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**The Relationship between Personality, Sensation Seeking,
Reaction Time and Sport Participation: Evidence from
Drag Racers, Sport Science Students and Archers**

A thesis submitted to Middlesex University
in partial fulfilment of the requirements
for the degree of
Doctor of Philosophy

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Acknowledgements

The main aim of this thesis was to examine the relationship between personality, sensation seeking and reaction time in drag racers, archers and students. Drag racers are a novel group that I have had the pleasure of working with. I travelled for 6 years around the UK, Europe and American and was privileged to be part of the team holding the title of European champions for the last 4 years during that period. I have also had access to archers having worked with a London archery club and supervised a trainee psychologist working with GB archers. My interest in extreme sport has grown and this has provided me with opportunities in working with the media on magazine articles, newspaper features and television.

As Head of the London Sport Institute at Middlesex University, I enjoy managing the staff and strategizing on the development of sport. I enjoy teaching university sport science students who are always enthusiastic to hear about extreme sport and to participate in research. I am extremely grateful for the expertise and encouragement of my PhD supervisory team, Dr. Bahman Baluch and Dr. Linda Duffy. Their help has been invaluable on this academic journey.

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Table of Contents

Acknowledgements	2
Abstract	9
1. Chapter 1: Introduction and Overview	11
1.1 Preface	11
1.2 Eysenck’s Personality Dimension and Sporting Behaviour.....	12
1.3 Sensation Seeking and Sporting Behaviour.....	14
1.4 Eysenck’s Personality Traits and Sensation Seeking.....	15
1.5 Personality Traits and Reaction Time.....	16
1.6 Criticism on Lack of Scientific Rigour.....	17
1.7 Difficulty in Examining Studies on ‘Extreme Sport’	17
1.8 Comparison Groups in Sport.....	19
1.9 Other Factors Affecting Research Findings	20
1.9.1 Gender Differences in Relation to Personality and Reaction Time.....	20
1.9.2 Age	21
1.9.3 Level of performance: Elite and Amateur	22
1.10 Conclusion	23
2.0 Chapter 2: Key Historical Research (pre 2000) on the Relationship between Personality Traits and Sport	25
2.1 Preface	25
2.2 The Nature of Personality	26
2.3 Personality and Sport.....	28
2.4 Sensation Seeking and Personality.....	30
2.5 Measuring Sensation Seeking	32
2.6 Personality and Reaction Time	34
2.7 Reaction Time and Length	35
2.8. Reaction Time Models.....	37
2.9 Reaction Time in Sports	39
2.10 Reaction Time and Cues	40
2.11 Reaction Time and Arousal.....	41
Figure 1 - A graphic display of the relationship between Degree of Arousal and Reaction Time. Yerkes-Dodson Effect, 1908.....	42
2.12 Reaction Time and Other Factors.....	43
2.13 Conclusion	43

3.0 Chapter 3: Key Historical Research (post 2000) on the Relationship between Personality Traits and Sport.....	46
3.1 Preface	46
3.2. Personality and Sport (post 2000).....	48
3.3. Personality and Sensation Seeking.....	51
3.4 Sensation Seeking Testing.....	54
3.5 Sensation Seeking, Sport, Risk and External occupational comparisons	54
3.6 Reaction Time and Sport.....	58
3.7 Conclusion.....	63
4.0 Chapter 4: Gender, Age, Level of Performance in Personality and Reaction Time	65
4.1 Preface	65
4.2 Gender Differences.....	65
4.3 Age.....	69
4.4 Levels of Performance	70
4.5 Comparison Groups and Homogeneity of Sports.....	72
4.6 Conclusion.....	73
5.0 Chapter 5 - Defining Sport and 'Extreme Sport'	74
5.1 Preface	74
5.2 The Changing Definitions of Sport and 'Extreme Sport'.....	75
5.3 High-Risk Sport.....	77
5.4 Alternative Sport.....	79
5.5 Action Sport.....	79
5.6 Adventure Sport	80
5.7 Lifestyle Sport.....	80
5.8 A Spatial Dimension.....	81
5.9 An Emotional and Individualistic Dimension	82
5.10 A Transgressive Dimension	83
5.11 Drag Racing as an 'Extreme Sport'	84
5.12 A Definition of 'Extreme Sport'	86
5.13 Conclusion	87
6. Chapter 6: Personality and Sensation seeking.....	89
6.1 Preface	89
6.2 Study 1: The Relationship between Personality and Sporting Performance: Evidence from Drag Racers and University Sport Science Students.....	91
6.2.1 Background and Aims	91
6.2.2 Hypotheses.....	91

6.2.3 Methodology.....	92
6.2.4 Results.....	95
Table 6.1 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers and university sport science students.....	96
Table 6.2 - Mean extraversion scores and corresponding standard deviations by participant and gender.....	97
Table 6.3 - Mean neuroticism scores and corresponding standard deviations by participant and gender.....	98
Table 6.4 - Mean extraversion scores and corresponding standard deviations by participant and level of performance	99
Table 6.5 - Mean neuroticism scores and corresponding standard deviations by participant and level of performance	100
Figure 2- Bar chart representing the comparison of personality measures of university sport science students and drag racers with the population norms.....	101
6.2.5 Discussion.....	101
6.3 Study 2: The Relationship between Sensation Seeking and Sporting Performance: Evidence from Drag Racers and University Sport Science Students.....	107
6.3.1 Background and Aims	107
6.3.2. Hypotheses.....	108
6.3.3 Methodology.....	108
6.3.4. Results.....	110
Table 6.6 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers and university sport science students.....	110
Table 6.7 - Mean sensation seeking scores and corresponding standard deviations by participant and gender.....	111
Table 6.8 - Mean thrill and adventure seeking scores and corresponding standard deviations by participant and gender.....	112
Table 6.9 - Mean experience seeking scores and corresponding standard deviations by participant and gender.....	113
Table 6.10 - Mean disinhibition scores and corresponding standard deviations by participant and gender.....	114
Table 6.11 - Mean boredom susceptibility scores and corresponding standard deviations by participant and gender	115

Table 6.12 - Mean sensation seeking scores and corresponding standard deviations by participant and level of performance	116
Table 6.13- Mean thrill and adventure seeking scores and corresponding standard deviations by participant and level of performance	117
Table 6.14 - Mean experience seeking scores and corresponding standard deviations by participant and level of performance	118
Table 6.15 - Mean disinhibition scores and corresponding standard deviations by participant and level of performance	119
Table 6.16 - Mean boredom susceptibility scores and corresponding standard deviations by participant and level of performance	120
6.3.5 Discussion.....	121
6.4: Study 3 -The Relationship between Personality, Sensation Seeking and Sporting Performance: Evidence from Drag Racers, University Sport Science Students and Archers.....	127
6.4.1 Background and Aims	127
6.4.2 Hypotheses.....	130
6.4.3 Methodology.....	131
6.4.4 Results.....	133
Table 6.17 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers, university sport science students and archers	133
Table 6.18 - Mean extraversion scores and corresponding standard deviations by participant and gender.....	135
Table 6.19 - Mean neuroticism scores and corresponding standard deviations by participant and gender.....	136
Table 6.20 - Mean sensation seeking scores and corresponding standard deviations by participant and gender.....	137
Table 6.21- Mean thrill and adventure seeking scores and corresponding standard deviations by participant and gender.....	139
Figure 3- The graphic display of the interaction effect (TAS and gender)	140
Table 6.22 - Mean experience seeking scores and corresponding standard deviations by participant and gender.....	141
Table 6.23 - Mean disinhibition scores and corresponding standard deviations by participant and gender.....	142
Table 6.24 - Mean boredom susceptibility scores and corresponding standard deviations by participant and gender	143

