endler, 1978; Gould & Krane, 1992; Martens, Vealey & Burton, 1990).

3.4.3 Stability of the working relationship and individual factors

The success of the equestrian team is dependent upon an effective working relationship between its team members across all kinds of training and competition conditions. This can be challenging for the reactivity of the horse and the self confidence of the rider. However, the stability aspect of the equestrian relationship in sport has been overlooked in the empirical research. The equine science literature investigates the responses and reactions of horses across environments, and sports psychology researchers investigating the rider have identified some factors that influence the rider in the competition environment. However, neither scientific discipline has considered how the horse and rider work as a team in different environments.

The working relationship was examined here from a rider and judge perspective across both the training and competition environments. This study did not discover any differences in these ratings due to environmental conditions. This consistency of the working

relationship across environments is quite surprising, as the degree of difficulty in achieving a consistent dressage test is very high. It was expected that the rider would be able to identify moments of irregularities during their interactions with the horse that would reduce quality of their working relationship. However, as a highly trained A level dressage judge rated the working relationship as stable and consistent in both training and competition, this then supports the rider's perception of the working relationship. It does indicate that the riders and judges appear to be assessing the same dynamic within this working relationship. Thereby, it can only be assumed that the working relationship as rated by this method is consistent across environments. This consistency across environments was also demonstrated, using the heart rate synchronisation. As this consistency in the working relationship across environments is observed by both riders and judges and supported with the heart rate synchronisation measure, it is concluded that this relationship is stable. This finding could also represent successful training, in that this group of riders achieved their goal of a consistency of performance when riding a dressage test at training and competition.

Fraser (1992) and Williams (1999) suggest that the bond horses develop with their riders allows the horse to seek comfort from humans, and in such circumstances horses may not show the expected reactivity in behaviour associated with changes of environment. Furthermore, if the rating of the horse's temperament is indicative of psychological traits, then one would not expect evidence of environmental influences. The horse temperament scores in this study demonstrated stability across environments. This study recorded the horse's heart rate and found the same stability across environments as recorded for the horse's temperament.

Studies into the horse's heart rate have investigated the relationships between training and the emotional aspects of the interaction with humans and the training environment (McCann, Heird, Bell & Lutherer, 1988a, 1988b; Visser et al., 2002). It is

presumed that if the horse's activity or intensity of activity is the same in both environments, an increase in heart rate is indicative of emotionality of the horse (Visser et al., 2002). Heart rate has also been used to assist in determining the fear responses in horses, predicting that the greater the increase in the heart rate, the higher the fear level (Joseph, 2007).

These heart rate sensitivities to environmental conditions were not evident in this study. The horse's heart rate mean and the heart rate when they entered the dressage arena were not significantly different between environments. This stability of heart rate suggests no evidence of the emotionality-heart rate link proposed by Visser et al. (2002). However, these analyses in real-life conditions are different from those in experimental test conditions. Here the horse may experience the rider as supportive, pre-empting any arousal due to new stimuli, unlike the horse that is set free alone in experimental arena tests.

This stability in heart rate is also interesting, in that there is no evidence of the expected increase in heart rate related to the horse's extra physical exertion in response to the rider's demands for competition-level performance. This suggests that the horse's physiological exertion during a dressage test in the training environment does not change when doing the same test in the competition environment. Given that dressage horses learn aspects of the test routines; this stability in heart rate is understandable. It also could be argued that the horse and rider work consistently at the same level in training and competition, though the increase in rider heart rate in competition would not be consistent with this explanation. Another consideration is that the heart rate monitors in this research recorded heart rate over a 5-second interval, which is not as sensitive as a beat-to-beat monitor. Perhaps the technology used here was unable to identify the subtle changes in heart rate. All of these explanations are only speculative and set out a possible comparison for future research. However, as the Horse Temperament Inventory suggests stable psychological traits, and as the horse heart rate parallels physiological stability across environments, it is

argued that overall stability of the horse between training and competition environments is more evident here than previous equine science and expert opinion have suggested.

It was also expected from the findings of previous studies, that riders would report different levels of anxiety across environments. As the leader of the equestrian team, the rider is responsible for performance outcomes which may be influenced by many factors. One of these factors is the psychological challenges of performing well in competition. This may be a source of anxiety which can reach levels that inhibit mental and physical preparation and performance. This competition anxiety is compounded in the dressage rider, with the added challenges of interaction with the horse such that it stays energetic, yet calm and focussed to perform the competition test. Anxiety can play a key role in the ability to concentrate, balance and execute technical skills (Benedict & Qin, 2007; Martens, Vealey & Burton, 1990; Neil, Mellalieu, Wilson & Hanton, 2007),

This study used both the CSAI-2 and the CSAI-2R to assess the rider's anxiety across environments. Each measure demonstrated that not all aspects of a rider's anxiety are sensitive to environmental changes. On the CSAI-R, only the rider's somatic anxiety was influenced by environmental conditions. On the EMCA-Q only the emotion experience of anxiety was sensitive to the environmental influences and parallels changes in the rider's somatic anxiety.

Interpreting the definitions given to these subscales, these findings suggest that the rider's experience of anxiety is related to perceived physiological arousal with a focus on the specific experience in which they are engaged at the time. Despite the appearance of dressage riders to be calm and relaxed while executing dressage tests, the *post hoc* analysis confirms that dressage riders experience considerably higher levels of somatic anxiety than showjumping riders while at competition. Indeed, the level of dressage riders' somatic anxiety in the training environment is within the same ranges as showjumping riders at

competitions. This is the first study to compare the anxiety levels of dressage riders with previous reports from showjumping riders (Fitzpatrick, 2004,) and therefore contributes to empirical knowledge.

If the changes in somatic anxiety are an indication of perceived increased heart rate as originally proposed in the construction of the CSAI (Martens, Vealey & Burton, 1990), then the rider's heart rate would predictably increase in parallel and correlate with somatic anxiety. Such a parallel pattern of increases in heart rate and reported somatic anxiety is demonstrated in this study. However, this pattern was not statistically significant. Hence it cannot be concluded on the basis of these data that increases in rider heart rate are partly explained by increases in rider anxiety.

As the heart rate of athletes is also traditionally used as a measure of physiological exertion and stress, it could be argued here that the environmental differences in heart rate are indicative only of increased exertion in competition. However, Tremayne and Barry (2001) discuss the research proposed by Barry (1981 & 1988), Lacey (1967) and Lacey and Lacey (1970) regarding the vigilance of an athlete as a possible rationale for the decrease in elite pistol shooters heart rate in the moments preceding the competition activity. They advocate that the athletes cognitive processing and heart rate are intertwined within the dynamics of their psychophysiology when engaging in sports. However, it is interesting that in this research the rider showed increases in their heart rate in the competition environment, whilst their horses show no similar additional physical effort in competition in response. Therefore, if vigilance was considered with respect to these riders, it may be postulated that an increase in their heart rate across environments may partly reflect an absence of vigilance in their performance focus. Indeed, anecdotally there is much opinion that riders are seldom capable of getting their horses to work as hard as riders do, especially at competition, and consequently riders seldom get the performance that their horses are capable of.

3.4.4 Methodological considerations

This study sought to improve on the methodologies of the Eventing study in several ways. With regard to the Working Relationship measure (WRI), an A level dressage judge was used as an external observer of the working relationship and the ratings were made from a videotape. The use of videotape reduces the doubt an observer may have regarding any behaviours, lack of movement or interaction they may perceive by either horse or rider as they are able to rewind the tape and confirm or discount the interactions between horse and rider. Thus, this method of recording the working relationship data from videotape gives a process that allows for the confirmation of the recorded data that is not available during real time observations.

Furthermore this study was able to demonstrate good internal reliability for these measures. Issues still remain regarding the factor structure and construct validity of the measures, as there was not the correlation between the two that was expected. However, the measures did correlate as hypothesized with some individual horse and rider factors, which lends some indication of convergent validity.

This study also replicated the sensitivity and usefulness of heart rate synchronisation to investigate patterns of physiological interactivity between horse and rider and as well as differences in this interactivity between environments for some individual teams. The measure also showed profiles of changing degrees of synchronicity between horse and rider over the duration of the dressage test, and comparatively between training and competition. Evidence for such physiological patterns and profiles has not been demonstrated previously across training and competition.

However, heart rate data collection was not without challenges in the sport of dressage. Equipment failures did not occur during the eventing study, though horses and

riders were active jumping fences. Several dressage riders were in the habit of tightening the girth just prior to entering the arena. This prevented the researcher from checking if the contact of the electrode was altered. Despite repeating instructions, some dressage riders continued this habit apparently unconsciously. Future research involving dressage riders requires more diligence in the management of the heart monitor equipment immediately before the rider enters the arena, which will require special permission from the chief judge to approach the arena boundary. However, it is concluded that heart rate data and heart rate synchronisation provide significant insight into the physical interactivity of horse and rider, and is worth the methodological challenges.

As reviewed earlier, equine sciences do not have validated methodologies to assess horse temperament. Furthermore, it appears in the literature that research does not define or differentiate characteristics as traits that are stable over time, or states that depict reactivity to particular stimuli and conditions. The data from the horse temperament inventory designed for this study are suggestive of a stable trait on the basis of observations across two very different environmental contexts. The inventory showed good internal reliability, however the limited sample size prevented further analyses in terms of factor structure that would assess the assumed positive and negative categories of descriptors.

Future psychometric development of this temperament inventory is required to determine the factor structure. Such that change or stability of the total score can be further understood in regards to horse temperament. As the total score may not change significantly it is possible that there has been changes within particular dimensions of the horse's temperament within positive and negative attributes. Thus, the patterns of this inventory require further consideration regarding the lack of correlation due to weaknesses of the scale construction, given its stage of construction.

To assess the rider's anxiety within the working relationship, the CSAI-2 was chosen, as it is a popular measure in sports psychology research and permitted comparison with other sports, and because it gave indicators of cognitive and somatic anxiety, the latter being of particular concern to equestrians because of its possible effect on the riding aids. However, the controversy as to whether it is a valid measure of actual multiple dimensions of competition anxiety is recognised (Cox, Russell & Robb, 1995; Craft, Magyar, Becker & Feltz, 2003; Lane, Sewell, Terry, Bartram & Nesti, 1999). This study provided an opportunity compare findings based on use of the CSAI-2 and the CSAI-2R. Analysis showed that the CSAI-2 detected significant differences between the training and competition environments from the rider's self report of all subscales. The CSAI-2R showed significant differences in somatic anxiety and self-confidence reported by riders, but not cognitive anxiety. The sample size here was too small to permit comparisons of factor structures, however previous research reliabilities reported for the CSAI-2 (Lane, Sewell, Terry, Bartram & Nesti, 1999; Martens, Vealey & Burton, 1990) and the CSAI-2R (Cox, Martens & Russell, 2003; Terry, Lane & Shepherdson, 2005) reveal slightly lower Cronbach alpha coefficients for both the CSAI-2 and the CSAI-2R than were found in this study. The continued use of the CSAI in equestrian research would permit an accumulation of comparative data to assess the ranges of anxiety levels and the reliability of the finding that somatic aspects of anxiety are most salient to equestrians in relation to horse characteristics.

The use of the CSAI-2 was supplemented with the inclusion of the EMCA-Q. It was valuable in identifying a differentiation between the emotion and mood experience of anxiety across environments. Combined with the CSAI-2, a comprehensive profile of rider anxiety emerges, which points to the importance of assessment in training and competition environments when determining anxiety targets for intervention.

A further consideration for future methodologies is the order of collecting data when investigating the physiological and psychological dimensions of horses and riders simultaneously. For example when a rider is completing the WRI-R after the warm up period if they perceive a positive relationship with the horse this could increase their levels of self confidence and reduce anxiety levels which may also impact on their heart rate, which inturn may impact working relationship with the horse during the actual competition. A limitation in this study was the heart rate monitors were fitted to the riders after they had completed the CSAI-2 and EMCA-Q questionnaires and before they completed the WRI-R inventory. If the heart rate monitors were fitted to the riders before they completed the psychological questionnaires changes in physiological reactivity may have been found leading up to the test period. Therefore, a future pilot study is required to test the reactivity of heart rate when asking people to complete questionnaires before equestrian activities.

A final and significant methodological issue is managing participant engagement and data collection with dressage riders. Like the equestrian sport of eventing, the dressage sport is not organised as other traditional team sport, where there are regularly scheduled training sessions on specific days. Most equestrians typically train whenever their work commitments, horse's health and weather permit. This flexibility is possible because most train at their own private arenas, which do not require pre-scheduling. This presented several difficulties when maintaining a one week period between the training session and the nominated competition for the research.

Once dressage participants were recruited into the research program, the next hurdle was to retain them in both training and competition phases. As both horses are prone to injuries, high dropout rates for a particular competition are not uncommon. In this sample 21 percent of participants did not compete after the training data collection. In addition, in dressage competitions, participants can be eliminated before finishing the test if they make

more than three errors on the course. In this sample three percent of participants were eliminated. As a result of these factors it was difficult to obtain data of repeated measures for horse and rider.

These methodological issues are presented here to highlight the difficulties of equestrian research and to explain the tendency in the literature toward small samples, and mostly univariate research. This dressage study represents the first study to obtain sufficient horse and rider data to make comparisons across environments on four main variables.

3.5 Summary and Conclusions

This study set out to explore the physiological and psychological dynamics of the working relationship and heart rate synchronisation between horse and rider. Despite the practical and methodological difficulties, this study contributes to the little empirical work in equine science and equestrian sport psychology that addresses interactive human and horse factors.

The working relationship, as assessed by riders and judges, showed no differences between the training and competition environments. However, heart rate synchronicity showed significant differences between training and competition environments at both an individual team level and group level. At a group level, synchronisation was more evident in the training environment than in the competition environment. At an individual level, nine teams showed less, six teams showed more, and one team showed the same heart rate synchronicity from the training to the competition environments.

There were no significant relationships between the rider's perception of working relationship and the judge's perception of working relationship and heart rate synchronicity. Similarly, there were no significant relationships between the horse's temperament and rider's anxiety, and the rider's perception of their working relationship in the training or

competition environment. At a group level there were no significant correlations between rider's cognitive and somatic anxiety, and horse's temperament, with heart rate synchronisation. However, trends in the analysis did indicate some possible relationships between these variables.

As hypothesized, riders reported significantly higher levels of cognitive and somatic state anxiety and significantly lower levels of self-confidence in the competition environment compared to the training environment. Similarly, the heart rate of riders in the training environment was significantly lower than their heart rate in the competition environment. The data suggests that there are patterns of difference within psychological and physiological measures that suggest possible links, even though there were no significant correlations between them.

The findings, while speculative, due to limited sample sizes for psychometric analyses of measures and limited statistical power, point to the utility of research in this area for both the equine scientist and the sport psychologist. This study provides some data to support anecdotal and expert opinion on the importance of considering characteristics of individual riders and individual horses, and their relationship in building strong competitive equestrian teams.