Table 6.25 - Mean extraversion scores and corresponding standard deviations by participant and level of performance	144
Table 6.26 - Mean neuroticism scores and corresponding standard deviations by participant and level of performance	145
Table 6.27 - Mean sensation seeking scores and corresponding standard deviations by participant and level of performance	147
Figure 4 - Bar chart representing the comparison of personality measures of drag racers, university sport science students and archers with the population norms.....	146
Table 6.28 - Mean thrill and adventure seeking scores and corresponding standard deviations by participant and level of performance	149
Table 6.29 - Mean experience seeking scores and corresponding standard deviations by participant and level of performance	151
Table 6.30 - Mean disinhibition scores and corresponding standard deviations by participant and level of performance.	152
Table 6.31 - Mean boredom susceptibility scores and corresponding standard deviations by participant and level of performance.	154
6.4.5 Discussion.....	155
7. 0 Chapter 7: Reaction Time Latencies and Sport.....	162
7.1 Preface.....	162
7.2 Study 4: The Relationship between Personality Traits and Reaction Time Latencies to Simple and Sport Specific Tasks amongst Drag Racers, University Sport Science Students and Archers	164
7.2.1 Background and Aims	164
7.2.2 Hypotheses.....	169
7.2.3 Methodology.....	170
7.2.4 Results.....	175
Table 7.1 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers, students and archers.....	175
Table 7.2 - Mean extraversion scores and corresponding standard deviations by participant and gender.....	177
Table 7.3 - Mean neuroticism scores and corresponding standard deviations by participant and gender.....	178
Table 7.4 - Mean sensation seeking scores and corresponding standard deviations as by participant and gender.....	180

Table 7.5 - Mean RTG scores measured in milliseconds and corresponding standard deviations by participant and gender.....	181
Table 7.6 - Mean RTS scores measured in milliseconds and corresponding standard deviations as by participant and gender	182
Table 7.7 - Mean PCG scores and corresponding standard deviations by participant and gender.....	183
Table 7.8 - Mean PCS scores and corresponding standard deviations by participant and gender.....	184
Table 7.9 - Mean extraversion scores and corresponding standard deviations by participant and level of performance	186
Table 7.10 - Mean neuroticism scores and corresponding standard deviations by participant and level of performance	187
Table 7.11- Mean sensation seeking (SS) scores and corresponding standard deviations by participant and level of performance.....	189
Table 7.12- Mean RTG scores and corresponding standard deviations by participant and level of performance	
Table 7.13 - Mean RTS scores and corresponding standard deviations by participant and level of performance	191
Table 7.14 - Mean PCG scores and corresponding standard deviations by participant and level of performance	192
Figure 5- A graphic display of the interaction effects (PCG and level of performance)...	193
Table 7.15 - Mean PCS scores and corresponding standard deviations by participant and level of performance	194
Figure 6 - A graphic display of the interaction effects (PCS and level of performance)	195
Correlations	196
7.2.5 Discussion.....	197
Conclusion	206
8.0 Chapter 8: General Discussion	208
8.1 Preface	208
8.2 Summary of the studies.....	209
8.3 Contributions.....	217
8.4 Implications and Future Research.....	221
8.5 Conclusion.....	225
References	226
Appendix I – Eysenck and Eysenck’s Personality Inventory (EPI).....	252
Appendix II- Zuckerman’s Sensation Seeking Scale – (SSS-V).....	256
Appendix III- SuperLab Reaction Time Sport Specific Stimuli.....	262

Abstract

This thesis examined for the first time psychological variables namely, personality traits and reaction time amongst elite and amateur drag racers, archers and a sample of university sport science students.

In study 1, using Eysenck and Eysenck's Personality Inventory (1982) 144 drag racers (mean age 31, SD =12.27) 108 male, 36 female were compared with a control group of 82 university sport science students (mean age 22.9, SD = 2.99) 44 male, 38 female. There was a significant difference between the participants on neuroticism only. Drag racers scored lower on this scale than students who scored higher on neuroticism.

In study 2, using Sensation Seeking Scale (SSS-V) (Zuckerman, 1994) data from the above 144 drag racers were compared with a control group of 82 university sport science students. The results indicated that there were no significant differences between drag racers and university sport science students on measures of sensation seeking. Level of performance (elite versus amateur) did not distinguished drag racers from the comparison group. A significant difference in gender was found only on the subscale of disinhibition (DIS).

Study 3 included archers as an appropriate group involved in a non-extreme sport. Forty-five archers (mean age 37.2, SD = 11.68) 30 male and 15 female were included in this study. The results on personality tests (EPI and SSS), whilst employing controls for age, gender and level of performance indicated that there was a significant difference between the 3 sporting groups (as well as in comparison to university sport science students) in sensation seeking, thrill and adventure seeking and disinhibition. Level of performance was shown to be a significant variable on sensation seeking and thrill and adventure seeking. Gender was a highly significant variable only on a measure of neuroticism.

In study 4, an experiment was conducted on the relationship between personality traits and reaction times as a function of sporting performance. There were 29 male drag racers (mean age = 45.82, SD = 8.56), 11 female drag racers mean age (42.72, SD = 8.33), 26 male archers (mean age 35.53, SD = 11.93), 13 female archers (mean age 38.92 , SD = 11.68), 34 male students (mean age = 22.82, SD = 2.62) and 25 female students (mean age = 23.08, SD = 3.36). The issue examined was whether drag racers, archers and students differ on tests of simple (non sport specific i.e. dots on a screen) and task specific (sport related- series of lights) reaction time. These tests were designed on SuperLab specifically for drag racers. The results demonstrated that there was a significant difference between the participants (i.e. drag racers and students) in accuracy. Overall, there was a significant correlation between extraversion and accuracy on a sport specific task. With archers, there was a relationship between extraversion and accuracy and for both elite and amateurs, which was highly significant for female archers. With amateur drag racers there was an inverse relationship between sensation seeking measures and accuracy. This demonstrates the importance of level of performance as a moderating factor. The implications of these findings are discussed.

1. Chapter 1: Introduction and Overview

“Personality makes the difference between the best and the rest in just about any field of human endeavour” Aidman (2007).

1.1 Preface

Is the personality of an individual engaged in ‘extreme sport’ different from one that is not involved in ‘extreme sport’? Can the study of personality in sport be more scientifically robust? Can cognitive perceptual test incorporating reaction time latency be used alongside personality tests as a useful measure in profiling athletes? Can the cognitive processing of accuracy be the missing key in understanding and developing performance in ‘extreme sport’? These are questions that to a large extent remain unanswered and will be analysed in this doctoral thesis.

The relationship between personality traits and sporting performance has been investigated for more than 30 years. It has been documented in an early review by Eysenck et al., (1982) and reviewed more recently by Rhodes and Smith (2006). The study of personality traits is predominantly based on Eysenck’s Personality Dimensions, namely neuroticism and extraversion (Eysenck and Eysenck, 1982). However, as personality tests are being considered for selection and talent search in sport (e.g. Aidman, 2007) improvements in the level of scientific rigour in personality studies need to be undertaken (Deaner and Silva, 2002). This issue will be investigated in this thesis.

Some sports labelled as high-risk have been researched in relation to the personality trait of sensation seeking (e.g. Zuckerman, 1994). However, these studies include all sports identified where there is a high-risk of injury or death, and do not make the distinction of what is 'extreme sport'. The labelling of a sport as being 'extreme' is a relatively new phenomenon as is its inclusion in scientific research This thesis aims to make a

significant contribution to the existing literature by defining what is ‘extreme sport’ and by being the first study to examine personality traits through the sport of ‘drag racing’.

In addition to personality tests, other studies have examined objective psychological variables such as:

- The relationship between perceptual motor skills and sporting performance (Royal, Farrow, Mujika, Halson, Pyne and Abernethy, 2006; Thompson, Watt and Liukkonen, 2009)
- Perceptual skills, gender and personality (Burton, Pfaff, Bolt, Hadjikyriacou, Stilton, Kilgallen, Cofer and Allimant, 2010)
- Reaction time, gender and sporting performance (Ak and Kocak, 2010).