Chapter 4. A closer look at horse behaviour and its relationship to rider anxiety and their working relationship

Abstract

Findings from the Eventing Study suggested that further investigation of characteristics of horse behaviour were warranted to extend the research that has been done from the perspective of horse temperament. Temperament, as assessed by the Horse Temperament Inventory (HTI-R,) within this Dressage study, was stable as a trait across environments. However, equine research indicates that horse's sensitivity to changes in environments can also be an issue in the working relationship. This study attempted to develop an objective assessment of horse behaviours to capture the more transient state characteristics of the horse for equestrian sport research. Based on previous equine science research, the behaviour checklist developed here included tail swishing behaviour and a group of behaviours including head tossing, bucking, rearing, balking, bolting, and kicking up with hind legs. These behaviours were considered to be representative of "misbehaviour" in an equestrian sport context. Two trained equestrians noted the occurrence of these behaviours from video-taped footage of a dressage test performed in training and competition settings. The inter-observer reliability revealed fair-to-excellent concurrence. To explore whether the occurrence of these behaviours further informed aspects of the horse-rider working relationship, data were analysed in relation to several factors. There were no differences between training and competition settings in the occurrences of tail swishing and horse misbehaviour. Occurrences of tail swishing in the competition environment had a significant negative correlation with the judge's rating of the working relationship. A significant negative relationship was also found between the horses' misbehaviour and the horses' temperament, the rider and judge's rating of the working relationship, and the test

scores in the competition environment. The test score in the training environment also had a significant negative correlation with the horse's misbehaviour in the training environment. A positive correlation was revealed between the horse's misbehaviour and the rider's somatic anxiety in the competition environment. While the misbehaviour indicator appears to be more sensitive to relationship factors than horse temperament, a discriminant function analysis showed horse temperament was more successful in classifying riders with low and high somatic anxiety. However, neither horse temperament or horse misbehaviour indicators were associated with cognitive anxiety. The patterns of these relationships are mostly as would be predicted from previous research and anecdotal literature.

4.1 Introduction

This investigation expands on the horse behaviour findings of the Eventing Study. It was conducted as part of the Dressage study. However, this exploration into horse behaviour is considered an important new facet of equestrian sports research and is reported separately from the main findings of the Dressage Study in Chapter 3. The eventing study revealed that a single behavioural observation was not sufficient to identify associations with the horse or rider variables in that study. However, it did show that horses will show variations in behaviour. The literature outlines two possible reasons for the changes in the horse's behaviour between environments. Firstly, these differences may be due to the rider; secondly, they may be due to the horse itself (McGreevy, 2004; McGreevy & McLean, 2005). The equipment used by the rider can influence how the horse reacts in different environments. This equipment impacts on the rider's seat position and sequentially on how they apply the aids. The horse may respond to the equipment and/or the rider by bucking, bolting, evading the aids, kicking up, rearing or even removing the rider from its back with an object such as a tree (McGreevy & McLean, 2005). Furthermore, the horse may react to the rider's behaviour

towards the horse (Hama, Yogo & Matsuyama, 1996; Sondergaard & Halekoh, 2003; Williams, 1976, 1999; Zucca, Minero, Grignani & Canali, 2007) and respond by displaying misbehaviours. The horse may also have a change of behaviour due to physiological problems such as an injury or illness. If the horse is of a nervous disposition, it may be more reactive to the stimuli in new environments (McCann, Heird, Bell & Lutherer, 1988a, 1988b).

In a dressage test horses are required to respond correctly to the rider's aids for each movement, regardless of external stimuli. However, horses do not always respond consistently. Sometimes they may not do the movement at all and at other times they respond with brilliant paces. In considering what horse behaviours to include in this study, previous research was consulted. Tail swishing behaviour was selected, as it is easily observed and has been interpreted as an indicator of the emotional communication of agitation or discomfort (Nuff, 1988; Rees, 1984; Waring, 2003; Weeks, Crowell-Davis, Caudle & Heusner, 2000). Tail swishing may be displayed as initial agitation just prior to kicking, striking, bucking and baulking when the horse is being ridden. Indeed, research has shown that tail swishing is related to poor performance of horses (Hutson, 2002; Hutson & Haskell, 1997; Weeks, Crowell-Davis, Caudle & Heusner, 2000; Wolff, Hausberger & LeScolan, 1997).

Horse behaviours such as head tossing, bucking, rearing, baulking, bolting, kicking up with hind legs are normally considered to be problem behaviours in the competition dressage horse. These misbehaviours are also referred to in the literature as hyper-reactivity responses that form behaviour problems (McGreevy, 2002, 2004; McGreevy & McLean, 2005; Rees, 1984; Waring, 2003). McGreevy (2004) and McGreevy & McLean (2005) identify hyper-reactivity behaviour as shying, leaping laterally in response to an olfactory or visual stimulus, and bolting or galloping from a perceived threat with no obedience to the rider's rein-aids. Agonistic behaviours such as bucking, kicking up and rearing are responses of aggression used to fight their congener and dislodge predators. Behaviours such as

baulking and bolting home occur when the motivation to return home is stronger than that of submitting to the human directed work (McGreevy & McLean, 2005).

Understanding more specifically the links between horse behaviour and the rider's anxiety, working relationship and performance is the focus of this next investigation of the dressage data. As discussed in more detail earlier, a link has been identified between horse behaviour and the horse's psychological reactive state, suggesting behaviours reveal emotionality within the horse (McCann, Heird, Bell, & Lutherer, 1988a, 1988b; Vallerand & Celine, 2000). It is further demonstrated empirically that horses attempt to articulate their desires, intentions and emotions through body language and specific behaviours (Weeks & Beck, 1996). However, care must be taken when observing the body language and behaviours of horses, as environmental factors also influence the horse's behaviour (Veserat & Cirelli, 1996).

There is much anecdotal discussion, but little empirical evidence, that rider anxiety is associated with horse misbehaviour and hence performance outcomes of riders (Kais & Raudsepp, 2005). Indeed, some sports psychology research has shown that rider competition anxiety itself does not impact on competition performance of dressage riders (Tompkins, 1999), showjumping riders (Fitzpatrick, 2004) or rodeo riders (Meyers, Bourgeois, LeUnes & Murray, 1999). However, equestrian success cannot be achieved without a cooperative horse, regardless of rider anxiety; thus, it is important that horse behaviour and rider anxiety be assessed in relation to the horse-rider relationship.

Understanding the impact of horse behaviours on their own riding performance assists riders during their training sessions to improve the horse's ability to perform in the competition environment. The literature shows mixed results in linking the observations of horse behaviour to other factors. While Mills (1998b) expresses concern over the ability of people to concur on the definitions regarding horse behaviours or temperament traits, other

researchers confirm the reliability between observers in the assessment of horse behaviours (Anderson, Friend, Evans & Bushong, 1999; Le Scolan, Hausberger & Wolff, 1997; Morris, Gale & Duffy, 2002; Visser, van Reenen, Rundgren, Zetterqvist & Blokhuis, 2003). This investigation attempts to contribute further to this discussion by adhering to MacKenzie and Thilboputot's (1997) recommendation to observe and rate behaviour from video to gain maximum accuracy from the observation, to use trained observers and to assess during training and competition.

In summary, horse behaviour assessment has been the subject of many equine studies. However, it has not been used in equestrian sport studies as a possible factor that can uncover human-horse relationship components. The further development and analysis of such a measure would inform future research involving training and completion performance.

4.1.1 Hypotheses

Hypothesis 1: Tail swishing and misbehaviours will occur significantly more often in the competition environment than the training environment.

Hypothesis 2: Tail swishing and misbehaviour will correlate significantly and negatively with the working relationship indicators and heart rate synchronisation between horse and rider in both the training and competition environments.

Hypothesis 3: Tail swishing and misbehaviour will correlate significantly and negatively with the dressage test score.

Hypothesis 4 Tail swishing and misbehaviours will correlate significantly and positively with the rider's cognitive and somatic anxiety.

Hypothesis 5: Riders with low and high cognitive and somatic anxiety can be discriminated into groups on the basis of horse's heart rate, temperament, misbehaviour and tail swishing.

This chapter next outlines the methodology employed and provides a descriptive assessment of the horse's tail swishing and misbehaviour. It concludes with analysis of whether these behaviours are related to horse temperament, rider anxiety and working relationship indicators.

4.2 Method

4.2.1 Participants and research sites

The horses and research sites are as described in Chapter 3.

4.2.2 Measures

This study included behaviours that were suitable for observation from the video of a dressage test. They are tail swishing and misbehaviour. The occurrences of tail swishing or one of the misbehaviour indicators were recorded every 2 seconds during the dressage test. In this study the occurrences of the horse's tail swishing were recorded as "yes" and the absence of this behaviour was recorded as "no". The variable of misbehaviour included group behaviours such as head tossing, bucking, rearing, baulking, bolting, kicking up with hind legs and shying. Misbehaviour was recorded as "yes" if the horse was displaying one of the listed indicators of misbehaviours, or "no" if the horse was not displaying any of the listed behaviours.

Dressage judges deduct points from the team's score if a horse displays tail swishing or any one of the behaviours listed in the misbehaviours group during a dressage test. The number of occurrences of these behaviours was summed to give a total score ranging from 0 to 242, depending on the duration of the dressage test.

4.2.3 Procedures

As discussed in Chapter 3, participants gave consent for their training and competition sessions to be videotaped. In the training environment, the video camera was set up to record each dressage test. This position of the camera was at the letter C in the arena, where a dressage judge would normally sit to allow the video observer the best view of the horse and rider. However, if this was not possible, the camera was set up in the same position at the other end of the arena at the letter A where the horse and rider enter the arena. The camera was set up at a distance of 10 to 15 metres away from the arena as per EFA competition rules. This made it difficult to maintain a consistent camera position to the dressage arena in the competition environment. In addition, the camera was set up in a position that would not interfere with the judge's view of the dressage test in the competition environment. Thus, it was not possible to consistently place the camera in the same position in the training and competition environments.

Each videotaped test was reviewed by an observer, who recorded the occurrences of the horse's tail swishing and misbehaviour. These behaviours were recorded at 2 second intervals during the segment of the tape from the time the horse entered the arena until the horse halted and rider saluted at the end of the dressage test. The behaviours were observed and recorded individually and then the tape was rewound to record the next behaviour. Each behaviour occurrence within the whole dressage test was summed to calculate a total tail swishing and misbehaviour score for each horse.

To assess the reliability of this observer's identification of occurrences of behaviour, a second observer was asked to identify occurrences of behaviour in eight horses. They selected at random 4 horses from the training environment tapes and 4 horses from the competition environment tapes. The total number of occurrences for these behaviours was then correlated with the first observer, using a Pearson correlation to determine the inter-

observer reliability. The correlation for the inter-observer observations across both environments was not significant for tail swishing behaviour (r=.66, p > .05). Given the low level of agreement between observers, there will be no further analysis of this data. A significant correlation was found between observers for horse misbehaviour across the training and competition environments (r = .89, p = 0.01).

4.3 Results

4.3.1 Environmental impact on horse behaviour

To test the hypothesis that horse misbehaviours will occur significantly more often in the competition environment than the training environment, a paired sampled t-test statistical procedure with a level of significance for a one tailed test was used. The analysis showed no difference for horse misbehaviour between the training (M = 2.63, SD = 4.30) and competition (M = 2.03, SD = 3.67) environments (t (30) = .552, p = .58). It was therefore concluded that the hypothesis was rejected.

4.3.2 Horse behaviour and temperament, and rider anxiety and association with the working relationship and heart rate synchronisation

To test the hypothesis that horse misbehaviour is significantly and negatively correlated with the working relationship score and heart rate synchronisation between horse and rider during the dressage test in the training and competition environments, a Pearson correlation coefficient statistical procedure with a level of significance for a one tailed test was used. The analysis showed a significant (p < 0.01) negative correlation was found between the horse's misbehaviour at competition and the rider and judge's rating of the working relationship at competition (Table 4.2). No other correlations were found for horse

misbehaviour (Table 4.1 and 4.2). Therefore it is concluded that the hypothesis be partially accepted.

Table 4.1: The Pearson coefficients of horse misbehaviour and rider anxiety, working relationship and performance variables at training

	Misbehaviour
Rider	
Cognitive anxiety	-.13
Somatic anxiety	-.31
Horse	
HTI training	-.05
Working relationship	
WRI (rider rating) training	-.12
WRI (judge rating) training	-.03
Heart rate horse-rider	
HRS training	-.22
Performance outcome	
Test score training	-.52**
* = $p < 0.05$ ** = $p < 0.01$	N = 30

To test the hypothesis that horse misbehaviour is significantly negatively correlated with the dressage test score, a Pearson correlation coefficient statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that the horse misbehaviour has a significant negative correlation with the dressage test score in both the training and competition environments (Table 4.1 and 4.2). It is interesting to observe that at both, training and competition environments, 25% of the test score variance is explained by horse misbehaviour. It was therefore concluded that the hypothesis is accepted with regard to horse

misbehaviour, as significant negative correlations were revealed between the horse misbehaviour and the test scores in both environments.

Table 4.2: The Pearson coefficients of horse misbehaviour and rider anxiety, working relationship and performance variables at competition

	Misbehaviour
Rider	
Cognitive anxiety	-.12
Somatic anxiety	.50**
Horse	
HTI competition	-.51**
Working relationship	
WRI (rider rating)	-.38*
WRI (judge rating)	-.52**
Heart rate horse-rider	
HRS	.19
Performance outcome	
Test score	-.52**

* = $p < 0.05$ ** = $p < 0.01$ N = 30

To test the hypothesis that the horse's misbehaviours have a significant positive correlation with the rider's cognitive and somatic anxiety, a Pearson correlation coefficient statistical procedure with a level of significance for a one tailed test was used. Analyses revealed that a significant ($p < 0.01$) negative correlation between horse temperament and the horse misbehaviour in the competition environment, with no correlation found in the training environment. Furthermore, no relationship was found with the rider's cognitive anxiety and the horse's misbehaviour in the training or competition environments. The rider's somatic anxiety in the training showed no relationship to misbehaviour. However, the rider's somatic

anxiety at competition displayed a significant ($p < 0.01$) negative correlation with horse misbehaviour in the training environment. It is interesting that in the competition environment a significant positive correlation is revealed between rider somatic anxiety at competition and horse misbehaviour. It was therefore concluded that the hypothesis was partially accepted, as the rider's cognitive and somatic anxiety was not consistently correlated with the horse's misbehaviour in both training and competition environments.

It is interesting to note that rider experiences of horse misbehaviour in training and competition were both related to somatic anxiety in competition ($r = .48$, $p \leq 0.01$ and $r = .50$, $p \leq 0.01$ respectively). To determine whether misbehaviour at both training and competition environments contributes to the rider's somatic anxiety at competition, a simple regression analysis was conducted. The results indicated a significant contribution to the rider's competition somatic anxiety by horse misbehaviour at both training and competition environment (see Table 4.3).

Table 4.3: Summary of the regression analysis predicting rider competition somatic anxiety

Variable	**B**	**SE**	**β**
Misbehaviour Training	-.69	.26	-.40*
Misbehaviour competition	.81	.29	.42*

*= $p \leq .01$

4.3.3 A discriminant analysis of riders with high and low anxiety on the basis of horse characteristics

To further explore the relationships between horse factors and rider anxiety, a discriminate analysis was preformed. It is hypothesised that riders with low or high cognitive and somatic anxiety can be classified into groups on the basis of the horse's heart rate, temperament, and misbehaviour.

To conduct the discriminant analysis, the scores for rider cognitive and somatic anxiety were categorised into high and low levels of anxiety. To categorise riders, the midpoint of the data was selected; thus, riders classified in the low anxiety group were below the median point and the riders in the high anxiety group were above and equal to the median point. A discriminant function analysis was conducted to determine if the indicators of horse temperament, horse heart rate, and horse misbehaviour could discriminate dressage riders of high or low cognitive and somatic anxiety. No theoretical model or previous research is available to predetermine the order of entry. Therefore, a stepwise procedure was used to determine the smallest set of predictor variables. 30 cases were valid for entry, with 34 cases excluded due to missing data or out-of-range group codes.

Table 4.4: Means and standard deviations of variables for rider's somatic anxiety groups and the tests of equality of means for a discriminant analysis

Variables	Low anxiety	S.D.	High anxiety	S.D.	Wilks' Lambda	$F_{(1,16)}$	Sig
Horse's heart rate mean	105.94	16.60	109.97	15.44	0.98	0.28	0.60
Horse' heart rate at A	111.22	25.91	113.11	15.81	0.99	0.04	0.85
Horse's temperament	60.89	6.15	48.78	11.4	0.67	7.87*	0.01
Horse misbehaviour	1.00	2.00	4.33	5.55	0.85	2.88	0.11

* $p < 0.05$

Analyses revealed that only the horse's temperament was significant ($p < 0.01$) in the equality of means test (Table 4.4). Only one discriminant function was calculated in this analysis. The horse's temperament was accepted with an $F = 7.87$, allowing entry for further analysis with a combined χ^2 (10) = 6.199, P< 0.01.

The results of this discriminant analysis are presented in Table 4.5. This analysis revealed that 70 percent of the cases are correctly grouped. These data were cross validated using the jack-knifed classification procedure, revealing that only 66.7 percent of cases were

correctly classified. It shows a slightly lower number of correctly grouped cases than were found in the original analysis. This variation can be identified when examining the correctly grouped cases of high and low somatic anxiety.

Table 4.5: The results of discriminant function analysis of somatic anxiety of riders

Discriminating variable	1	2	Wilks' lambda	$F_{(1,16)}$			
Horse temperament	0.73	0.58	0.67	7.87*			
Canical R	0.57						
Eigenvalue	0.49						
Actual Group	No. of Cases	Predicted	high anxiety		Predicted	low anxiety	
		n	%	jk %	n	%	jk %
High anxiety	15	9	60	60	6	40	40
Low anxiety	15	6	40	26.7	12	80	73.3

* $p < 0.05$

Table 4.5 shows that 12 out of 15 riders (80 percent) could be correctly classified from the horse's temperament score as having reported low somatic anxiety. This left only 3 riders (20 percent) not fitting the classification criteria for low somatic anxiety. This classification was also cross-validated using the jack-knifed classification procedure. Only 73.3 percent of cases were correctly classified for low somatic anxiety, revealing a reduced number of correctly grouped cases compared with the original analysis.

Nine of the15 riders (60 percent) reporting high somatic anxiety levels could be accurately classified from the horse temperament score, leaving six riders (40 percent) that did not fit the classification criteria for the high somatic anxiety from the horse temperament score. This classification was also confirmed through cross-validation with the jack-knifed procedure. As both the classifications were better than 50% chance, the hypothesis was accepted for horse temperament only.

To determine if the riders with low or high cognitive anxiety could be classified on the basis of knowing horse temperament, horse misbehaviour, horse heart rate mean and horse heart rate when entering the arena at A, a stepwise discriminant analysis was performed. This analysis also uses an *N* of 18 cases that were valid for entry to the calculations. The first stage of the discriminant analysis reveals that the indicators of horse temperament and horse misbehaviour did not met the criteria to discriminate riders who reported high or low cognitive anxiety (Table 4.6).

Table 4.6 Means and standard deviations of variables for riders' cognitive anxiety groups and the tests of equality of means for a discriminant analysis

Variables	Low anxiety	S.D.	High anxiety	S.D.	Wilks' Lambda	$F_{(1,16)}$	Sig.
Horse's heart rate mean	100.68	10.21	117.05	17.14	0.72	6.36*	0.02
Horse' heart rate at A	102.90	13.35	123.75	23.46	0.74	5.67*	0.03
Horse's temperament	53.80	14.48	56.13	5.03	0.98	0.19	0.66
Horse misbehaviour	2.50	4.45	2.88	4.612	0.99	0.03	0.86

* $p < 0.05$

The analyses revealed that the horse's heart rate mean and the heart rate entering the arena at A were significant ($p < 0.05$) in the equality of means test. One discriminant function was calculated. The horse's mean heart rate was accepted into the analysis with an $F = 6.364$, allowing entry for further analysis with a combined χ^2 (10) = 5.191, $p< 0.02$.

The results of this discriminant analysis are presented in Table 4.7. This analysis revealed that 77.8 percent of the cases are correctly grouped. This variance was confirmed with a cross validation of the data, using the jack-knifed classification method to eliminate bias when all predictor variables are forced into the equation (Tabachnick & Fidell, 2007). The jack-knifed classification was calculated and confirmed that 77.8 percent of the cases were grouped correctly.

Table 4.7 shows that 9 out of 10 riders (90 percent) could be correctly classified as having low cognitive anxiety from the horse's heart rate mean. This was confirmed with a cross validation, using the jack-knifed classification procedure. This left only 1 rider (10 percent) who did not fit the prediction criteria for low cognitive anxiety (Table 4.7). The prediction of riders reporting high cognitive anxiety reveals that 5 of 8 riders (62.5 percent) could be accurately discriminated, using the horse's mean heart rate, leaving 3 riders (37.5 percent) who did not fit the prediction criteria for the high cognitive anxiety from the horse's heart rate mean. This prediction was also confirmed with the Jack-knifed method (Table 4.6). It was therefore concluded that the hypothesis was accepted for the horse's heart rate mean and rejected for all other variables.

Table 4.7 The results of discriminant function analysis of riders with low and high cognitive anxiety

Discriminating variable	1	2	Wilks' lambda	$F_{(1,16)}$			
Horse heart rate mean	0.54	0.63	0.72	6.36*			
Canonical R	-0.53	.67					
Eigenvalue	0.40						
Actual Group	No. of Cases	Predicted	high anxiety		Predicted	low anxiety	
		n	%	jk %	n	%	jk %
High anxiety	8	5	62.5	62.5	3	37.5	37.5
Low anxiety	10	1	10	10	9	90	90

* $p < 0.05$

4.4 Discussion and Conclusion

There is considerable speculation and anecdotal evidence regarding the horse-rider interaction which has not been empirically investigated. While there is research concerning how horses behave with humans (Lansade, Bouissou & Boivin, 2007; Sondergaard &

Halekoh, 2003; Zucca, Minero, Grignani & Canali, 2007) there is no data on how characteristics of horses and humans might be implicated in their interactions and working relationships. This study is an attempt to look specifically at horse behaviour and its relationship to rider anxiety. The first challenge was to develop an indicator of specific horse behaviours that have been noted as evidence of horse reactivity, as opposed to horse temperament, which was reported on in Chapter 3.

This analysis is based on data from the dressage study to investigate whether occurrences of horse misbehaviour had any relationship with indicators of rider's anxiety, the working relationship between horse and rider, and the physiological synchronisation between horse and rider in terms of heart rate. Several findings in this analysis suggest support for the commonly held speculations regarding the horse-rider interactions, particularly rider anxiety.

To do this analysis first required the development of a methodology to observe and record particular horse behaviours (Hutson, 2002; Hutson & Haskell, 1997; Mills, 1998; Weeks, Crowell-Davis, Caudle, & Heusner, 2000; Wolff, Hausberger, & LeScolan, 1997). Based on research within equine domains, the study was able to show very good inter-observer reliability for a group of behaviours labelled misbehaviour; namely, head tossing, bucking, rearing, baulking, bolting, kicking up with hind legs and shying. Observation of a second horse behaviour, tail swishing, did not have such favourable reliability when assessed between the two observers. The agreement between the observers was only slightly better than chance for recording occurrences of tail swishing behaviour displayed by the horse. It is evident from inter-observer correlations of this study that it is difficult to construct a reliable measure of horse behaviours, despite attempts to conduct behavioural observations with trained observers. It is evident in the earlier literature review that not all research clearly assesses the reliability of the specific behaviour data reported by the investigators.

As a starting point, this analysis investigated the misbehaviour of the dressage horse in different environments. The data revealed that horse misbehaviour was consistent across the training and competition environments during a dressage test. This does not support the anecdotal belief that the horse's behaviour is altered by the novel stimuli and pressure in the competition environment. Furthermore, it is also contrary to the limited empirical equine behaviour research, which suggests that horse behaviours change when tested in novel environments away from a familiar setting (Lundin, 2005-6).

There are several possible reasons for these differences. Firstly, the experimental test sites in which horses are observed are very different from the competition environment. During these observation periods the horse is not in the company of other horses, they are rarely accompanied by a familiar handler and the novel stimuli are certain not to be familiar to the horse. The test environment is isolated from the general activities on most occasions, to reduce external influence on observations; in general most research investigating reactivity in horses attempts to exclude all stimuli except the stimuli being tested.

It would therefore seem that the findings from equine behavioural studies are not generalizable to practical novel settings in which riders experience their horses. Again this suggests the need for more applied research on horse-human interactions outside of controlled experimental conditions.

The analysis next explored possible relationships between horse misbehaviours, the working relationship and heart rate synchronisation variables. As predicted horse misbehaviour at competition showed limited significant negative correlations with the rider's and judge's ratings of the working relationship. This suggests that horse misbehaviours are considered by the rider and judge for assessing of the working relationship. This is supported further by the negative correlations between misbehaviours and team's performance scores in both the training and competition environments.

This demonstrates that displays of misbehaviour during a dressage test are responsible for some deductions of marks in the performance scores at dressage competitions. These findings show that the horse behaviour is a major factor within the working relationship and the success of the dressage team. This performance relationship supports the findings of Hutson and Haskell, (1997) and Hutson (2002). Understanding the impact of these misbehaviours on performance is important, as the dressage rider consistently attempts to address components of poor performance.

One of the most informative findings from this study is the positive association between the horse's misbehaviours and the rider's somatic anxiety. This confirms the speculations of Williams (1999), of the association between the horse's behaviour and the rider's mental state, although the research design here does not permit cause-effect conclusions. The depth of this horse-rider relationship is highlighted with the significant findings that horse misbehaviour in the training environment and in the competition environment each contribute significantly to the rider's somatic anxiety at competition. This further confirms the interactive nature of the horse and rider, but again does not address the direction of this association directly, whether an anxious rider or horse produces misbehaviour in the other. The discriminant analyses in this study suggest riders with low or high levels of cognitive and somatic anxiety can be discriminated on the basis of horse characteristics. Riders with low and high somatic anxiety could be classified on the basis of temperament, while riders with low and high cognitive anxiety can be classified on the basis of the horse's heart rate mean. This is the first study to demonstrate a relationship between horse and rider psychological and physiological variables. This ability to predict the rider's level of cognitive anxiety from the horse's heart rate mean and to identify a rider's level of somatic anxiety from the horse's temperament score demonstrates the complexities of the relationship between them during equestrian sports. These links between the horse and rider

as individuals and the team provide an exciting new basis for further investigation of the working relationship. It further confirms the speculation of anecdotal writing (Roberts, 1996; Roberts, 1987; Twelveponies, 1982; Williams, 1976, 1999) about the existence of these interactive relationships.

These findings suggest that current equestrian sports psychology research, which studies aspects of rider anxiety, would benefit from delineation of the impact of the horse on the rider, and the working relationship between them, rather than focussing only on the individual rider.

Chapter 5. General discussion and conclusion

This dissertation set out to investigate the working relationship between horse and rider during equestrian sport, and to identify behavioural, physiological and psychological factors of the individual horse and rider that may be related to it. This required the development of a conceptual and operational definition of the horse- rider relationship and the determination of factors which may be associated with it. Given the lack of previous empirical study in this area, the dissertation required the integration of expert opinion, anecdotal evidence and equine science research to develop the required methodologies. A significant contribution of this dissertation is to provide a foundation for empirical investigation into the horse-rider working relationship, the interactive associations between horse and rider heart rates during equestrian sport, horse temperament and rider anxiety, and reactive horse behaviour and rider anxiety. From within the sports of eventing competition and dressage competition, the research uncovers several interesting relationships between horse and rider variables, and differences between competition and training environments, which will prove valuable to equestrian sport psychologists. These specific findings and their implications for future research and sport psychology practice will be discussed next.

5.1 The working relationship between horse and rider

This dissertation introduces a new area of equine sports research with new methodologies to assess the working relationship between horse and rider. As stated earlier, the first step was to develop a measure that assesses the working relationship between horse and rider, and its stability across environments. These measures included a physiological indicator of synchronicity, and the rider's perception and an external observer's perception of the relationship during training and competition.

The only previous empirical research to investigate the relationship between horse and rider assessed the harmony of motion between the horse and rider (Largarde, Peham, Licka & Kelso, 2005; Peham, Licka, Kapaun & Scheidl, 2001; Peham, Licka, Schobesberger & Meschan, 2004). It identified a physiological synchronisation between them. The researcher for this dissertation sought a more practical and easily assessable physiological measure that could be used in a competition environment, without impeding either horse or rider. Correlation of horse and rider heart rate was chosen to test for physiological synchronisation. The heart rate synchronisation data demonstrated in both the eventing and dressage sports that the synchronisation measure is sensitive in its ability to detect differences between individual teams, and between training and competition environments. Some teams achieved high levels of heart rate synchronisation in the training environment, but lower levels of synchronisation in the competition environment, while other teams demonstrated the reverse effect. Therefore, when the heart rate synchronisation data is observed over the duration of the dressage test, it is evident that high heart rate synchronisations occur from the start of the dressage test in the training environment and diminish towards the end of the test (Appendix N, Table A.5). In the competition environment the reverse occurred, with little synchronisation at the start of the dressage tests and gradual synchronisation between horse and rider to high levels at the end of the dressage tests. Therefore, being able to identify levels of heart rate synchronisation between horse and rider is a major contribution to equestrian sport research.

To coincide with this physiological measure of synchronicity between horse and rider, a self report and observational method of assessing this relationship were used. As the empirical research has never investigated this field of research before, the researcher had to focus on published expert opinion and the anecdotal literature from several equestrian sports to obtain items for use in the development of this measure. It was apparent that such

publications only speculate on the relationship between horse and rider, with no report of empirical methods for assessing it. A critical analysis of published official standards of equestrian sport found that dressage is the only equestrian sport that actually formally evaluates the horse- rider relationship. The sport of dressage focuses on the harmonious relationship between horse and rider and outlines the essential dimensions of this relationship in a hand book for judges. Therefore, this dissertation used this handbook to design the items listed in the Working Relationship Inventory-Rider (WRI-R) to suit a rider's perspective.

The WRI-R was able to identify changes within the working relationship reported by eventing riders across environments. However, in the dressage environment riders did not report differences. This could indicate a lack of sensitivity of the measure for dressage, but given that it was created from dimensions identified by the sport; it is more likely that in this sport the working relationship is stable across training and competition.