Reaction time latencies and their relationship with personality traits in sport may complement psychological predictors of sporting performance. It has been demonstrated that personality traits may advantage high altitude climbers in the processing of information in relation to stimulus response tasks (Bolmont, Bouquet and Thullier, 2001). The sport of drag racing, as an ‘extreme sport’, has provided a useful dataset of reaction times for this thesis against comparison groups of archers and students, as this measure is a crucial component of success in the sport. This study looks at the relationship between personality and reaction time and whether these factors can be a predictor of sporting performance in ‘extreme sport’.

The final section of this review chapter sums up the arguments put forward and the significance of the present work as a doctoral thesis on the grounds of its scientific rigour and the originality of the conducted studies herein.

1.2 Eysenck’s Personality Dimension and Sporting Behaviour

Historically, primarily two models have explained the structure of personality: the two/three dimensional model (Eysenck and Eysenck, 1982; 1985) and the Five Factor Model (Costa and McCrae, 1992). Both of these personality models have been

supported by theoretical and empirical research conducted over the past few decades on the relationship between sport and personality. Eysenck Personality Inventory (Eysenck and Eysenck, 1982) which includes extraversion and neuroticism and its more recent version Eysenck Personality Questionnaire (Eysenck and Eysenck, 1985) have been the main tests used for measuring personality (Goma-i-Freixanet, 1991). The Five Factor Model of Costa and McCrae, (1992) which includes the dimensions of neuroticism, extraversion, openness, agreeableness and conscientiousness, has also been the subject of some investigations (e.g. Nia and Besharat, 2010). Results from studies using both the Eysenck and Costa and McCrae models have suggested that there is a positive correlation between sport and extraversion, as well as a negative correlation between sport and neuroticism (Erikson, 1993; McKelvie, Lemieux, and Stout, 2003).

There are many examples of studies in sport literature which are based on the Eysenck and Eysenck (1982) model:

- Differences in personality between athletes and non-athletes:
(Schroth, 1995; Gat and McWhitier, 1998; Eagleton, McKelvie, and de Man, 2007)
- Difference in personality between different skill level: (Davis and Mogk, 1994)
- The personality of athletes competing in teams versus individual sports:
(Gat and McWhirter, 1998)
- Personality variations based on different playing positions within the same sport: (Kirkcaldy, 1982; Cox 1987; Greenwood and Simpson, 1994; Newcombe and Boyle, 1995)
- Personality traits of participants in specific sports such: wrestling (Silva, 1985); tennis (Gondola and Wughalter, 1991); rugby (Golby and Sheard, 2004); American football (Schaubhut, Donnay, and Thompson, 2006)

In a classic review paper, Eysenck et al., (1982) discussed the failure of research to control important distinguishing factors necessary in studying the relationship between sport and personality. This thesis utilises Eysenck et al's, (1982) review paper as a starting point in examining the weakness in personality research. In addition, as the Eysenck and Eysenck (1982) personality measure has its historical roots in research examining the relationship between personality and sporting performance, it will be one

of the tests used in comparing personality in 'extreme sport' of drag racing to 'non-extreme sport'.

1.3 Sensation Seeking and Sporting Behaviour

During the 1990's, a growing interest emerged into Zuckerman's concept of a 'sensation seeking' trait defined as "the seeking of varied, novel, complex and intense sensations and experiences and the willingness to take physical, social, legal and financial risk for the sake of experiences" (Zuckerman, 1994, p. 27).

This led to the development of a sensation seeking scale (SSS) (Zuckerman, 1994) to assess overall sensation seeking, which was significantly related to a number of personality and perceptual measures (Zuckerman, 1994). The SSS could provide important information about different preferences for risky and non-risky modes of arousal. The sensation seeking scale itself (Zuckerman, 1994) includes an overall measure of sensation seeking as well as 4 sub-factors: Thrill and Adventure seeking, Experience Seeking, Disinhibition and Boredom Susceptibility. The Thrill and Adventure Seeking (TAS) subscale displays the desire to be involved in physical activities that present unusual sensations and experiences such as mountain climbing or skydiving. Experience Seeking (ES) is about pursuing new experiences through the mind and senses such as music, art, travel and reading. Disinhibition (DIS) focuses around the seeking of arousal through a nonconforming lifestyle and through spontaneous unplanned activities. These activities may or may not be socially acceptable such as (wild) parties, gambling, (binge) drinking, sex or even multiple sexual partners. Finally, the Boredom Susceptibility (BS) subscale represents an aversion to a repetitive situation.

Those who score high on the subscale of thrill and adventure seeking (TAS) tend to engage more frequently in high-risk sports (Zuckerman, 1994). For example, scuba divers were shown to be high in thrill and adventure seeking, experience seeking and low on boredom susceptibility and disinhibition (Taylor, O'Toole, Auble, Ryan and

Sherman, 2001). It could be assumed that sensation seeking is therefore a pre-requisite for engaging in ‘extreme sport’ (Wagner and Houlihan, 1994; Malkin and Rabinowitz, 1998). However, results from the relationship between sensation seeking and risk are inconsistent, as research studies on sensation seeking have only demonstrated a moderate correlation with extreme activity (Furnham, 2004). Whilst studies have demonstrated that ‘extreme sport’ participants have a preference for high-risk activities (Slanger and Rudestam, 1997; Franques, Auriacombe, Piquemal, Verger, Brisseau-Gimenez and Grabot, 2003; Diehm and Armatas, 2004) high sensation seekers may develop skills, which decrease the risk associated with participation in high-risk activities.

The trait of sensation seeking will be examined in this thesis by using the ‘extreme sport’ of drag racing alongside two comparison groups, archers and university sport science students. As Roberti (2004) states “the relation of sensation seeking to behavioural and biological correlates makes it a key personality variable deserving continued empirical study” (p273).

1.4 Eysenck’s Personality Traits and Sensation Seeking

In the few specific studies looking at sport, correlations have been demonstrated between extraversion/neuroticism and sensation seeking (see review papers by Eysenck et al., 1982; Koelega, 1992; Zuckerman, 2007) Furthermore, research using both Eysenck’s Dimensions of Extraversion/Neuroticism, e.g. EPI (1982) and Zuckerman’s Sensation Seeking e.g. SSS-V (1994) has shown that those who engage in sport measure high in extraversion and in sensation seeking compared to non participants (Zuckerman, 1994; Rhodes and Smith, 2006). However, there are only limited studies in the area of extreme sport (Goma-i-Freixanet, 2004).

As will be discussed later in this review chapter and in subsequent chapters, there are other variables such as gender, experience, type of sport, comparison groups as well as the definition of what constitutes extreme sport, which can affect the results and therefore, need to be considered.

1.5 Personality Traits and Reaction Time

Early studies by Eysenck et al., (1982), Brooke (1967) and Cattell, Eber and Tatzucka (1970) suggested a link between the extraversion-dimension and reaction time. Extroverted personalities for instance have demonstrated faster reaction times than non-extraverts (Brebner, 1980). However, much of the earlier work can be criticised for not controlling gender variables when there is evidence that men consistently demonstrate faster reaction times than women (Silverman, 2006). Vital factors, such as accuracy, are often not taken into account in reaction time studies (Starkes and Deakin, 1984). In sport, where specific stimulus response tasks are required, reaction time appears to be important (Thompson et al., 2009). According to Royal, et al., (2006) task specificity appears to affect the accuracy of responses.

Recent research in sport and performance has utilised measures of reaction time latencies to sport specific stimuli in understanding sporting behaviour. For example, in a study by Christenson and Winkelstein (1988), athletes had significantly faster reaction times than non-athletes to neutral and to sport specific stimuli. In view of the criticisms applied to the 'subjective' use of personality measures as a predictor of (sporting) performance (Furnham, 1990), the objective measure of reaction time latencies could be seen as a more reliable measure. Furthermore, what has been of interest is that in spite of criticism applied to the studies investigating reaction times amongst athletes (see e.g. Silverman, 2006) there is now a growing body of research examining the link between personality traits and reaction time (e.g. Robinson and Tamir, 2005) as well as between sporting skills and reaction time (Williams, Vickers, and Rodrigues, 2002; Mann, Williams, Ward and Janelle, 2007).