The WRI-R was also supported by an observer's perspective of the working relationship. These observers were accredited A level dressage judges, who used their familiar dressage test sheets to score the working relationship between horse and rider. The measure covers all the items which were included on the WRI-R. Judge's evaluations coincided with the rider's evaluations and did not indicate differences in the working relationships between environments. However, comparison of the items used to assess the working relationship between horse and rider identified a relationship between the judge's perceptions of working relationship in the competition environment, and the heart rate synchronisation between horse and rider. However, no associations were found between the rider's perceptions of the working relationship, the judge's perceptions of the working relationship or heart rate synchronisation.

This leads to concerns about the construct validity of the working relationship inventories; in other words, are these inventories measuring the working relationship that is

under investigation here? The data are inconclusive as there is limited evidence of latent or underlying constructs linking relationships between indicators of this working relationship. However, there are a couple of considerations with regard to this finding.

It would be expected that dressage riders would be more aware of their working relationship with their horse, as it is a component of their competition requirements, and it would be assumed that they would spend time training their horse to produce a more harmonious relationship. However, the dressage riders in this study perceived their working relationship did not change across environments.

An alternative view is that the eventing riders, whose performance is assessed on the basis of clearing a fence, would be aware of the critical subjective elements concerning their working relationship. Perhaps this safety concern is more salient, making awareness of their working relationship a prerequisite for survival on the course. It is evident from the unequivocal findings of the two studies, that more research is needed to determine the stability of the horse-rider relationship, from experiences of training together, to experiences while competing together.

5.2 Horse and rider factors and their association with the working relationship

Research has considered horse and human interaction in husbandry and training management situations; however, this dissertation is the first empirical research in a sports context where characteristics of horses and humans are considered. The interaction required for a successful horse- rider team in equine sport is intensive and extensive. In this interaction, horse behaviour is influenced by how the rider perceives their relationship with the horse (Mills & McNicholas, 2005). Thus, whether the rider perceives the horse as a pet, a vehicle of work, a companion or even a family member, it influences rider behaviour and hence the way they conduct their training practices. Researchers have shown that the impact

of riders' behaviour and associated behaviour on the horse's subsequent behaviour is not consistent, and that it varies between breeds and within breeds (Hausberger & Richard-Yris, 2005; Visser et al., 2001; Visser et al., 2002). Research indicates that training management and environmental conditions of the individual sport horse impact on their behaviour and their success during training and competition (Kiley-Worthington, 1987; Mills & Clarke, 2002; Zeeb & Schnitzer, 1997). This dissertation now considers the factors of horse temperament, misbehaviour, and heart rate and rider anxiety and heart rate, and their association with the working relationship.

The horse's temperament is of major concern to the rider when selecting a competition horse (Buckley, Dunn & More, 2004) and, as stated earlier, how the rider views their horse's temperament is associated with how they interact with the horse. The dissertation consulted the equine science literature (Table 1.1) to design a measure that identifies the temperament traits of the horse, is simply constructed and user friendly in a competition environment, and gives a numerical score for statistical comparisons with the working relationship and rider factors. This Horse Temperament Inventory drew items from the literature to identify a rider's and observer's perception of the horse's temperament. This inventory was then able to give a score to the horse's temperament. It was able to demonstrate that the horse's temperament score was stable across environments, thus, confirming that the Horse Temperament Inventory is identifying temperament traits.

The horse's temperament score did have positive associations with the rider's perception of the working relationship. Therefore, this demonstrates that a rider's perception of their horse is associated with how they are interacting with each other at competition. To support the temperament inventory, the horse's heart rate was examined using Polar 610s coded monitors. These monitors were successful at collecting data in the eventing study. However, in the dressage study, riders tended to ignore requests from the experimenter and

checked their girths prior to entry to the dressage arena. This routine interrupted the monitors on the horses and important data were lost. However, the horse's mean heart rate and range of heart rate did not change under environmental conditions.

While it was anticipated that the horse's heart rate and temperament would be related, no such relationship was identified. However, both measures display the same parallel patterns across environments. Therefore, it can be concluded that while the horse's temperament inventory is identifying psychological traits of the horse, there is nonetheless no conclusive support that this stability parallels the horse's heart rate.

As described earlier in the dissertation, while the horse has a stable temperament, it is still a reactive animal. Williams (1999) speculates that horses may display reactive behaviours in response to riders' psychological states. If a rider ignores the horse's responsive behaviour, some horses will increase their hyper-reactivity and look to shy or bolt or display misbehaviours such as bucking or baulking (McGreevy, 2002).

This dissertation firstly examined the horse's reactive behaviour in an attempt to replicate Hutson and Haskell's, (1997) and Hutson's (2002) findings that were evident in the eventing study. However, the research in this dissertation did not replicate their findings, as it was evident that the single occurrence of reactive behaviour on the behaviour check list before the cross-country course was insufficient to determine a performance relationship. Therefore, this method was modified to observe the occurrences of the tail swishing and misbehaviour of horses during a dressage test on two occasions in training and competition.

The inter-observer reliability of tail swishing behaviour was weak. However, the observation of the horse's misbehaviours displayed an excellent inter-observer reliability. However, there were no differences between environments for horse misbehaviour. This stability of reactive horse behaviour is not consistent with the literature, which suggests that horse's reactive behaviour changes in different environments (Mills 1998a). This difference

in findings may be due to the horses in this study being preoccupied with submitting to the tasks demanded by the rider (Brandt, 2004; McLean, 2003; McLean & McGreevy, 2004; Waring, 2003), rather than responding to environmental stimuli. However, this does not account for the associations that were identified between misbehaviour with both the rider's and judge's perception of the working relationship and heart rate synchronisation in the competition environment. This finding suggests horse misbehaviour has a detrimental effect on the working relationship. This negative association of horse misbehaviours on the working relationship extends to the dressage performance scores in both training and competition environments. These associations between horse misbehaviours and the working relationship, and performance, are suggesting a bi-directional interaction between horse and rider during the dressage test at competition.

As suggested earlier, there was a significant relationship between riders' anxiety and the added problem of the misbehaviours of their horses. This is not surprising, given that a rider's state anxiety reflects an individual experience of a perceived threatening circumstance or to a perceived challenging event (Hoehn-Saric & McLeod, 2000; Raglin & Hanin, 2000). It is suggested in the state anxiety literature that worrying and having concerns regarding a specific event influences mental preparation and skills, because of the cognitive anxiety that is generated, whilst the physical sensations of arousal which are considered indicative of somatic anxiety affect the physical preparation and skills, by impeding the rider's ability to apply the physical communication aids to the horse (Reilly, 2000). Thus, it was expected that rider cognitive and somatic anxiety would be associated with the horse-rider working relationship. However, only the rider's somatic anxiety showed this relationship in particular in competition events. Some literature speculates that the cognitive processes required of a dressage rider may in fact inhibit responses in anxiety (Cumming & Harris, 2001), while the

somatic is more immediate and unconditioned, due to the direct physical contact with the horse that does not entail cognitive processes.

Therefore, having a methodology whereby the rider's experience of anxiety is assessed at training, to determine a noncompetition baseline, is important in preventing the assumption that the experience of anxiety is related only to the competition itself. Furthermore, knowing that the rider's emotion experience of anxiety changes across environments, and that their mood experience of this anxiety is stable across environments, helps to distinguish a profile of rider anxiety that does not presume all dimensions will parallel each other in their occurrence. The data here suggests this group of equestrians is reporting anxiety on the basis of perceived physiological arousal, which is attributed to the experiences taking place at the time of testing, in this case more related to riding in the competition arena than in the training arena.

The parallel patterns of results for cognitive anxiety and mood, and somatic anxiety and emotion are interesting. For example, the mental processing of concerns and worries associated with cognitive anxiety, and the mood experience of anxiety which is unfocused and has cognitive consequences, have the same patterns of no significant changes between environments in this study. This is different from somatic anxiety, which is the perceived physiological arousal, or experience of physical symptoms and which parallels the emotion experience of anxiety that is focused on specific events with behavioural consequences. This demonstrates that it is useful to investigate the cognitive and somatic components of anxiety with the emotion and mood experience of anxiety to appreciate the complexities of rider anxiety.

Relationships are also identified here between the rider's somatic anxiety and the horse's temperament and misbehaviour at competitions. This is a major finding as it suggests some support for the speculation regarding the bi-directional interactivity between horse and

rider during equestrian sport. It also lends some support to the anecdotal writings that the horse-rider relationship is about one's partnership and harmony with the horse.

As this study used the same scale as Fitzpatrick (2004), comparisons of levels of anxiety by dressage riders and show jumping riders at competition were able to be made. These comparisons are interesting in providing initial comparisons between equestrian sports. The dressage riders in this research reported higher levels of cognitive and somatic anxiety and less self-confidence in competition than the show jumping riders examined by Fitzpatrick (2004). A further comparison of the anxiety and self confidence reported by dressage riders in the training environment with the show jumping riders at a competition, showed dressage riders reported anxiety levels similar to or higher than show jumping riders at competition, but their levels of self-confidence were significantly higher at training. While it is assumed that dressage is less anxiety- provoking, given the perceived calmness of the sport compared to jumping horses over fences, this comparison suggests the observer and the psychologist should not make naive assumptions about the anxiety-provoking stimuli implicit in a sport.

Indeed, the associations and differences in anxiety found in this dissertation have two important aspects for consideration by sports psychologists working with equestrians. Firstly, it appears here that it is the physiological stimuli and emotion experience of the anxiety, rather than the cognitive processing that may be the most effective target of intervention to reduce anxiety. Appreciation must be had for the physical sensation of the horse's energy and misbehaviour, and how the rider can learn to react calmly to this physiological arousal to pre-empt their own unproductive arousal. Secondly, the bi-directional associations of somatic anxiety with the horse's misbehaviour and temperament suggests it would be productive for the psychologist to inquire about the rider's perceptions of their team-mate in terms of the degree of cooperation they can expect . This also needs to

be considered in training and competition environments, as an intervention practised in one venue may not be as effective in the other.

The rider's heart rate did not correlate with the rider's anxiety, but there were parallel increases between training and competition environments. This parallel pattern of somatic anxiety and rider heart rate does reflect that physiological contact with the horse can set up the context of the physiological reactivity to each other. This was also demonstrated by Hama, Yogo and Matsuyama (1996) who show that human attitude has an influence on their physiological response to stroking horses. They showed that people with a positive attitude have lower heart rates when interacting with horses and those with negative attitudes displayed higher heart rates. While horse heart rates increased with people with negative attitudes, they did not do so with people who had positive attitudes or who were familiar with horses. This suggests that the physiological expression of horse heart rate and their riders' psychological attitude or anxiety, or vice versa, may not be related directly, but could have some association in the response to the situation of events.

In conclusion, there is much expert opinion and expectation regarding rider-horse reactivity. This conjecture in the literature, until now, has had no empirical basis to draw links between horse and rider. This dissertation has contributed by taking anecdotal information and conducting empirical testing to demonstrate psychological and physiological associations between horses and riders in the sport of dressage. This dissertation shows that riders with high or low levels of cognitive anxiety can be classified from the horse's heart rate mean, and the riders with high or low levels of somatic anxiety can be classified from the horse's temperament scores.

5.3 Methodological considerations and limitations

To address the questions and hypotheses proposed in this dissertation, considerable challenges were met in terms of developing new measures and methods for psychological and physiological data, while integrating with industry standardised measures such as the CSAI-2.

This study demonstrated that heart rate is a suitable tool to monitor physiological changes of individual riders and horses, singly and together, across environments. As the coded Polar heart rate monitors are able to operate in close proximity to each other makes it an ideal instrument to identify physiological synchronisation between horse and rider. This allows researchers to draw inferences regarding the individual rider or horse, or investigate the physiological relationship between the two during equestrian sports.

The timing of this dissertation research resulted in interest to compare two versions of the CSAI-2, as the second revision was published during the data collection process. Analyses showed that only the subscale of somatic anxiety had consistent outcomes for the two measures. It is an empirical question as to whether this is an artefact of the scale when used with equestrians in particular, given that there were no outcomes of significance with the cognitive and self confidence subscales. However, it points to the importance of continuing psychometric analyses of the properties of the two versions, which was pre-empted here due to the low participant numbers.

Another major challenge to this research was the recruiting of equestrian teams. There are often unforseen developments in the sport being researched, such as described earlier in the dissertation in Study one. In addition, during Study Two the 12 month time restriction on the data collection period finished at the end of the competition session.

The issue of participant numbers may raise concerns that the limited data sets in the dissertation severely limit the findings. It is unfortunate that these numbers reduced the

ability to assess the psychometric properties of the working relationship and the horse temperament questionnaires. However, the number of participants enables some inferences to be drawn from the analyses, and this sample size is consistent with the numbers represented in other published equine research as described next.

The only previous research to investigate the relationship between horse and rider (Largarde, Peham, Licka & Kelso, 2005; Peham, Licka, Kapaun & Scheidl, 2001; Peham, Licka, Schobesberger & Meschan, 2004) used one to two riders who rode 20 to 21 horses to determine if a harmony of motion was evident between horse and rider. Their analysis resulted in conclusions regarding major differences in classes of riders, based on differences between one professional rider and one recreational rider with respect to the working relationship. In another study researchers tested the accuracy of heart rate monitors on horses, using a sample of six horses (Holopherne, Hodson & Rose, 1999) and on humans with a sample of 20 athletes (Laukkanen & Virtanen, 1998). Published research comparing heart rate and horse behaviour during transportation has used as few as seven horses (Waran & Cuddeford, 1995). To investigate aggressive behaviours in horses, 20 horses or fewer have been considered sufficient to analyse data from these observations (Weeks & Beck, 1996; Weeks, Crowell-Davis, Caudle & Heusner, 2000). When comparing behavioural data with either physiological or psychological data in horse and human research, the literature shows researchers have used as few as 24 participants (Christensen & Rundgren, 2008; Christensen, Zharkikh & Ladewig, 2008; Egloff, Wilhelm, Neubauer, Mauss & Gross, 2002; Lansade, Bertrand, Boivin & Bouissou, 2004). In published comparative psychology research, as few as two animals have been used to infer a significant finding. Hanggi (1999) acquired sufficient data from the observation of two horses to determine learning styles during a two choice discrimination task.

In heart rate studies of athletes small samples are also evident, such as the study investigating eight Taekwondo practitioners over four evening sessions (Bridge & Jones, 2004). These are but a few studies that demonstrate the sample size used for the methodology in this dissertation are acceptable.

In terms of published CSAI research, a sample with as few as 26 participants has been reported to assess effects of environment at one home and one away competition (Bray & Martin, 2003). A review of sports psychological research shows that researchers, such as Lane, Jackson and Terry (2005), have used as few as 25 athletes to determine if sport modality influences exercise-induced mood changes. Lane and Jarrett (2005) used 34 mature golfers to determine mood changes after playing a round of golf.

Therefore, it is argued on the basis of the above review of empirical literature that participant numbers here are sufficient to draw some inferences and conclusions in regard to the questions posed by this dissertation.

5.4 Future research directions

This dissertation has demonstrated that behavioural, physiological and psychological relationships exist between horse and rider in both training and competition environments. They suggest an exciting new direction for future equestrian sport research. The identification of this heart rate synchronisation between horse and rider during equestrian sport pose further questions, such as why some teams achieve heart rate synchronisation and others do not, whether heart rate synchronisation changes over time during a dressage test are related to physical exertion only, or are due to psychological factors of horse or rider or both, and whether heart rate synchronisation captures other aspects of the working relationship between horse and rider besides physical exertion.

Furthermore, knowledge of the working relationship promises to improve the depth and breadth of psychological support for equestrian sporting teams. The next step from this dissertation is to further assess the psychometric properties of the working relationship questionnaires and develop a valid and reliable inventory adaptable to different equestrian sport across repeated applications.

Further development is also required for the horse temperament inventories to determine the construct validity. Even though the data from the dressage study showed consistency across environments, this was not evident in the eventing study. The concept of having a single temperament score is valuable to permit comparisons with other psychological factors in equine science, and to give the industry a sound temperament scale to evaluate horses suitable for the different equestrian sporting disciplines.

This dissertation used behavioural, psychological and physiological factors to investigate the working relationship between horse and rider. The identification of the associations between some of these indicators demonstrates the importance of using more than one methodology to investigate horses and riders. Therefore, it is recommended that future researchers continue the triangulation of behavioural, psychological and physiological factors for a more comprehensive understanding of the workings between horse and rider within a sporting context.

A final aspect of this dissertation that requires further investigation is the inclusion of different environmental conditions. This dissertation reports significant differences and associations between training and competition environments; however, no attempt was made to determine what elements of these environments were related to these differences for horses and riders. More controlled research designs within these different environments would produce a greater depth of understanding of the changes that occur when rider and horse

move from their familiar everyday surroundings to competition grounds with many new stimuli with which to contend, in addition to the psychological competition pressures.

5.5 Conclusion

In conclusion, the dissertation has achieved the initial aims set out in developing methodologies for the field of equestrian sport psychology, and taking a first look at relationships between horses and riders that have been the subject of many expert publications and much anecdotal literature for decades. It has addressed the development and implementation of a methodology to assess the quality of working relationships between horse and rider in equestrian sport. Furthermore, this research is the first to demonstrate the utility of calculating heart rate synchronisation to assess the physiological relationship between horse and rider during equestrian sport. This proved to be useful in both the training and competition environments. It also reports on the design of an inventory to measure horse temperament, which was sensitive to indicate significant relationships with rider anxiety.

The findings demonstrate associations between horse temperament and heart rate and the rider's cognitive and somatic anxiety during equestrian sport. This was enhanced with the findings of the relationship between the horse's misbehaviour and the rider's somatic anxiety in both the training and competition environments. Associations between the rider's cognitive and somatic anxiety and horse temperament with the heart rate synchronisation were also identified. The new research directions prompted by this dissertation, challenge equine scientists and sports psychologists to collaborate to explore this unique working relationship between horse and human.

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Appendix A

Eventing research training questionnaire

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How you and your horse feel about training today

Part One

For our identification system, please insert your initials (in capitals) and the last two digits of the year in which you were born (e.g. TMB66) in these boxes.

This Questionnaire is part of an investigation into the psychological aspects of performance and safety during the cross country phase of eventing competitions. The information you provide will help us better understand the psychological challenges facing riders during eventing training and competitions.

This will help to improve information used in training and competition preparation in your sport.

We appreciate your participation
in this project!

USQ

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Getting to know you and your horse

First a few questions about the riding and competition career of you and the **HORSE YOU WILL BE RIDING** for this research project.

1. **Gender (tick one):** ☐ Male ☐ Female
2. **Your Age?** ☐☐ years
3. **No of years you have ridden?** ☐☐ years
4. **No of years you have competed in Eventing?** ☐☐ years
5. **Do you work with a (Please cross <u>as many</u> boxes as applicable):**
   ☐ Horse Trainer ☐ Riding Coach ☐ Sports Psychologist
6. **What is your (rider) training level (Please cross one box)**
   ☐ Introductory ☐ Novice
   ☐ Preliminary ☐ Intermediate
   ☐ Pre Novice ☐ Advanced
7. **At what levels are you competing this season (Please cross as <u>many boxes</u> as applicable).**
   ☐ Introductory ☐ Preliminary ☐ Pre Novice
   ☐ Novice ☐ Intermediate ☐ Advanced
8. **Horse's name?** _____
9. **Horse's age?** ☐☐
10. **Is he/she a (tick one):** ☐ Gelding ☐ Mare ☐ Stallion
11. **How long has <u>this horse</u> competed in eventing?** ☐☐ years – ☐☐ months
12. **How many years have <u>you</u> been competing <u>this</u> horse in eventing?** ☐☐ years
13. **Average number of competitions that you take part in per season <u>on this horse</u>?** ☐☐
14. **Horse's Training level (Please cross <u>one</u> box)**
    ☐ Introductory ☐ Preliminary ☐ Pre Novice
    ☐ Novice ☐ Intermediate ☐ Advanced

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SECTION 1 Some Questions About How You Are Feeling

Read each statement and then place a cross in the appropriate box to the right of the statement to indicate **HOW YOU FEEL RIGHT NOW**. There are no right or wrong answers. Do not spend too much time on any one statement, but choose the answer which describes how you feel **right now**.

Please cross one box for each statement.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. I am concerned about this training session	☐	☐	☐	☐	☐
2. I feel nervous	☐	☐	☐	☐	☐
3. I feel at ease	☐	☐	☐	☐	☐
4. I have self-doubts	☐	☐	☐	☐	☐
5. I feel jittery	☐	☐	☐	☐	☐
6. I feel comfortable	☐	☐	☐	☐	☐
7. I am concerned that I might not do as well in this session as I could	☐	☐	☐	☐	☐
8. My body feels tense	☐	☐	☐	☐	☐
9. I feel self-confident	☐	☐	☐	☐	☐
10. I am concerned about not performing well	☐	☐	☐	☐	☐
11. I feel tense in my stomach	☐	☐	☐	☐	☐
12. I feel secure	☐	☐	☐	☐	☐
13. I am concerned about stuffing up under pressure	☐	☐	☐	☐	☐
14. My body feels relaxed	☐	☐	☐	☐	☐
15. I am confident I can meet the challenge	☐	☐	☐	☐	☐
16. I'm concerned about performing badly	☐	☐	☐	☐	☐
17. My heart is racing	☐	☐	☐	☐	☐
18. I'm confident about performing well	☐	☐	☐	☐	☐
19. I'm concerned about reaching my goal for today	☐	☐	☐	☐	☐
20. I feel my stomach sinking	☐	☐	☐	☐	☐
21. I feel mentally relaxed	☐	☐	☐	☐	☐
22. I'm concerned that others will be disappointed with my performance	☐	☐	☐	☐	☐
23. My hands are clammy	☐	☐	☐	☐	☐
24. I'm confident because I mentally picture myself reaching my goal today	☐	☐	☐	☐	☐
25. I'm concerned I won't be able to concentrate	☐	☐	☐	☐	☐
26. My body feels tight	☐	☐	☐	☐	☐
27. I'm confident of coming through the pressure	☐	☐	☐	☐	☐

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Section 1 cont. A Few More Questions About How You Are Feeling

Below is a list of statements that may or may-not apply to you at the moment. Please indicate, by placing a cross in the appropriate box to the right of the statement, the degree to which each statement describes **Your Feelings Right Now**.

Please cross **one** box for each Statement.

	Not at all	Slightly	Moderately so	Very much so
1. I feel nervous when I think about this training session	☐	☐	☐	☐
2. At the moment I seem to be worried about a lot of things	☐	☐	☐	☐
3. I am worried that the pressure of this session will make me perform poorly	☐	☐	☐	☐
4. At the moment I keep remembering occasions when I failed to achieve my goals	☐	☐	☐	☐
5. I have doubts about achieving my goals	☐	☐	☐	☐
6. I am anxious at the moment, but not for any one particular reason	☐	☐	☐	☐
7. I feel apprehensive about this session	☐	☐	☐	☐
8. I believe some of my goals are unachievable at the moment	☐	☐	☐	☐
9. I feel anxious about not performing as well as I should in this session	☐	☐	☐	☐
10. At the moment I feel anxious about several unrelated things	☐	☐	☐	☐

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SECTION 2 Some Questions About Your Horse

Below is a list of words that could describe your horse's behaviour. Please read each one carefully. Then from your observations cross the box which best describes **This Horse Right Now**. Make sure you answer every question.

Please cross one box for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Affectionate	☐	☐	☐	☐	☐
2. Alert	☐	☐	☐	☐	☐
3. Anxious	☐	☐	☐	☐	☐
4. Bold	☐	☐	☐	☐	☐
5. Bad Tempered	☐	☐	☐	☐	☐
6. Confident	☐	☐	☐	☐	☐
7. Calm	☐	☐	☐	☐	☐
8. Enthusiastic	☐	☐	☐	☐	☐
9. Exhausted	☐	☐	☐	☐	☐
10. Excitable	☐	☐	☐	☐	☐
11. Fizzy	☐	☐	☐	☐	☐
12. Flighty	☐	☐	☐	☐	☐
13. Fighting	☐	☐	☐	☐	☐
14. Honest	☐	☐	☐	☐	☐
15. Hot	☐	☐	☐	☐	☐
16. Intelligent	☐	☐	☐	☐	☐
17. Laid Back	☐	☐	☐	☐	☐
18. Lazy	☐	☐	☐	☐	☐
19. Moody	☐	☐	☐	☐	☐
20. Nervous	☐	☐	☐	☐	☐
21. Obedient	☐	☐	☐	☐	☐
22. Relaxed	☐	☐	☐	☐	☐
23. Sensitive	☐	☐	☐	☐	☐
24. Sharp	☐	☐	☐	☐	☐
25. Willing	☐	☐	☐	☐	☐

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Section 2 cont. A Few More Questions About Your Horse

Below is a list of characteristics we sometimes use to describe our competition horse. Please tick the appropriate box to the right of the characteristic to indicate how your horse rates on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross one box for each statement.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Responding to the aids	☐	☐	☐	☐	☐
2. Engaging hindquarters	☐	☐	☐	☐	☐
3. Willing to go forward	☐	☐	☐	☐	☐
4. Working as part of a team	☐	☐	☐	☐	☐
5. Paying attention	☐	☐	☐	☐	☐
6. Feeling at ease	☐	☐	☐	☐	☐
7. "His personality" has changed from on the ground to under saddle	☐	☐	☐	☐	☐
8. Accepting the bit	☐	☐	☐	☐	☐
9. Is soft in hand	☐	☐	☐	☐	☐
10. Is making snappy transitions	☐	☐	☐	☐	☐
11. Has good rhythmn all gaits	☐	☐	☐	☐	☐
12. Is submitting to the work	☐	☐	☐	☐	☐
13. Working with impulsion	☐	☐	☐	☐	☐

Appendix B

Eventing research competition questionnaire

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How you and your horse feel about Competing today

Part Two

For our identification system, please insert your initials (in capitals) and the last two digits of the year in which you were born (e.g. TMB66) in these boxes.

This Questionnaire is part of an investigation into the psychological aspects of performance and safety during the cross country phase of eventing competitions. The information you provide will help us better understand the psychological challenges facing riders during eventing training and competitions.

This will help to improve information used in training and competition preparation in your sport.

We appreciate your participation
in this project!

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Please fill this in **AFTER** you have warmed-up your horse, and **BEFORE** you enter the start box for your cross-country phase. Please refer to the **SAME HORSE** throughout the questionnaire. Please complete the last section (Section 3) only **AFTER** you have ridden in the cross-country phase. The questionnaire will take approximately 7 minutes to complete.

1. **What Level are you competing today? (Please cross one box)**

☐ Introductory ☐ Novice
☐ Preliminary ☐ Intermediate
☐ Pre Novice ☐ Advanced

2. **How Important is your result in this cross country Phase ? (Please cross one box)**

☐ Of little importance ☐ Less than average importance ☐ Of average importance
☐ Above average importance ☐ Extremely important

3. **How well do you think you and horse will perform in todays competition (Please cross one box)**

☐ Greatly below our usual ☐ Be ow our usual ☐ As usual
☐ Better than Usual ☐ Greatly above our Usual

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SECTION 1 Some Questions About How You Are Feeling

Read each statement and then place a cross in the appropriate box to the right of the statement to indicate **HOW YOU FEEL RIGHT NOW**. There are no right or wrong answers. Do not spend too much time on any one statement, but choose the answer which describes how you feel **right now**.

Please cross <u>one</u> box for each statement.

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

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Section 1 cont. A Few More Questions About How You Are Feeling

Below is a list of statements that may or may-not apply to you at the moment. Please indicate, by placing a cross in the appropriate box to the right of the statement, the degree to which each statement describes **Your Feelings Right Now**.

Please cross **one** box for each Statement.

	Not at all	Slightly	Moderately so	Very much so
1. I feel nervous when I think about this competition	☐	☐	☐	☐
2. At the moment I seem to be worried about a lot of things	☐	☐	☐	☐
3. I am worried that the pressure of this competition will make me perform poorly	☐	☐	☐	☐
4. At the moment I keep remembering occasions when I failed to achieve my goals	☐	☐	☐	☐
5. I have doubts about achieving my goals	☐	☐	☐	☐
6. I am anxious at the moment, but not for any one particular reason	☐	☐	☐	☐
7. I feel apprehensive about this competition	☐	☐	☐	☐
8. I believe some of my goals are unachievable at the moment	☐	☐	☐	☐
9. I feel anxious about not performing as well as I should in this competition	☐	☐	☐	☐
10. At the moment I feel anxious about several unrelated things	☐	☐	☐	☐

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SECTION 2 Some Questions About Your Horse

Below is a list of words that could describe your horse's behaviour. Please read each one carefully. Then from your observations cross the box, which best describes **This Horse Right Now**. Make sure you answer every question.