In 'extreme sport' such as drag racing where there is a high level of risk, the need to make quick but accurate decisions can be the difference between life and death. This thesis examines whether reaction time and accuracy play an important role in predicting sporting success (in terms of distinguishing elite level of athletes from amateur) in 'extreme sport' compared to comparison groups. In this thesis, the criticisms applied to research on the relationship between reaction time and sporting performance and on the

relationship with personality traits will be identified in this review chapter and then discussed in future chapters.

1.6 Criticism on Lack of Scientific Rigour

Research into the relationship between sport and personality dates back to early 1980's although, much of it is criticised for its lack of robust scientific methodology. Eysenck et al. (1982) criticised personality research as being of a low scientific standard and reliant on small and unrepresentative sample sizes. Koelega (1992) in his review of studies on personality and vigilance over a 30-year period, called for more systematic research as well as a strengthening of studies through parametric analysis. Davis and Mogk (1994) highlighted classification problems in research studies, which compared athletes and non-athletes. LeUnes and Nation (2002) identified three methodological flaws in the research of personality; namely, sample numbers, data analysis and response distortion (athletes falsifying answers). Rhodes and Smith (2006) in their review paper on personality and physical activity from 1969 to 2006 wrote that personality research was still too limited to draw definite conclusions about moderating factors and also suggested the use of multivariate analyses.

This thesis examines and addresses these criticisms by conducting scientific research into personality through the controlling of specific variables.

1.7 Difficulty in Examining Studies on 'Extreme Sport'

In examining studies on 'extreme sport' there is ambiguity and lack of consistency on what constitutes extreme sport as this terminology has been used interchangeably with a variety of other expressions. The most prevalent terms for 'extreme sport' are descriptors and include common terms such as 'high-risk' sport, 'alternative sport', 'adventure sport', 'action sport', and 'lifestyle sport'. Collectively, many of these terms are synonymous, though there are distinct differences between them. For example, the term 'alternative sport' also suggests that participants lack the desire to follow rules and

regulations, set up for most conventional sports by national governing bodies (NGB). The terms 'adventure sport' or 'individualistic sport' (Puchan, 2004) emphasises self-competition through personal challenge and the idea of just 'doing it' (Wheaton, 2004).

The term 'high-risk' sport appears to dominate most of the academic research as meaning 'any sport where there is a chance of a severe injury or death as an inherent part of the activity' (Breivik, Johnsen, and Augestad, 1994). The major component within this 'definition' is notably the link with risk. 'Extreme sport' has always signified the existence of risk as well as the possibility of injury and death, yet participants of high-risk activities are acceptant of danger. They regard themselves as highly knowledgeable and skilled and therefore don't perceive that they are at risk (Lyng, 1990). The ways, in which sports are classified, e.g. low-risk, medium-risk and high-risk can palpably affect the analysis of a study's results. This point was noted by Goma-i-Freixanet (2004) in her review of sensation seeking and participation in physical risk sports.

Cazenave, LeScanff, and Woodman (2007) recently identified categories of risk taking, which are integral to sport. However, even in light of their categories, the consequence of ill-defined terminology affects the selection of sport participants and overall research findings in summarising and concluding about 'extreme sport'.

Drag racing, as an example of 'extreme sport', comes under the auspices of the Federation Internationale de L'Automobile (FIA). The sport itself lacks academic research within sport psychology literature. Indeed in this thesis, drag racing will be analysed for the first time within the context of 'extreme sport' with regards to personality, sensation seeking and reaction time.

The sport itself involves an acceleration contest in which specially prepared automobiles or motorcycles are raced against an opponent down a straight quarter mile track. The racetrack, referred as a drag strip uses electronic timing equipment to ascertain the winner. There are various classifications of vehicles and categories that range from amateur to elite where prize money is rewarded. The fastest vehicles can reach speeds of

300 miles per hour in just over 4 seconds from a standing start. It's a thrilling sport with an adrenalin buzz for the racers, teams and spectators. Tens of thousands of spectators are attracted to FIA race events around Europe and in the United States. Vehicles involved in crashes, fires or explosions can result in severe injury or even death for the driver. In the western world, high-risk or 'extreme sports' such as drag racing has increased in popularity exponentially (Llewellyn, Sanchez, Asgar and Jones, 2008).

1.8 Comparison Groups in Sport

Whilst there are many studies that use comparison groups in examining sport psychology, there are various methodological weaknesses and inconsistencies that will be examined in this thesis.

Many past studies have grouped all sport participants together to analyse the sporting personality and have not considered whether there are differences between those who participate in extreme or 'non-extreme sport' (Llewellyn et al., 2008). This thesis used university sport science students as they include participants from a variety of sport and therefore represent a heterogeneous mix of sport participants. In addition, university students sport science (or PE students in most countries) are a group often compared in sport literature to non participants. However, research is mixed on whether sports university sport science students are similar or different in personality compared to the general student population. In a study surveying the personalities of undergraduate university sport science students, the results identified university sport science students as more extrovert than other groups of students; in addition female students were more extravert than their male counterparts (Xiangle, 2009). Yet, no difference was found in extraversion between students who majored in Physical Education (PE) compared to those who did not major in PE though results did vary in neuroticism (Xia and Jie, 2002). Other research has shown that students, who volunteer to participate in personality testing, score higher in sensation seeking and extraversion than non-student volunteers (Farre, Lamas and Canf,1995).

Various research studies compared sport participants to non-sport participants (e.g. Dowd and Innes, 1981; Valliant, Simpson-Housley and McKelvie, 1981; Brevik, 1999). Yet research has shown that most non-sport participants are spectators of sport (Van Bottenburg, 2002) and that most spectators are typically involved in some sort of sport (Irlinger, 1994; White and Wilson, 1999). In addition, spectators typically score high on sensation seeking tests (Heino, 2000), which could undermine their use as comparison group. This thesis has chose to use two comparison groups to drag racers; namely, university sport science students and archers.

1.9 Other Factors Affecting Research Findings

There are methodological weaknesses noted in the psychology research literature due to a lack of controlling variables such as:

- Gender: using males and females as one cohort when there are differences identified in studies; randomly assigning men and women to different groups within a study)
- Age: not controlling for age when there are clear differences with some variables between older and younger participants
- Level of performance: utilising athletes in various degrees of expertise or skill when there are differences between outstanding and average participants.

These will now be discussed.

1.9.1 Gender Differences in Relation to Personality and Reaction Time

Many studies on personality in sport, collate results from men and women together and do not examine specific gender differences (Celsi, 1995; Goma-i-Freixanet, 2001). According to Celsi, Rose and Leigh, (1993), with an increasing number of female participants in sport, it is beneficial to the research to compare the results of men and women separately.

In general psychology literature, it is well known that there are significant gender differences in personality trait scores (see e.g. Costa and McCrae 1990; Chapman, Duberstein, Sorensen and Lyness, 2007). In research on risk taking, for example, there is a clear gender divide. Males more often engage in risky behaviour than females do

(Harris, Jenkins and Glaser, 2006). In their meta-analysis review, Harris et al., (2006) concluded that male participants are more likely to take a risk compared to female participants. In examining 'extreme sport', there was a general consensus that there are differences between men and women in making decisions to engage in risky behaviours (Zaleskiewicz, 2001; Eckel and Grossman, 2002; Larkin and Pines, 2003). According to Cooper, Wood, Orcutt and Albino, (2003) personality characteristics are likely to influence women's risk taking behaviour.

Research literature has predominantly shown that males have faster reaction times than females (Welford, 1980; Adam, Paas, Buekers, Wuuyts, Spijkers and Wallmeyer, 1999; Dane and Erzurumluoglu, 2003). However, Silverman (2006) in a meta-analysis review of 21 studies over a 73-year period, evidenced that the differences in simple visual reaction time between the genders may be narrowing. Some recent studies do find females to be quicker in reaction time than males within several age brackets (e.g. Sadeh, Gruber and Ravis, 2002; Hommel, Li and Li, 2004). Thomas and French (1985) carried out a meta-analysis on the sex differences in reaction time across childhood and adolescents. They concluded that there were significant differences across age. As age increases, reaction time decreases for both men and women, though the differential between the two genders is maintained (Jevas and Yan, 2001). In a meta analysis review by Voss, Kramer, Chandramallika, Prakash and Roberts (2009), gender was an overall moderator suggesting that male athletes were faster at cognitive processing than female athletes.

In this thesis, the research conducted with drag racers and the comparison groups has considered gender differences.

1.9.2 Age

Age is an important predictor of involvement in risk behaviour. Generally, young adults have higher involvement in risk taking behaviours than older people (Arnett, 1992; Bradley and Wildman, 2002). Research has demonstrated that young adults score higher on sensation seeking (Martin, Kelly, Rayens, Brogli, Benzel and Smith, 2002) and Giambra, Quilter and Philips (1989) suggested that attention and therefore, arousal decreases with age. Kontos (2004) confirmed gender differences in risk taking with

adolescents. As age increases, risk seeking decreases (Slovic, 2000; Butkovic and Bratko, 2003) and so does sensation seeking (Zuckerman and Neeb, 1980; Ball, Farnill and Wangeman, 1984). Several studies account for age by restricting the sample within a certain age group (e.g. VanZille-Tamse, Testa, Livingston and Harlow, 2006; Rhea and Martin, 2010). Kontos (2004) demonstrated that adolescents perceive situations as less risky than adults. In addition, youth tend to overestimate their ability, which can therefore lead to a significant increase in the risk of injury for adolescents who participate in 'extreme sport'. In this thesis, the research conducted with drag racers and the comparison groups has considered and controlled for age differences.

1.9.3 Level of performance: Elite and Amateur

Eysenck et al., (1982) suggested that research into sport should consider the level of expertise of the performer. Starkes and Ericsson (2003) identified that in sport, the level of performance from novice to expert is a useful differentiation in measuring cognitive perceptual skills such as reaction time. Review papers into sport have shown that elite athletes perform better on cognitive perceptual tasks than non-elite (see Mann et al., 2007). However, in relation to the level of expertise, variations in methodology can account for mixed test results (Lum and Yang, 2005). Indeed, in a meta-analytic review on cognition and sport expertise, Voss et al., (2009), criticised research into expert-novice cognitive perceptual skill, for utilising small sample sizes and suggested that researchers utilise more examples of different sport (e.g. static sport). Voss et al., (2009) coded studies to evaluate the role of moderators such as expertise (and gender).

There is little research that contributes to the understanding of the differences in personality and reaction time latencies between elite and amateur involved in extreme versus 'non-extreme sport'. In studies on personality, Watson and Pulford, (2004) found that instructors (i.e. elite) were higher in extraversion and lower in neuroticism than amateurs and non-participants of 'extreme sport'. Other studies concluded that amateur athletes have a more negative psychological profile than the elite who compete in risk-taking sport (Goma-i-Freixanet, 2001; Castanier, Le Scanff and Woodman, 2010). Though the processing of information between elite and amateur has been evidenced (Allard and Starkes, 1980; Starkes, Allard, Lindley and O'Reilly, 1994; Mann et al., 2007) there are few studies examining reaction time latencies in 'extreme sport'.

Another reason for controlling for level of performance in this thesis is that in some previous studies it has not been controlled for separately from age. For example, the participants in a study by Castanier et al. (2010) had on average, 10 years experience. Whilst in a study by Rhea and Martin (2010), participants ranged dramatically in experience from 2 to 30 years. In drag racing, it will be possible to control for level of performance, as there are both amateur and elite classes.

Studies often combine participants from various 'extreme sports' and compare them to non-participants. Egloff and Gruhn (1996) suggested that differences between outstanding and average athletes are hidden within homogeneous samples; they even criticised their own study for its lack of including top athletes. The reason for the small sample size in this area may be due to problems in finding large cohorts of outstanding athletes who are at the same 'elite' level.

In this thesis, the skill level (amateurs and elites) of participants will be used to examine the differences in personality and reaction time latencies.

1.10 Conclusion

Taking into account the criticisms and weaknesses of existing studies, drag racing will be used as an 'extreme sport' within which individuals can test their own limits or boundaries and at the same time satisfy their innate needs (i.e. arousal, stimulation, thrill seeking and new experience). Furthermore, the present thesis will employ appropriate comparison groups (university sports students and archers) to investigate the relationship between sport, personality and reaction time. The possible impact of gender differences, levels of expertise and age of participants will also be investigated.

The present thesis will investigate personality, sensation seeking and reaction time latencies within 'extreme sport', being the first study to use the sport of drag racing for this purpose. This thesis, by testing within drag racing, will control for the

methodological weakness in the existing literature and aims to make a useful contribution to it. This thesis will investigate whether the ability to make quick and accurate decisions can complement the use of personality measures in order to understand and enhance performance within an 'extreme sport'.

The content and structure of the remainder of this thesis is as follows: For a clearer classification, the review of literature will be divided into two parts. Chapter 2 examines the strengths and weaknesses of early (pre 2000) research underpinning the relationship between personality, sensation seeking and reaction time. Chapter 3 investigates the latest (post 2000) research on personality, sensation seeking and reaction time studies. Chapter 4 will examine the issues that have been raised from the research discussed. In particular, the methodological issues and the significance of gender, age, level of expertise and comparison groups in researching into personality, sport and reaction time. Chapter 5 reviews the current definitions of sport and 'extreme sport', and proposes a new definition of 'extreme sport'. The empirical work starts in Chapter 6 with studies into extraversion/neuroticism and sensation seeking amongst drag racers compared to sport students and archers. In Chapter 7, a further study focuses on the analyses of reaction time latencies for drag racers, university sport science students and archers. Chapter 8 aims to contribute to the existing literature by concluding with a general discussion laying out the implications and recommendations of this doctoral thesis.

2.0 Chapter 2: Key Historical Research (pre 2000) on the Relationship between Personality Traits and Sport

2.1 Preface

In a study by Vanden Auweele, De Cuyper and VanMele, (1993) personality was identified as an important factor in transforming ability into achievement and in impacting on how much effort is given to overall success. How does sporting personality compare to non-sporting personality? Is there a different profile for those involved in 'extreme sport'? Do 'extreme sport' participants have a specific set of perceptual skills?

Historically, Sport Psychology has been fascinated with the relationship of whether personality can predict successful sporting performance. The majority of personality research, conducted in the 1960's and 1970's, explored which factors lead to successful sporting performance in traditional sports (Ruffer, 1976). Studies in the 1970's then focused on the development and the use of personality tests to distinguish between those who might achieve winning performance and those are unlikely to achieve such a high standard.

Though there is extensive research on the relationship between sport and personality, much can be criticised for its lack of robust scientific methodology (Eysenck et al., 1982; Kirkcaldy, 1982; Furnham, 1990). Eysenck et al., (1982) criticised the absence of a disciplined approach as one of the primary reasons why psychology has not achieved scientific respectability, despite its 100-year history of research. Furthermore, he criticised personality studies as being of a low scientific standard often due to small sample sizes. Despite Eysenck's et al., (1982) critical review paper, 10 years later little had changed. Koelega (1992), in his review of studies on extraversion and vigilance over a 30 year period, called for a more systematic approach to research as well as a strengthen of studies through parametric analysis. A few years later, studies such as Davis and Mogk (1994) were still identifying problems in personality research, such as the unsystematic classification of participants as either athletes or non-athletes.