Please cross one box for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Affectionate	☐	☐	☐	☐	☐
2. Alert	☐	☐	☐	☐	☐
3. Anxious	☐	☐	☐	☐	☐
4. Bold	☐	☐	☐	☐	☐
5. Bad Tempered	☐	☐	☐	☐	☐
6. Confident	☐	☐	☐	☐	☐
7. Calm	☐	☐	☐	☐	☐
8. Enthusiastic	☐	☐	☐	☐	☐
9. Exhausted	☐	☐	☐	☐	☐
10. Excitable	☐	☐	☐	☐	☐
11. Fizzy	☐	☐	☐	☐	☐
12. Flighty	☐	☐	☐	☐	☐
13. Fighting	☐	☐	☐	☐	☐
14. Honest	☐	☐	☐	☐	☐
15. Hot	☐	☐	☐	☐	☐
16. Intelligent	☐	☐	☐	☐	☐
17. Laid Back	☐	☐	☐	☐	☐
18. Lazy	☐	☐	☐	☐	☐
19. Moody	☐	☐	☐	☐	☐
20. Nervous	☐	☐	☐	☐	☐
21. Obedient	☐	☐	☐	☐	☐
22. Relaxed	☐	☐	☐	☐	☐
23. Sensitive	☐	☐	☐	☐	☐
24. Sharp	☐	☐	☐	☐	☐
25. Willing	☐	☐	☐	☐	☐

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Section 2 cont. A Few More Questions About Your Horse

Below is a list of characteristics we sometimes use to describe our competition horse. Please tick the appropriate box to the right of the characteristic to indicate how your horse rates on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross one box for each statement.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Responding to the aids	☐	☐	☐	☐	☐
2. Engaging hindquarters	☐	☐	☐	☐	☐
3. Willing to go forward	☐	☐	☐	☐	☐
4. Working as part of a team	☐	☐	☐	☐	☐
5. Paying attention	☐	☐	☐	☐	☐
6. Feeling at ease	☐	☐	☐	☐	☐
7. "His personality" has changed from on the ground to under saddle	☐	☐	☐	☐	☐
8. Accepting the bit	☐	☐	☐	☐	☐
9. Is soft in hand	☐	☐	☐	☐	☐
10. Is making snappy transitions	☐	☐	☐	☐	☐
11. Has good rhythmn all gaits	☐	☐	☐	☐	☐
12. Is submitting to the work	☐	☐	☐	☐	☐
13. Working with impulsion	☐	☐	☐	☐	☐

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DO NOT COMPLETE UNTIL AFTER THE CROSS-COUNTRY PHASE

1. **How well do think you went in today's Cross- country Phase ? (Please cross one box)**

☐ Greatly below expectation ☐ Below expectation ☐ As expected

☐ Above expectation ☐ Greatly above Expectation

2. **How well do think this horse went in todays cross country Phase ? (Please cross one box)**

☐ Greatly below expectation ☐ Below Expectation ☐ As Expected

☐ Above expectation ☐ Greatly above expectation

3. **Course Time** _____

4. **Number of Penalties** _____

5. **If you were unable to complete the course, please cross the appropriate box below that explains why.**

☐ Error of course ☐ Horse or rider fell ☐ Disqualified due to dangerous riding

☐ Your own choice ☐ 3 Refusals at the same fence

☐ Other reason _____

Thank you for time and Patience

Appendix C

Eventing research training questionnaire

0481510795 9999

How the horse and rider are behaving during training today

Part One

For our identification system, please insert the initials (in capitals) of rider and the last two digits of the year in which they were born (e.g. TMB66) in these boxes.

This Behaviour observation sheet is part of an investigation into the relationship of Anxiety in the Equestrian team and performance and safety during the cross country phase of eventing competitions. The information you provide will help us better understand the performance issues affecting horse and rider during eventing.

We appreciate your participation in this project!

USQ

AUSTRALIA

5507510799 9999

Behaviour of horse without rider

Below is a list of words that could describe a horse's behaviour. Please read each one carefully. Then from your observations cross the box, which best describes This Horse **Right Now**. Make sure you answer every question.

Please cross **one box** for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Alert	☐	☐	☐	☐	☐
2. Anxious	☐	☐	☐	☐	☐
3. Calm	☐	☐	☐	☐	☐
4. Excitable	☐	☐	☐	☐	☐
5. Fizzy	☐	☐	☐	☐	☐
6. Flighty	☐	☐	☐	☐	☐
7. Fighting	☐	☐	☐	☐	☐
8. Nervous	☐	☐	☐	☐	☐
9. Relaxed	☐	☐	☐	☐	☐

7067510792 9999

Below is a list of characteristics of body language or behaviours we sometimes use to assess our competition horse's mental attention. Please tick the appropriate box to the right of the characteristic to indicate how you rate the horse on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross **one box** for each statement.

1. Ear Position

Foward	Middle	Back	Side ways
☐	☐	☐	☐

2. Head Position

Up	Normal	Down	Star gazing
☐	☐	☐	☐

3. Nose Position

Foward	Vertical	Towards chest
☐	☐	☐

4. Mouth

☐ Open	☐ Closed normally	☐ Clenched shut
☐ Teeth beared	☐ Top lip curled	☐ Tight bottom lip

5. Mouth Moisture

Not at all	Wet	Foaming	Excessive Frothing
☐	☐	☐	☐

6. Eye Blinking

Not at all	Occasionally	Frequently
☐	☐	☐

1402510799 9999

Characteristics of body language or behaviours Cont.

9. Standing

Quitely & Dozing ☐ Looking around ☐ Fidgeting ☐

8. Sweating

Normally ☐ Abnormally ☐ Not sweating ☐

9. Pawing

Yes ☐ No ☐

6. Tail Position

☐ Up ☐ Normal ☐ Down

☐ Tight between legs ☐ Bent in any direction ☐ Swishing

11. Defecating

No ☐ Normal ☐ Sloppy ☐ Frequently ☐ Fequently and sloppy ☐

12. Vocalising

Yes ☐ No ☐

3096510790 9999

Behaviour of horse under saddle with rider

Below is a list of words that could describe a horse's behaviour. Please read each one carefully. Then from your observations cross the box, which best describes This Horse **Right Now**. Make sure you answer every question.

Please cross **one box** for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Alert	☐	☐	☐	☐	☐
2. Anxious	☐	☐	☐	☐	☐
3. Calm	☐	☐	☐	☐	☐
4. Excitable	☐	☐	☐	☐	☐
5. Fizzy	☐	☐	☐	☐	☐
6. Flighty	☐	☐	☐	☐	☐
7. Fighting	☐	☐	☐	☐	☐
8. Nervous	☐	☐	☐	☐	☐
9. Relaxed	☐	☐	☐	☐	☐
10. Accepting the bit	☐	☐	☐	☐	☐
11. Engaging hind quarters	☐	☐	☐	☐	☐
12. Willing to go forward	☐	☐	☐	☐	☐
13. Working as part of a team	☐	☐	☐	☐	☐
14. Paying attention	☐	☐	☐	☐	☐
15. Fighting rider	☐	☐	☐	☐	☐
16. Is submitting to the work	☐	☐	☐	☐	☐
17. Has good rhythm in all gaits	☐	☐	☐	☐	☐
18. Working with impulsion	☐	☐	☐	☐	☐
19. Working with rider	☐	☐	☐	☐	☐

6760510791 9999

Below is a list of characteristics of body language or behaviours we sometimes use to assess our competition horse mental attention. Please tick the appropriate box to the right of the characteristic to indicate how you rate the horse on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross **one box** for each statement.

1. Ear Position

Foward	Middle	Back	Side ways
☐	☐	☐	☐

2. Head Position

Up	Normal	Down	Star gazing
☐	☐	☐	☐

3. Nose Position

Foward	Vertical	Towards chest
☐	☐	☐

4. Mouth

☐ Open	☐ C osed normally	☐ Clenched shut
☐ Teeth beared	☐ Top lip curled	☐ Tight bottom lip

5. Mouth Moisture

Not at all	Wet	Foaming	Excessive Frothing
☐	☐	☐	☐

6. Eye Blinking

Not at all	Occasionally	Frequently
☐	☐	☐

5227510798 9999

Characteristics of body language or behaviours Cont.

9. Standing

Quitely & Dozing ☐ Looking around ☐ Fidgeting ☐

8. Sweating

Normally ☐ Abnormally ☐ Not sweating ☐

9. Pawing

Yes ☐ No ☐

6. Tail Position

☐ Up ☐ Normal ☐ Down

☐ Tight between legs ☐ Bert in any direction ☐ Swishing

11. Defecating

No ☐ Normal ☐ Sloppy ☐ Frequently ☐ Fequently and sloppy ☐

12. Vocalising

Yes ☐ No ☐

Appendix D

Eventing research competition questionnaire

9837318997 9999

How the horse and rider are behaving at today's Competition

Part Two

For our lentification system, please insert the initials (in capitals) of rider and the last two digits of the year in which they were born (e.g. TMB66) in these boxes.

This Behaviour observation sheet is part of an investigation into the relationship of Anxiety in the Equestrian team and performance and safety during the cross country phase of eventing competitions. The information you provide will help us better understand the performance issues affecting horse and rider during eventing.

We appreciate your participation
in this project!

USQ

AUSTRALIA

7610318994 9999

Behaviour of horse without rider

Below is a list of words that could describe a horse's behaviour. Please read each one carefully. Then from your observations cross the box, which best describes This Horse **Right Now**. Make sure you answer every question.

Please cross **one box** for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Alert	☐	☐	☐	☐	☐
2. Anxious	☐	☐	☐	☐	☐
3. Calm	☐	☐	☐	☐	☐
4. Excitable	☐	☐	☐	☐	☐
5. Fizzy	☐	☐	☐	☐	☐
6. Flighty	☐	☐	☐	☐	☐
7. Fighting	☐	☐	☐	☐	☐
8. Nervous	☐	☐	☐	☐	☐
9. Relaxed	☐	☐	☐	☐	☐

1269318998 9999

Below is a list of characteristics of body language or behaviours we sometimes use to assess our competition horse mental attention. Please tick the appropriate box to the right of the characteristic to indicate how you rate the horse on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross **one box** for each statement.

1. Ear Position

Foward	Middle	Back	Side ways
☐	☐	☐	☐

2. Head Position

Up	Normal	Down	Star gazing
☐	☐	☐	☐

3. Nose Position

Foward	Vertical	Towards chest
☐	☐	☐

4. Mouth

☐ Open	☐ Closed normally	☐ Clenched shut
☐ Teeth beared	☐ Top lip curled	☐ Tight bottom lip

5. Mouth Moisture

Not at all	Wet	Foaming	Excess ve Frothing
☐	☐	☐	☐

6. Eye Blinking

Not at all	Occasionally	Frequently
☐	☐	☐

7362318998 9999

Characteristics of body language or behaviours Cont.

9. Standing

Quitely & Dozing ☐ Looking around ☐ Fidgeting ☐

8. Sweating

Normally ☐ Abnormally ☐ Not sweating ☐

9. Pawing

Yes ☐ No ☐

6. Tail Position

☐ Up ☐ Normal ☐ Down

☐ Tight between legs ☐ Bent in any direction ☐ Swishing

11. Defecating

No ☐ Normal ☐ Sloppy ☐ Frequently ☐ Fequently and sloppy ☐

12. Vocalising

Yes ☐ No ☐

7485318994 9999

Behaviour of horse under saddle with rider

Below is a list of words that could describe a horse's behaviour. Please read each one carefully. Then from your observations cross the box, which best describes This Horse **Right Now**. Make sure you answer every question.

Please cross **one box** for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Alert	☐	☐	☐	☐	☐
2. Anxious	☐	☐	☐	☐	☐
3. Calm	☐	☐	☐	☐	☐
4. Excitable	☐	☐	☐	☐	☐
5. Fizzy	☐	☐	☐	☐	☐
6. Flighty	☐	☐	☐	☐	☐
7. Fighting	☐	☐	☐	☐	☐
8. Nervous	☐	☐	☐	☐	☐
9. Relaxed	☐	☐	☐	☐	☐
10. Accepting the bit	☐	☐	☐	☐	☐
11. Engaging hind quarters	☐	☐	☐	☐	☐
12. Willing to go forward	☐	☐	☐	☐	☐
13. Working as part of a team	☐	☐	☐	☐	☐
14. Paying attention	☐	☐	☐	☐	☐
15. Fighting rider	☐	☐	☐	☐	☐
16. Is submitting to the work	☐	☐	☐	☐	☐
17. Has good rhythm in all gaits	☐	☐	☐	☐	☐
18. Working with impulsion	☐	☐	☐	☐	☐
19. Working with rider	☐	☐	☐	☐	☐

4982318993 9999

Below is a list of characteristics of body language or behaviours we sometimes use to assess our competition horse mental attention. Please tick the appropriate box to the right of the characteristic to indicate how you rate the horse on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross **one box** for each statement.

1. Ear Position

Foward	Middle	Back	Side ways
☐	☐	☐	☐

2. Head Position

Up	Normal	Down	Star gazing
☐	☐	☐	☐

3. Nose Position

Foward	Vertical	Towards ches:
☐	☐	☐

4. Mouth

☐ Open	☐ Closed normally	☐ Clenched shut
☐ Teeth beared	☐ Top lip curled	☐ Tight bottom lip

5. Mouth Moisture

Not at all	Wet	Foaming	Excessive Frothing
☐	☐	☐	☐

6. Eye Blinking

Not at all	Occasionally	Frequently
☐	☐	☐

7139318990 9999

Characteristics of body language or behaviours Cont.

9. Standing

Quitely & Dozing	Looking around	Fidgeting
☐	☐	☐

8. Sweating

Normally	Abnormally	Not sweating
☐	☐	☐

9. Pawing

Yes	No
☐	☐

6. Tail Position

Up	Normal	Down
☐	☐	☐
Tight between legs	Bent in any direction	Swishing
☐	☐	☐

11. Defecating

No	Normal	Sloppy	Frequently	Fecuently and sloppy
☐	☐	☐	☐	☐

12. Vocalising

Yes	No
☐	☐

Appendix E

Animal ethics approval letter

USQ
AUSTRALIA

The University of Southern Queensland

TOOWOOMBA QUEENSLAND 4350
AUSTRALIA
TELEPHONE (07) 4631 2100
www.usq.edu.au

Office of Research and Higher Degrees

Postgraduate & Ethics Officer
Telephone: 07 46 312956
Facsimile: 07 46 312955
Email: bartletc@usq.edu.au

17 September 2002

Mr Donald Bridgeman
11 Moroney Road MS 437
GATTON QLD 4343

Dear Mr Bridgeman

Re: Ethics Clearance for Use of Animals in Research Project: *Anxiety in the equestrian team and its relationship to risk management during eventing competitions*

The USQ Animal Ethics Committee recently considered your application for ethics clearance for the above research project. I am pleased to advise that the Committee has approved your application for ethics clearance for the above research project.

Please note that reference number **02STU165** has been assigned to this approval.

May I remind you of details included in the *Guidelines for the Preparation of Applications for Ethics Clearance.*

- Subsequent to ethics approval by the Committee, an applicant must provide written advice to the Committee should there be any variation to the procedures. In particular, the Committee must be advised immediately of the revision of any techniques.
- A progress report is required for all research applications that receive ethics approval. Please provide details on the attached form when your project is completed **OR** twelve months from the date of ethics approval.
- The Committee reserves the right to undertake spot checks at any time to ensure compliance with ethics approvals. Non-compliance may result in the withdrawal of approval.

Yours sincerely
C. Bartlett.
Christine Bartlett
Postgraduate & Ethics Officer
Office of Research and Higher Degrees

Appendix F

Human ethics approval letter

USQ
AUSTRALIA

The University of Southern Queensland

TOOWOOMBA QUEENSLAND 4350
AUSTRALIA
TELEPHONE (07) 4631 2100
www.usq.edu.au

The Office of Research and Higher Degrees

Postgraduate and Ethics Officer
Telephone: 0746 312956
Facsimile: 0746 312955
Email: bartletc@usq.edu.au

16 September 2002

Mr Donald Bridgeman
11 Moroney Road MS 437
GATTON QLD 4343

Dear Mr Bridgeman

Re: Ethics Clearance for Research Project, *Anxiety in the equestrian team and its relationship to risk management during eventing competitions*

The USQ Human Research Ethics Committee recently reviewed your application for ethics clearance. Your project has been endorsed and full ethics approval is now confirmed. Reference number **H02STU227** has been assigned to this approval.

The Committee is required to monitor research projects that have received ethics clearance to ensure their conduct is not jeopardising the rights and interests of those who agreed to participate. Accordingly, you are asked to forward a **written report** to this office after twelve months from the date of this approval or upon completion of the project.

A questionnaire will be sent to you requesting details that will include: the status of the project; a statement from you as principal investigator, that the project is in compliance with any special conditions stated as a condition of ethical approval; and confirming the security of the data collected and the conditions governing access to the data. The questionnaire, available on the web, can be forwarded with your written report.