Various reasons were attributed to these inconsistent results, such as inadequate sample size, lack of age control, variation in types of sport (e.g. endurance running) as well as varying performance levels (Egloff and Gruhn, 1996). Research has highlighted methodological flaws in studies of personality, namely, sample numbers, method of data analysis and response distortion (i.e. athletes falsifying answers). In a review paper on personality and physical activity from 1969 to 2006, Rhodes and Smith (2006) wrote that research in this area, was still too limited to draw definite conclusions about potential moderators such as design and instrumentation. They also concluded that multivariate analyses would be beneficial for future studies. Generalising results, which do not take into account the aforementioned variables has therefore lead to lack of consistency in personality and sport research, producing problematic outcomes. This chapter will focus on pre-millennium, classic works such as Eysenck et al., (1982). The subsequent chapter 3, will discuss more recent research post millennium, e.g. Silverman (2006). Furthermore, chapter 4 will deal specifically with the issues being addressed as a result of both old and newer research and its relevance to studies within this thesis.

2.2 The Nature of Personality

Personality can be distinguished by constructs of trait, state and type. Traits are innate pre-dispositions, which can be measured, e.g. being born with an anxious personality. States are situational and transient. For example, an athlete may only experience state anxiety when engaging in a competitive environment. These variables are useful in explaining variations in behaviour within a personality framework, though they have been criticised by those advocating a pure interactions approach (Mischel, 2004).

Traits are hierarchical and linked in with behaviours for example, those who are high-risk seekers also rate low on anxiety in risky situations (Zuckerman, 1994). These correlations generate second order factors called types. Research has shown (Eysenck and Eysenck, 1985) that 3 major second order or super factors exist. These are extraversion-introversion (E), neuroticism-stability (N) and psychoticism–superego (P). Extraversion-introversion is a therefore a core dimension within personality theory.

According to Eysenck and Eysenck (1985), extraverts seek excitement often via the company of others, they are also acknowledged to be friendly and assertive. Introverts, on the other hand, are less outgoing, more self-reserved and less sociable, requiring less stimulation from others, though this may be because they are content with their own thoughts. Neuroticism is another trait in Eysenck's theory concerned with the tendency to experience negative emotional states. Those who score highly are more likely to experience feelings of anxiety, depression or anger. They tend to perceive situations as being threatening and therefore are often stressed. They are self-conscious, have difficulty in controlling urges and thereby in delaying gratification. Neuroticism is also a risk factor for internalising mental disorders such as depression and panic disorders. A further, more extreme dimension is Psychoticism. A description of an individual scoring high on the Psychotic scale (P) would be: egocentric, cold, non-conformist, aggressive-impulsive, hostile, suspicious and antisocial. An individual with a low P score would indicate someone who is cooperative, empathic, caring and highly socialised. These types have typically been identified by a variety of personality measures such as Eysenck's Personality Inventory (EPI), (Eysenck and Eysenck, 1982), the Eysenck's Personality Questionnaire (EPQ) (Eysenck and Eysenck, 1985), the Zuckerman-Kuhlman Personality Questionnaire - ZKPQ (Zuckerman, Kuhlman, Joireman, Teta, and Kraft, 1993) and Neuroticism Extraversion Openness - Personality Inventory-Revised (NEO-PI-R) (Costa and McCrae, 1985; 1992).

The extraversion-introversion connection has been linked in with cortical arousal mediated by the reticular formation. Introverts appear to have higher levels of cortical arousal when at rest different from extraverts. Neuroticism-stability (N) has an association with the limbic system and the autonomic system. Psychoticism (P) is associated with androgens and serotonin. Low sensory stimulation (e.g. sensory deprivation) or high sensory stimulation (e.g. pain) affects those with an introvert or extravert personality in different ways. Introverts are motivated to maintain what they see as adequate levels of stimulation conversely, extravert seek-out strong sensory stimulation rather than to avoid it (Petrie, 1978).

2.3 Personality and Sport

Early psychological research examined the concept of risk, though not necessarily related to sport, and concluded that it was linked with mental illness (e.g. Deutsch, 1926). The psychoanalytic view, regarded physical risk taking as the expression of a death wish, though Anna Freud stated that a high-risk activity served the function of mediating anxieties (Huberman, 1968).

Although there was inconclusive evidence for a specific sport personality profile in the 1960's (Knapp, 1965; Singer, 1969), research on personality did link the traditional sport personality with extraversion (Brooke, 1967; Ikegami, 1970). Eysenck et al., (1982) identified athletes as higher in extraversion and lower in neuroticism than non-athletes. Since then, studies have consistently demonstrated that those who engage in sport tend to have an extravert personality (Kirkcaldy, 1982; Furnham, 1990).

With regards to neuroticism, research examining whether athletes demonstrate stability or low neuroticism as a personality trait was inconclusive (Warburton and Kane, 1980). Lower levels of neuroticism were found in athletes compared to non-athletes (Davis and Morgk, 1994; O'Sullivan, Zuckerman, and Kraft, 1998). However, the conflicting results maybe due to age variability (Eysenck et al., 1982), or the use of coping mechanisms to compensate for neuroticism.

Athletes who engaged in team sport were shown to differ in extraversion (rank higher) than athletes who participate in individual sports (Colley, Roberts and Chipps, 1985; Gat and McWhirter, 1998). In sports where aggression is permissible (e.g. rugby, boxing), athletes measure higher in terms of extraversion than in sports where aggression is not an overt part of performance (Newcombe and Boyle, 1995). There appears to be a lack of consistency as to how personality differs from sport to sport. Danio (1985) concluded that tennis players had higher extraversion and less neuroticism than non-participants. Endurance athletes were shown to be more extroverted than non-exercisers (Egloff and Grunhn, 1996). In more traditional sports such as archery, a study found the personality of archers to be at least as assertive as rowers, cross country

runners, judo players and canoeists (Dolphin, O'Brien, Cahill and Cullen, 1980). In 'extreme sport', mountain climbers were higher in extraversion compared to students (Fowler, von Knorring and Orelan, 1980).

Goma-i-Freixanet (1991) believed that all extreme or risk sports could be researched collectively as a group compared with non-athletes. Goma-i-Freixanet (1991) compared the personality traits of alpinists, mountaineering climbers, extreme skiers and a heterogeneous group of athletes involved in other extreme sports (i.e. diving, water skiing, motor boat racing, white water kayaking, flying, sky diving, paragliding, ballooning, motor racing and adventurism) to non-participants. The study did not demonstrate any differences between alpinists, mountaineers, climbers and skiers. Goma-i-Freixanet (1991) did find that these extreme participants (mountain climbers and skiers) had significantly higher scores on extraversion than non-participants (non mountain climbers). Extreme sport participants also demonstrated the lowest scores in neuroticism (with the lowest neuroticism shown by alpinists), however the scores in comparison to non-participants were not significantly different. Goma-i-Freixanet results are congruent with the studies of Eysenck et al. (1982), who found athletes to be more extraverted and less neurotic.

Breivik (1999) conducted several studies on personality and 'extreme sport' finding that though elite alpinists were extraverts they did not score as high on an extravert scale compared to others who engage in 'extreme sport' (Breivik, 1999). He distinguished between two types of alpinists, dependent upon their cultural background. One type, i.e. English or Italian, he described as more introverted, with relatively high tension and anxiety levels (Breivik, 1999). The other type, Czech Norwegian or Slovakian, were less guilty and anxious (Breivik, 1999). In a comparison of sky divers, alpinists, military recruits and students (Breivik, 1999) he found that skydivers demonstrated higher scores on extraversion, compared to alpinists who were the lowest. Breivik also revealed differences between skydivers and alpinists, on neuroticism and extraversion, which he attributed to the distinct nature of the sports. On the basis of this finding he deduced that each high-risk sport should be studied separately (Breivik, 1999).