Participants in your project should be advised that, if they have a concern regarding the implementation of the project, they should contact The Secretary, Human Research Ethics Committee USQ or telephone (07)4631 2956. Please note that you are responsible for notifying the Committee immediately of any matter that might affect the continued ethical acceptability of the proposed procedure.

Yours sincerely

Christine Bartlett
Postgraduate and Ethics Officer
Office of Research and Higher Degrees

Appendix G

Consent form to participate in the eventing research

UNIVERSITY OF SOUTHERN QUEENSLAND
CONSENT to PARTICIPATE IN RESEARCH FORM

I have read the information provided and I understand that the purpose of this study is to explore anxiety in equestrian sports. I agree to take part in the study into anxiety in the equestrian team during an eventing competition. I understand that this consent form will be detached from the rest of the questionnaire, so that my name is not attached to the questions.

Please tick the box to indicate you have read the points to the right each box and understand the role you will undertake in this study.

❑ I will be asked to respond to questions regarding my emotions and mood before and during the cross country phase of an eventing competition.

❑ I will be accompanied by the researcher and interviewed regarding my strategy for each obstacle while I walk the cross country course prior to competition.

❑ I understand that both my **horse and I** will be observed and videotaped before (in my usual training area), during, and after an eventing competition

❑ I understand that my **horse and I** will be fitted with heart rate monitors before training and competing in an eventing competitions.

❑ I understand that I will be fitted with a radio microphone before competing in an eventing competition.

❑ I understand that any information I give will not be identified with me personally and that my ID and responses are kept in a coded format as to maintain confidentiality.

❑ I understand that my participation is completely voluntary and that I may withdraw at any time with no questions asked.

❑ I understand that the results of this research will be published in group format in a thesis and scientific journals.

I declare that I am at least 18 years of age, and I hereby give my consent to participate in this study.

Signature:……..……. Date:……

In order to thank you for your participation, we would like to give you the opportunity to enter into a draw for cash prizes ranging from $20 to $200. These prizes are drawn at the end of each semester, and entrants include those who have participated in psychological research during semester.

Would you like to be included in the draw for cash prizes? Yes / No
(Please circle)

Would you like to receive a copy of the results of this study? Yes / No
(Please circle)

If you answered <u>YES</u> to any of the questions above, please write your name, address, and phone number in the space below. If you answered <u>NO</u> to these questions, please leave the following details blank. (Again remember that this consent form will be kept separate from your questionnaire so that you cannot be identified).

PLEASE USE BLOCK LETTERS:

Name: ……..

Address: ……..
……..
……..

Phone: ……..

Appendix H

Extra tables for for Study 1

Table A.1: The working relationship scores and heart rate synchronisation values for each eventing team

	Team 1		Team 2		Team 3		Team 4		Team 5	
	T	C	T	C	T	C	T	C	T	C
Rider perception	41	34	45	50	49	56	32	43	42	45
Observer 1 perception	37	36	28	25	35	34	-	-	27	26
Observer 2 perception	-	31	26	27	31	34	-	30	-	-
Heart rate Synchronisation	0.91	0.92	0.45	0.74	-0.37	0.30	0.92	0.95	0.67	0.82

T = training environment; C = competition environment

Table A.2: Anxiety and heart rate variables for riders

Source	Team 1		Team 2		Team 3		Team 4		Team 5	
CSAI- 2 original subscales	T	C	T	C	T	C	T	C	T	C
Cognitive anxiety	14	23	15	17	32	15	20	27	12	11
Somatic anxiety	10	28	11	19	21	12	17	31	12	21
Self confidence	31	21	35	30	37	42	30	27	35	33
CSAI-2 revised subscales										
Cognitive anxiety	10	14	10	14	21	9	9	17	8	5
Somatic anxiety	7	20	8	15	19	8	12	23	8	15
Self confidence	17	14	23	16	18	25	17	18	19	21
EMCA-Q										
Emotion	5	10	5	15	9	5	10	11	5	7
Mood	6	11	11	9	10	5	7	9	5	7
Heart rate										
Maximum	159	192	133	181	226	214	135	174	157	188
Minimum	101	110	81	122	72	85	87	103	99	62
Mean	129.5	165.6	95.8	95.8	125.1	168.9	107.7	149.8	125.9	153.5
Standard deviation	18.2	26.9	11.7	18.4	28.8	27.5	12.8	20.3	17.0	27.1

T = training environment; C = competition environment

Table A.3: The temperament scores and heart rate variables for each team's horse

	Team 1		Team 2		Team 3		Team 4		Team 5	
Horse Temperament	T	C	T	C	T	C	T	C	T	C
Rider	84	89	102	85	92	113	85	95	92	99
Observer 1 without rider	41	39	38	41	41	33	42	38	41	35
Observer 1 with rider	43	41	33	38	37	40	-	41	37	34
Observer 2 without rider	-	43	37	43	41	36	-	39	-	39
Observer 2 with rider	-	41	27	-	34	38	-	35	-	35
Max Heart rate	140	214	160	133	233	210	126	206	157	194
Min Heart rate	47	114	71	81	72	78	52	45	60	74
Heart rate mean	79.7	166.9	94.8	95.8	125.1	155.0	76.7	141.0	103.7	135.8
Heart rate std	33.8	26.6	22.9	11.7	28.8	45.6	22.8	43.9	34.7	40.6

T = training environment; C = competition environment

Table A4: Behaviours of horses

Behaviours \Team	PTY				CSW			
	Observer 1		Observer 2		Observer 1		Observer 2	
	T	C	T	C	T	C	T	C
Without rider								
Ear Position	Foward	Middle	-	Forward	Back	Forward	Middle	Back
Head Position	Normal	Normal	-	Normal	Normal	Up	Normal	Normal
Nose Position	Forward	Vertical	-	Forward	Forward	Forward	Forward	Forward
Mouth Position	Closed	Closed	-	Closed	Closed	Closed	Closed	Closed
Mouth moisture	No	No	-	No	No	No	No	Wet
Eye blinking	Occasionally	Occasionally	-	Occasionally	Occasionally	Occasionally	Occasionally	Occasionally
Standing	Looking around	Looking around	-	Looking around	Fidgeting	Fidgeting	Looking around	Looking around
Sweating	No	Normally	-	No	No	No	No	Normally
Pawing	No	No	-	No	No	No	No	No
Tail Position	Normal	Normal	-	No	Normal	Swishing	Normal	Swishing
Defacating	No	Sloppy	-	No	Normal	No	No	No
Vocallising	No	No	-	No	No	No	No	No
With rider								
Ear Position	-	Forward	-	Middle	Middle	Middle	Forward	Middle
Head Position	-	Normal	-	Normal	Normal	Down	Normal	Normal
Nose Position	-	Forward	-	Vertical	Vertical	Forward	Vertical	Vertical
Mouth Position	-	Closed	-	Closed	Closed	Closed	Closed	Closed
Mouth moisture	-	Wet	-	Wet	No	No	Wet	Wet
Eye blinking	-	Occasionally	-	Occasionally	Occasionally	Occasionally	Occasionally	Occasionally
Standing	Quietly & dozing	Looking around	-	Looking around	-	Quietly	-	Looking around
Sweating	Normally	Normally	-	No	No	Normally	Normally	Normally
Pawing	No	No	-	No	No	No	No	No
Tail Position	Normal	Normal	-	Normal	Normal	Normal	Normal	Normal
Defecating	No	No	-	No	No	No	No	No
Vocalising	No	No	-	No	No	No	No	No

Table A.4: Cont.

Behaviours \Team	JBG				PTZ			
	Observer 1		Observer 2		Observer 1		Observer 2	
	T	C	T	C	T	C	T	C
Without rider								
Ear Position	Middle	Forward	Foward	Forward	Middle	Middle	-	Middle
Head Position	Normal	Normal	Up	Normal	Normal	Normal	-	Down
Nose Position	Foward	Forward	Forward	Forward	Vertical	Forward	-	Forward
Mouth Position	Closed	Closed	Closed	Closed	Closed	Closed	-	Closed
Mouth moisture	No	No	No	No	Wet	No	-	No
Eye blinking	Occasionally	Occasionally	-	Occasionally	Occasionally	Occasionally	-	Frequently
Standing	Fidgeting	Looking around	Looking around	Quitely	Quitely	Looking around	-	Looking around
Sweating	No	No	No	No	No	No	-	No
Pawing	Yes	No	No	No	No	No	-	No
Tail Position	Down	Normal	Down	Normal	Normal	Swishing	-	Swishing
Defecating	No	No	No	No	No	No	-	Sloppy
Vocalising	No	No	No	No	No	No	-	No
With rider								
Ear Position	Forward	Middle	Forward	Middle	Middle	Middle	-	Forward
Head Position	Up	Up	Up	Normal	Normal	Normal	-	Up
Nose Position	Forward	Foward	Forward	Forward	Forward	Forward	-	Forward
Mouth Position	Closed	Closed	Closed	Closed	Closed	Closed	-	Closed
Mouth moisture	Wet	Wet	No	No	Wet	No	-	Wet
Eye blinking	Occasionally	Occasionally	Occasionally	No	Occasionally	Occasionally	-	Frequently
Standing	-	-	Looking around	Quietly	Quietly	Looking around	-	Looking around
Sweating	Normally	Normal	No	No	No	No	-	Normallly
Pawing	No	No	No	No	No	No	-	No
Tail Position	Normal	Normal	Normal	Normal	Normal	Swishing	-	Up
Defecating	No	No	No	No	No	No	-	Sloppy
Vocalising	No	No	No	No	No	No	-	No

Table A.4: Cont.

Behaviours \Team	PDM			
	Observer 1		Observer 2	
	T	C	T	C
Without rider				
Ear Position	Forward	Middle	-	Forward
Head Position	Normal	Normal	-	Normal
Nose Position	Forward	Vertical	-	Forward
Mouth Position	Closed	Closed	-	Closed
Mouth moisture	No	No	-	No
Eye blinking	Occasionally	Occasionally	-	Occasionally
Standing	Looking around	Looking around	-	Looking around
Sweating	No	No	-	No
Pawing	No	No	-	No
Tail Position	Normal	Normal	-	Swishing
Defecating	No	No	-	No
Vocalising	No	No	-	No
With rider				
Ear Position	Forward	Forward	-	Forward
Head Position	Normal	Normal	-	Normal
Nose Position	Forward	Vertical	-	Forward
Mouth Position	Closed	Closed	-	Closed
Mouth moisture	No	Wet	-	Wet
Eye blinking	Occasionally	Occasionally	-	Occasionally
Standing	Looking around	Looking around	-	Looking around
Sweating	Normally	No	-	Normally
Pawing	No	No	-	No
Tail Position	Up	Normal	-	Normal
Defecating	No	No	-	No
Vocalising	No	No	-	No

Appendix I

Dressage research Training Questionnaire

2752647384 Page 1

How you and your horse feel about training today

Part One

For our identification system, please insert your initials (in capitals) and the last two digits of the year in which you were born (e.g. TMB66) in these boxes.

This Questionnaire is part of an investigation into the psychological aspects of performance during dressage competitions. The responses you provide will help us better understand the psychological challenges facing riders during training and competition and to improve psychological preparation for competition in your sport.

We appreciate your participation in this project!

USQ

AUSTRALIA

Dressage 1 - 2003

8896647389 Page 2

Getting to know you and your horse

First a few questions about the riding and competition career of you and the **HORSE YOU WILL BE RIDING** for this research project.

1. **Gender (tick one):** ☐ Male ☐ Female
2. **Your Age?** ☐☐ years
3. **No of years you have ridden?** ☐☐ years
4. **No of years you have competed in Dressage?** ☐☐ years
5. **Do you work with a (Please cross as many boxes as applicable):**

   ☐ Horse Trainer ☐ Riding Coach ☐ Sports Psychologist

6. **What is your (rider) training level (Please cross one box)**

   ☐ Preliminary ☐ Novice ☐ Elementary

   ☐ Medium ☐ Advanced ☐ Prix St George

   ☐ Intermediate I ☐ Intermediate II ☐ Grand Prix

7. **At what levels are you competing this season (Please cross as many boxes as applicable).**

   ☐ Preliminary ☐ Novice ☐ Elementary

   ☐ Medium ☐ Advanced ☐ Prix St George

   ☐ Intermediate I ☐ Intermediate II ☐ Grand Prix

8. **Horse's name?**
9. **Horse's age?** ☐☐
10. **Is he/she a (tick one):** ☐ Gelding ☐ Mare ☐ Stallion
11. **How long has this horse competed in dressage?** ☐☐ years – ☐☐ months
12. **How many years have you been competing this horse in dressage?** ☐☐ years
13. **Average number of competitions that you take part in per season on this horse?** ☐☐
14. **Horse's Training level (Please cross one box)**

    ☐ Preliminary ☐ Novice ☐ Elementary

    ☐ Medium ☐ Advanced ☐ Prix St George

    ☐ Intermediate I ☐ Intermediate II ☐ Grand Prix

6867647385

SECTION 1 Some Questions About How You Are Feeling

Read each statement and then place a cross in the appropriate box to the right of the statement to indicate **HOW YOU FEEL RIGHT NOW**. There are no right or wrong answers. Do not spend too much time on any one statement, but choose the answer which describes how you feel **right now**.

Please cross <u>one</u> box for each statement.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. I am concerned about this training session	☐	☐	☐	☐	☐
2. I feel nervous	☐	☐	☐	☐	☐
3. I feel at ease	☐	☐	☐	☐	☐
4. I have self-doubts	☐	☐	☐	☐	☐
5. I feel jittery	☐	☐	☐	☐	☐
6. I feel comfortable	☐	☐	☐	☐	☐
7. I am concerned that I might not do as well in this session as I could	☐	☐	☐	☐	☐
8. My body feels tense	☐	☐	☐	☐	☐
9. I feel self-confident	☐	☐	☐	☐	☐
10. I am concerned about not performing well	☐	☐	☐	☐	☐
11. I feel tense in my stomach	☐	☐	☐	☐	☐
12. I feel secure	☐	☐	☐	☐	☐
13. I am concerned about stuffing up under pressure	☐	☐	☐	☐	☐
14. My body feels relaxed	☐	☐	☐	☐	☐
15. I am confident I can meet the challenge	☐	☐	☐	☐	☐
16. I'm concerned about performing badly	☐	☐	☐	☐	☐
17. My heart is racing	☐	☐	☐	☐	☐
18. I'm confident about performing well	☐	☐	☐	☐	☐
19. I'm concerned about reaching my goal for today	☐	☐	☐	☐	☐
20. I feel my stomach sinking	☐	☐	☐	☐	☐
21. I feel mentally relaxed	☐	☐	☐	☐	☐
22. I'm concerned that others will be disappointed with my performance	☐	☐	☐	☐	☐
23. My hands are clammy	☐	☐	☐	☐	☐
24. I'm confident because I mentally picture myself reaching my goal today	☐	☐	☐	☐	☐
25. I'm concerned I won't be able to concentrate	☐	☐	☐	☐	☐
26. My body feels tight	☐	☐	☐	☐	☐
27. I'm confident of coming through the pressure	☐	☐	☐	☐	☐

Section 1 cont. A Few More Questions About How You Are Feeling

Below is a list of statements that may or may-not apply to you at the moment. Please indicate, by placing a cross in the appropriate box to the right of the statement, the degree to which each statement describes **Your Feelings Right Now**.