In conclusion, research pre-2000 has been consistent in finding high extraversion in sport participants though studies have so far neglected to differentiate between specific factors such as gender, age and level of expertise. Studies into personality and sport have consistently compared those in sport to non-participants though the issue as to whether 'extreme sport' or 'high-risk' sport participants should be investigated collectively or separately has been raised (Goma-i-Freixanet, 1991; Breivik, 1999). Findings in 'extreme sport' at this time have suggested that 'extreme sport' enthusiasts have found lower levels of neuroticism than other groups though this has not always been consistently demonstrated.

2.4 Sensation Seeking and Personality

Zuckerman, Kolin, Price and Zoob (1964) identified a personality type called a 'sensation seeker'. These individuals were high in Optimal Levels of Arousal (OLA) and displayed higher levels of stress due to sensory deprivation than low sensation seekers. He hypothesised that sensation seekers seek more novel and intense situations of stimulation in order to reach a higher OLA and function more efficiently. Conversely, low sensation seekers were nearer OLA and therefore a sensory deprived situation would stress them less. Zuckerman et al., (1964) also postulated that perhaps high and low sensation seekers were similar in their OLA in non-stimulated states. However, extraverts like sensation seekers need more arousal if under aroused and will typically seek activities to fulfil their need for stimulation. Zuckerman et al., (1964) also justified that sensation seeking is integral to personality and reflects individual differences in biological functioning.

In addition to Optimal Levels of Arousal (OLA), the theoretical underpinning for this area came from studies, which focused on Optimal Levels of Stimulation (OLS). OLS is when individuals look for sensory experiences that are beneficial to optimal functioning (Zuckerman et al., 1964). Hebb (1955) said that activities, such as driving fast or motor racing, would serve the function of increasing levels of stimulation and excitement. Those high in sensation seeking were identified as being oriented towards

physical sensations found in thrill-seeking activities (Zuckerman, Bone, Neary, Mangelsdorff and Brustman, 1972). Therefore, some sensation seekers crave high levels of arousal and will tend to make lifestyle choices accordingly in pursuing high-risk sports (Zuckerman et al., 1972).

Initially, experimental studies examined how participants classified as high or low sensation seekers reacted to sensory deprivation. Results demonstrated a relationship between sensation seeking and factors such as anxiety, boredom, hallucinations and cognitive inefficiency (Zuckerman et al., 1964).

Based on arousal and stimulation, personality research began to examine a sensation seeking trait characterised by the need for varied and complex sensation seeking experiences, including the need to undertake physical and social risk (Zuckerman et al., 1972).

From the 1960's onwards, new sports such as drag racing, bungee jumping and base-jumping developed that included greater elements of risk and danger than traditional sports and in line with this trend the literature began to examine high-risk sport. For example, athletes identified as extraverts and sensation seekers, demonstrated a willingness to undertake high risk to satisfy a need for greater arousal (Paulhus, Moline and Schacht, 1979). In the research that followed into the relationship between personality and sporting behaviour, the majority of studies examined skydiving or rock climbing (e.g. Hymbaugh and Garrett, 1974). The role of risk perception was also examined as key to participation in 'extreme sport'. For example, expert rock climbers felt that their ability to participate successfully in this activity outweighed the risk (Csikszentmihalyi, 1975). This was the same with novice climbers (Lefebvre, 1980). The general consensus was that those involved in such activities scored significantly higher on sensation seeking and extraversion than non-sport participants (Zuckerman, 1983). This is similar to the debate that was ensuing between Goma-i-Freixanet (1991) and Breivik (1999) and as to whether all high-risk sport participants could be treated as a group in personality testing. In addition, the definition of what constituted a high-risk

or ‘extreme sport’ could be seen as a confounding issue and this will be discussed again in chapter 5.

2.5 Measuring Sensation Seeking

The measurement of sensation seeking began in 1964, when Zuckerman et al. developed a sensation seeking scale (SSS) subsequently refined and still in use today (there are indeed 6 forms). This scale has been used in numerous studies, which have demonstrated that ‘extreme sport’ participants score higher than participants of lower risk sports (Zuckerman, 1983; Rowland, Franken and Harrison, 1986). The SSS-V includes 4 sub-factors: Thrill and Adventure seeking, Experience Seeking, Disinhibition and Boredom Susceptibility that combine to provide an overall sensation-seeking score. The Thrill and Adventure Seeking (TAS) subscale reflects the desire to be involved in physical activities that provide unusual sensations and experiences such as mountain climbing or skydiving. Experience Seeking (ES) concerns the pursuit of new experiences using the mind and senses such as music, art and reading. The Disinhibition (DIS) subscale indicates the extent of sensation seeking through other people. These activities include socially ‘deviant’ behaviours such as wild parties, binge drinking or even wild inhibited parties. Finally, the Boredom Susceptibility (BS) subscale represents an aversion to a repetitive situation and this trait is linked in with those high in psychopathological personalities. The internal reliability coefficients for SSS form V ranges from .83 to .86 making it the mostly widely used form of the SSS. In addition, there is a strong positive correlation between the sensation-seeking trait and extraversion (Zuckerman, 1994).

Risk taking is a correlate of sensation seeking but is not the primary motive in behaviour. Sensation seekers accept risk as a potential outcome of obtaining arousal; yet do not seek out risk for its own sake (Zuckerman, 1994). According to Zuckerman (1983), sensation seeking (on which the scale was constructed) is marked by a need for ‘novelty and complexity’ of stimulation. In 1994, Zuckerman added that sensation seeking is a “trait defined by the seeking of varied, novel, complex and intense sensations and experiences and the willingness to take physical, social, legal and

financial risks for the sake of such experiences” (p.27). This trait can be satisfied through various activities such as sport, lifestyle choices or job choice (Arnett, 1991; Zuckerman, 1994). A study by Glicksohn and Abulafia (1998) illustrated how personality measures and sensation can formulate a specific profile for occupational risk takers such as bomb disposal experts as the results on the Sensation Seeking Scale–Form V along with the Eysenck Personality Questionnaire-Revised-Shortened (EPQ-R-S, 1985) measure. The participants were found to be high on 3 Sensation Seeking subscales (Experience Seeking, Disinhibition and Boredom Susceptibility) and on neuroticism.

In examining the relationship between personality tests and sensation seeking tests (i.e. the EPI, EPQ, MMPI and 16PF), results demonstrated a significant, though moderate correlation between the Sensation Seeking Scale and the EPI (Zuckerman et al., 1972). Zuckerman et al., (1972) found that the Thrill and Adventure subscale had the highest correlation with extraversion as measured by the EPI. However, none of the subscales were significantly correlated with neuroticism. Zuckerman et al., (1972) found that the Minnesota Multiphasic Personality Inventory (MMPI) was the best overall correlate with all the subscales of the Sensation Seeking Scale, though the significance of the subscales did vary across the samples. For example, the Disinhibition subscale was only moderately correlated for females. In the other subscales, there was a high to moderate correlation between the MMPI and the Experience Seeking subscale for females. With the Thrill and Adventure Seeking and Boredom Susceptibility subscales there was a low to moderate correlation in gender in females however no correlation with males. The inconsistencies may have been due to small sample sizes and unequal numbers of males and females in these studies according to Zuckerman (1994). The Catell’s 16PF correlated well with the subscales of the SSS and especially with the impulsive, non-conforming type of extraversion (Zuckerman et al., 1972). Zuckerman et al., (1978) in a larger study compared the SSS to the EPQ and it was only moderately correlated to extraversion. However, unlike the EPI study, extraversion was most highly correlated with the Disinhibition subscale rather than the Thrill and Adventure subscale.

The above studies demonstrate the difficulties in examining sensation seeking and personality without taking into account factors such as gender and other factors. For example, Eysenck and Zuckerman (1978), examined the differences between gender, age and culture where they discovered an inverse relationship between sensation seeking and age. Additionally, they discovered that the scores attributed to the subscales of Thrill and Adventure Seeking and Disinhibition decreased faster with age than those in the Experience Seeking and Boredom Susceptibility subscales.