Please cross **one** box for each Statement.

	Not at all	Slightly	Moderately so	Very much so
1. I feel nervous when I think about this training session	☐	☐	☐	☐
2. At the moment I seem to be worried about a lot of things	☐	☐	☐	☐
3. I am worried that the pressure of this session will make me perform poorly	☐	☐	☐	☐
4. At the moment I keep remembering occasions when I failed to achieve my goals	☐	☐	☐	☐
5. I have doubts about achieving my goals	☐	☐	☐	☐
6. I am anxious at the moment, but not for any one particular reason	☐	☐	☐	☐
7. I feel apprehensive about this session	☐	☐	☐	☐
8. I believe some of my goals are unachievable at the moment	☐	☐	☐	☐
9. I feel anxious about not performing as well as I should in this session	☐	☐	☐	☐
10. At the moment I feel anxious about several unrelated things	☐	☐	☐	☐

SECTION 2 Some Questions About Your Horse

Below is a list of words that could describe your horse's behaviour. Please read each one carefully. Then from your observations cross the box which best describes **This Horse Right Now**. Make sure you answer every question.

Please cross one box for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Affectionate	☐	☐	☐	☐	☐
2. Alert	☐	☐	☐	☐	☐
3. Anxious	☐	☐	☐	☐	☐
4. Bold	☐	☐	☐	☐	☐
5. Bad Tempered	☐	☐	☐	☐	☐
6. Calm	☐	☐	☐	☐	☐
7. Flighty	☐	☐	☐	☐	☐
8. Fighting	☐	☐	☐	☐	☐
9. Honest	☐	☐	☐	☐	☐
10. Hot	☐	☐	☐	☐	☐
11. Intelligent	☐	☐	☐	☐	☐
12. Laid Back	☐	☐	☐	☐	☐
13. Moody	☐	☐	☐	☐	☐
14. Nervous	☐	☐	☐	☐	☐
15. Sensitive	☐	☐	☐	☐	☐

Section 2 cont. A Few More Questions About Your Horse

Below is a list of words and characteristics we sometimes use to describe our competition horse. Please tick the appropriate box to the right of the characteristic to indicate how your horse rates on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross one box for each statement.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Confident	☐	☐	☐	☐	☐
2. Energetic	☐	☐	☐	☐	☐
3. Excitable	☐	☐	☐	☐	☐
4. Obedient	☐	☐	☐	☐	☐
5. Relaxed	☐	☐	☐	☐	☐
6. Responding to the aids	☐	☐	☐	☐	☐
7. Engaging hindquarters	☐	☐	☐	☐	☐
8. Willing to go forward	☐	☐	☐	☐	☐
9. Working as part of a team	☐	☐	☐	☐	☐
10. Paying attention	☐	☐	☐	☐	☐
11. Feeling at ease	☐	☐	☐	☐	☐
12. "His personality" has changed from on the ground to under saddle	☐	☐	☐	☐	☐
13. Accepting the bit	☐	☐	☐	☐	☐
14. Is soft in hand	☐	☐	☐	☐	☐
15. Is making snappy transitions	☐	☐	☐	☐	☐
16. Has good rhythmn all gaits	☐	☐	☐	☐	☐
17. Is submitting to the work	☐	☐	☐	☐	☐
18. Working with impulsion	☐	☐	☐	☐	☐

Appendix J

Dressage research competition questionnaire

9192052020 Page 1

How you and your horse feel about Competing today

Part Two

For our identification system, please insert your initials (in capitals) and the last two digits of the year in which you were born (e.g. TMB66) in these boxes.

This Questionnaire is part of an investigation into the psychological aspects of performance during dressage competitions. The responses you provide will help us better understand the psychological challenges facing riders during competition and to improve information used in psychological preparation for competition in your sport.

We appreciate your participation
in this project!

USQ

AUSTRALIA

Dressage 2 - 2003

Please fill this in **AFTER** you have warmed-up your horse, and **BEFORE** you enter the Dressage arena. Please refer to the **SAME HORSE** throughout the questionnaire. Please complete the last section only **AFTER** you have ridden in the dressage competition. The questionnaire will take approximately 7 minutes to complete.

1. **What Level are you competing today? (Please cross one box)**

☐ Preliminary	☐ Novice	☐ Elementary
☐ Medium	☐ Advanced	☐ Prix St George
☐ Intermediate I	☐ Intermediate II	☐ Grand Prix

2. **How Important is your result in this dressage competition ? (Please cross one box)**

☐ Of little importance	☐ Less than average importance	☐ Of average importance
☐ Above average importance	☐ Extremely important	

3. **How well do you think you and horse will perform in todays competition (Please cross one box)**

☐ Greatly below our usual	☐ Below our usual	☐ As usual
☐ Better than Usual	☐ Greatly above our Usual	

1748052029 Page 3

SECTION 1 Some Questions About How You Are Feeling

Read each statement and then place a cross in the appropriate box to the right of the statement to indicate **HOW YOU FEEL RIGHT NOW**. There are no right or wrong answers. Do not spend too much time on any one statement, but choose the answer which describes how you feel **right now**.

Please cross <u>one</u> box for each statement.

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

Section 1 cont. A Few More Questions About How You Are Feeling

Below is a list of statements that may or may-not apply to you at the moment. Please indicate, by placing a cross in the appropriate box to the right of the statement, the degree to which each statement describes **Your Feelings Right Now**.

Please cross **one** box for each Statement.

	Not at all	Slightly	Moderately so	Very much so
1. I feel nervous when I think about this competition	☐	☐	☐	☐
2. At the moment I seem to be worried about a lot of things	☐	☐	☐	☐
3. I am worried that the pressure of this competition will make me perform poorly	☐	☐	☐	☐
4. At the moment I keep remembering occasions when I failed to achieve my goals	☐	☐	☐	☐
5. I have doubts about achieving my goals	☐	☐	☐	☐
6. I am anxious at the moment, but not for any one particular reason	☐	☐	☐	☐
7. I feel apprehensive about this session	☐	☐	☐	☐
8. I believe some of my goals are unachievable at the moment	☐	☐	☐	☐
9. I feel anxious about not performing as well as I should in this competition	☐	☐	☐	☐
10. At the moment I feel anxious about several unrelated things	☐	☐	☐	☐

SECTION 2 Some Questions About Your Horse

Below is a list of words that could describe your horse's behaviour. Please read each one carefully. Then from your observations cross the box which best describes **This Horse Right Now**. Make sure you answer every question.

Please cross one box for each word.

	Not at all	A little	Moderately	Quite a bit	Extremely
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2. Alert	☐	☐	☐	☐	☐
3. Anxious	☐	☐	☐	☐	☐
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7. Flighty	☐	☐	☐	☐	☐
8. Fighting	☐	☐	☐	☐	☐
9. Honest	☐	☐	☐	☐	☐
10. Hot	☐	☐	☐	☐	☐
11. Intelligent	☐	☐	☐	☐	☐
12. Laid Back	☐	☐	☐	☐	☐
13. Moody	☐	☐	☐	☐	☐
14. Nervous	☐	☐	☐	☐	☐
15. Sensitive	☐	☐	☐	☐	☐

Section 2 cont. A Few More Questions About Your Horse

Below is a list of words and characteristics we sometimes use to describe our competition horse. Please tick the appropriate box to the right of the characteristic to indicate how your horse rates on each of these **RIGHT NOW**. Make sure you answer every question.

Please cross one box for each statement.

	Not at all	A little	Moderately	Quite a bit	Extremely
1. Confident	☐	☐	☐	☐	☐
2. Energetic	☐	☐	☐	☐	☐
3. Excitable	☐	☐	☐	☐	☐
4. Obedient	☐	☐	☐	☐	☐
5. Relaxed	☐	☐	☐	☐	☐
6. Responding to the aids	☐	☐	☐	☐	☐
7. Engaging hindquarters	☐	☐	☐	☐	☐
8. Willing to go forward	☐	☐	☐	☐	☐
9. Working as part of a team	☐	☐	☐	☐	☐
10. Paying attention	☐	☐	☐	☐	☐
11. Feeling at ease	☐	☐	☐	☐	☐
12. "His personality" has changed from on the ground to under saddle	☐	☐	☐	☐	☐
13. Accepting the bit	☐	☐	☐	☐	☐
14. Is soft in hand	☐	☐	☐	☐	☐
15. Is making snappy transitions	☐	☐	☐	☐	☐
16. Has good rhythmn all gaits	☐	☐	☐	☐	☐
17. Is submitting to the work	☐	☐	☐	☐	☐
18. Working with impulsion	☐	☐	☐	☐	☐

DO NOT COMPLETE UNTIL AFTER THE DRESSAGE COMPETITION

1. **How well do think you went in today's dressage competition? (Please cross one box)**

☐ Greatly below expectation ☐ Below expectation ☐ As expected

☐ Above expectation ☐ Greatly above expectation

2. **How well do think this horse went in todays dressage competion? (Please cross one box)**

☐ Greatly below expectation ☐ Below expectation ☐ As expected

☐ Above expectation ☐ Greatly above expectation

3. **Competition Score** ☐☐.☐☐ percent

4. **Placing** ☐☐

Thank you for time and Patience

Appendix K

Consent form to participate in the Dressage Research

UNIVERSITY OF SOUTHERN QUEENSLAND

CONSENT to PARTICIPATE IN RESEARCH FORM

I have read the information provided and I understand that the purpose of this study is to explore anxiety in equestrian sports. I agree to take part in the study into anxiety in the equestrian team during a dressage competition. I understand that this consent form will be detached from the rest of the questionnaire, so that my name is not attached to the questions.

Please tick the box to indicate you have read the points to the right each box and understand the role you will undertake in this study.

❑ I will be asked to respond to questions regarding my emotions and mood before and during a dressage competition.

❑ I understand that both my **horse and I** will be observed and videotaped before (in my usual training area), during, and after a dressage competition

❑ I understand that my **horse and I** will be fitted with heart rate monitors before training and competing in a dressage competition.

❑ I understand that any information I give will not be identified with me personally and that my ID and responses are kept in a coded format as to maintain confidentiality.

❑ I understand that my participation is completely voluntary and that I may withdraw at any time with no questions asked.

❑ I understand that the results of this research will be published in group format in a thesis and scientific journals.

I declare that I am at least 18 years of age, and I hereby give my consent to participate in this study.

Signature:……. Date:……

In order to thank you for your participation, we would like to give you the opportunity to enter into a draw for cash prizes ranging from $20 to $200. These prizes are drawn at the end of each semester, and entrants include those who have participated in psychological research during semester.

Would you like to be included in the draw for cash prizes? Yes / No
(Please circle)

Would you like to receive a copy of the results of this study? Yes / No
(Please circle**)**

If you answered <u>YES</u> to any of the questions above, please write your name, address, and phone number in the space below. If you answered <u>NO</u> to these questions, please leave the following details blank. (Again remember that this consent form will be kept separate from your questionnaire so that you cannot be identified).

PLEASE USE BLOCK LETTERS:

Name: **……..**

Address: **……..**
……..
……..

Phone: ……..

Appendix L

Letter of approval from Dressage Queensland to use heart rate monitors

Dressage Queensland
P.O. Box 244 Spring Hill Qld 4004
A.B.N. 79 598 577 242

20 August 2003

Donald Bridgeman
Department of Psychology
Faculty of Science
University of Southern Queensland
TOOWOOMBA 4350

Dear Donald

Please refer to our previous correspondence concerning the use of heart rate monitors on horses at dressage competitions for the purpose of your research into anxiety in equestrian sports.

As promised, this matter was tabled at the meeting of the National Dressage Committee on 9 August 2003. We are now pleased to advise you that after due consideration the Committee approved the use of these devices providing the State dressage authority is kept informed of the situation, ie: where and when they are to be used, which horses will be wearing them, and judges at the relevant competitions are informed of their use.

We thank you for your cooperation in this matter and wish you well with your research.

Yours sincerely

Meredith Miller
Secretary

Appendix M

Extra Tables for study 2

Table A.5: The skewness and kurtosis for all dependent variables

	N		Skewness		Kurtosis	
	T	C	T	C	T	C
Rider						
CSAI-2 original						
Cognitive anxiety	30	30	.76	.55	.05	.05
Somatic anxiety	30	30	1.28	.73	1.43	-.02
Self confidence	29	30	-.06	.43	-1.06	-.16
CSAI-2 revised						
Cognitive anxiety	30	30	1.08	.51		
Somatic anxiety	30	30	1.71	.85		
Self confidence	30	30	-.38	.34		
EMCA-Q						
Emotion component	30	30				
Mood component	30	30				
Heart rate mean	28	28	.03	-.647	-.93	-.42
Heart rate entering at A	25	25	-.54	-1.00	-.26	.28
Horse						
HTI	28	28	-.67	-.91	-.23	.92
Heart rate mean	27	18	1.42	.82	3.50	-.01
Heart rate entering at A	27	18	.73	1.27	2.58	2.88
Interaction						
Rider WRI	29	30	- .54	-.92	-.24	1.45
Judge WRI	29	30	-2.91	-.46	12.79	.87
Heart rate synchronisation	30	30	-.54	-.77	1.52	.27

Table A.6: A Pearson correlation of the synchronicity of Heart rate for horse and rider for each 5 second interval during the dressage.

	Training		Competition	
Time	N	r	N	r
0.05	26	0.50**	18	0.36
0.15	26	0.49*	18	0.20
0.25	26	0.55**	18	0.34
0.35	26	0.45*	18	0.43
0.45	26	0.51**	18	0.46
0.55	26	0.57**	18	0.30
1.05	26	0.49*	18	0.09
1.15	26	0.37	18	0.16
1.25	26	0.56**	18	0.16
1.35	26	0.56**	18	0.21
1.45	26	0.53**	18	0.19
1.55	26	0.52**	18	0.44
2.05	26	0.50**	18	0.17
2.15	26	0.43**	18	-0.17
2.25	25	0.37	18	-0.11
2.35	25	0.42*	18	0.02
2.45	25	0.52**	18	0.14
2.55	25	0.56**	18	0.15
3.05	25	0.58**	18	-0.17

* $p \leq .05$ ** $p \leq .01$

Table A.6: Cont.

3.15	25	0.51**	18	-0.41
3.25	24	0.31	18	-0.33
3.35	24	0.37	18	-0.03
3.45	24	0.48*	18	0.16
3.55	24	0.52**	18	0.24
4.05	24	0.54**	17	0.25
4.15	24	0.53**	17	0.08
4.25	21	0.24	16	0.48
4.35	21	0.16	15	0.43
4.45	21	0.24	15	0.46
4.55	20	0.40	15	0.48
5.05	20	0.53*	13	0.56*
5.15	18	0.55*	11	0.72*
5.25	17	0.61**	11	0.71*
5.35	14	0.65	10	0.73*
5.45	13	0.65*	8	0.71*
5.55	12	0.70*	7	0.71*
6.05	11	0.62	7	0.78*
6.15	10	0.57	7	0.75
6.25	8	0.57	7	0.81*
6.35	7	0.48	5	0.48
6.45	6	0.67	4	0.80*
6.55	4	0.71	2	-1.00**
7.05	3	0.61	2	-1.00**

* $p \leq .05$ ** $p \leq .01$