An alternative way of measuring sensation seeking was proposed by Arnett (1994). He conceptualised sensation by advocating a psycho-physiological interaction between the social environment and an individual's genetic predisposition. The Arnett Inventory of Sensation Seeking (AISS; Arnett,1994) focuses on the novelty and intensity of the activity, does not consider socially unacceptable norm breaking behaviours, and does not examine sport.

Whilst much of the early research from Eysenck and Zuckerman (1978) suggested that there was a very strong link between sensation seeking and extraversion in sport, the results of studies into sensation seeking have generated mixed findings. Malkin and Rabinowitz (1998) found that high-risk sports showed a medium relationship with sensation seeking as did Arnett (1991) and Smith, Placek and Smoll, (1992). Other studies (Goma-I-Freixanet, 1991; Wagner and Houlihan, 1994) found a low relationship with sensation seeking (see review paper- Roberti, 2004 with studies from 1985 to 1998).

2.6 Personality and Reaction Time

What is the relationship between personality, sport and reaction time? Is the speed of processing visual information an important factor in predicting successful performance in 'extreme sport'?

Brebner (1980) showed that extroverted personality types had faster reaction times whereas Nettelbeck (1973) demonstrated that the anxious personality types had faster reaction times. In a variety of sports, anticipation was studied and was identified as an essential part of sporting success (Jones and Miles, 1978). However, they said that in other sports the introvert might rely on feedback as a corrective measure.

In Eysenck's review paper (Eysenck et al., 1982), reaction time is identified as a dispositional determinant within personality. With driving, he referred to it as a habitual activity and stated that the extent to which an individual reacts quickly or slowly is related to the traits of extraversion-introversion within the general context of personality. He also stated that extraverts tended to trade accuracy for speed (Eysenck et al., 1982).

In relation to sport, Eysenck identified baton passing, football passing and returning a serve in tennis as examples of activities requiring quick reaction times. In an unpublished study on different types of rifle and pistol shooting ranging from prone shooting to running boar shooting (Coleman, 1979 as in Eysenck, et al., 1982), a comparison was made into the differences in extraversion and reaction times using the EPI between the different groups of shooters. A further study looking at novice and experienced skiers identified a strong positive correlation between level of competency and visual reaction time (Stejskal, 1982).

2.7 Reaction Time and Length

Early reaction time studies were conducted in the 19th century. Reaction Time (RT) is defined as "the interval between the presentation of an unexpected stimulus and the initiation of the response" (Schmidt and Lee, 2005, p.466). Most of the studies examining reaction time used mathematical formulas on the average amount of time taken to perceive a stimulus and react with a simple movement. The brain activity in how information is processed is one of the oldest areas of study in psychology. Information on the average processing time, i.e. 189.5 msec (Ladd and Woodworth 1911, as cited in Vickers, 2007) and based on 9 empirical studies. Since that time,

continued research has confirmed that vision is the slowest of the sensory systems (180-200msec), followed by auditory (140-160msec), and lastly, kinaesthetic (120-140msec) which is the quickest (Brebner and Welford,1980).

The existing literature has examined various aspects around reaction time such as the differences between the types of stimuli exist whether or not the participant is required to take a simple response or a complex one (Sanders, 1998). However, if visual stimuli are longer in duration then they may evoke quicker reaction times (Froeberg, 1907 as in Kosinski,2009) and the results could be similar to reaction times for auditory stimuli (Wells, 1913 as in Kosinski, 2010). If the intensity of the stimulus is weak then reaction time is longer. If the intensity of the stimulus is consistent (moderate or strong) then the reaction time is also consistent (Luce, 1986). The variation between reaction time to light and sound can be reduced if high enough stimulus intensity is utilised (Kohfeld, 1971).

Psychological studies differentiate between reaction time and response time, combining the two to produce the reaction phase; response time is defined as the time needed to conduct the movement, whereas reaction time is the time taken to initiate it. The Fractionated Reaction Time Paradigm illustrates the following components of response time: 1) a warning signal to get ready 2) a signal to start the movement or 'go signal' 3) the first observable movement 4) the time when the movement ends (Ladd and Woodworth, 1911 as cited in Vickers, 2007).The reaction time period commences after the warning signal and consists of the pre-motor time and motor time. In the pre-motor time, limited movement can be detected when using an electromyography device (EMG) to assess the generation of muscular movement. During the motor time, a contraction of the muscles starts to take place. In relation to 100m sprints in sport competition, the verbal instruction, 'on your marks' starts the runners as they rise from the blocks awaiting the 'go' signal or firing of the gun. The average threshold for auditory reaction actually ranges from 140-160 msec though the international athletic community has set 100 msec. Sprinters who remove their foot from the back block - which detects movement – prior to 100 msec after the sound of the starting gun, are disqualified. Runners argue though, that with training, response time can be quicker

than the 100msec as allowed by the rules. Runners therefore, have to delay their exit from the blocks from 100-120 msec. Similarly, in drag racing, reaction times of less than 0.4 of a second, result in a red light and disqualification.

Hick's Law (Hick, 1952) explained that the time needed to prepare a response depends on the amount of stimulus-response (SR) choices, which need to be processed in order to undertake that response. In the 100m sprints, various stimuli are displayed such as the starter's voice, the sound of the gun, the noise from the other racers and the crowd. These stimuli can be paired with the necessary motor response such as assuming the starting position, getting set, the shift from the front foot to the push from the back foot etc. Hick's law discussed a linear relationship whereby the number of stimuli and response pairs increase in relation to reaction time. An overwhelming amount of information can therefore distract and thereby prevent an athlete from achieving their best performance especially with a novice athlete. In motorsport, in addition to external stimuli, vehicles have are numerous dials and digital readouts that drivers need to react to using both hands and feet. In drag racing, there can also be a long duration while waiting for the commencement of a race and there are long periods between races.

2.8. Reaction Time Models

Theoretically, Schmidt's model is the most comprehensive, and extensively referred to, cognitive-behavioural model of motor learning (Schmidt, 1991). There are 14 designated processing events in this model: 1. stimulus identification, 2. response selection, 3. response programming, 4. memory, neural, network, reference, minor neurons, 5. motor program, 6. spinal cord, 7. muscles, 8. observable movement, 9. environment, 10. response produced feedback, 11. comparator, 12. error, 13. measured outcome, and 14. external feedback. Reaction Time (RT) constitutes the first 1-7 events and the time associated during this part of the process can greatly vary depending on the sport and other variables.

Open and closed loop motor control can provide an understanding as to how reaction time is influenced by and interacts with movement time. Closed skills are repetitive skills often in a series of movements, which required technical ability. Open skills operate in environments where strategy is vital as the actions of opponents and the physical environment varies. If movement time is brief, then the athlete is operating under an open-loop control, as there is limited time for feedback. For example, the forward swing of a baseball bat, a forward stroke in tennis or a final extension of the hand in dart throwing, are all actions that occur in under 200msec. These movements are managed in advance, as there is limited time for feedback on how the action was performed. Conversely, a closed-loop movement may exceed 200msec and during the course of the skill there could be several changes. So for example, during a golf drive (900 -1400 msec) a golfer could make 3-4 alterations during the duration of the swing (e.g. keep the elbow in, shift the weight, watch the ball).

It takes time to process all the environmental informational cues especially if that information is complex, say in an extreme sport. In addition, when there is a new situation or with a novice involved, there is the added dimension of attentional choice. When a motor task is executed in sport then the majority of information is dismissed in favour of sport specific information. This process of attention has a limited capacity so only small amounts can be concentrated on at once. Selective attention is used as a filtering system to include or block out information (Neisser and Becklan 1975). In competitive sport especially, athletes learn to develop attentional skills in order to master the information that is important for successful achievement in their sport.

In research on information processing two types of systems are identified, i.e. bottom-up or top down processing. The bottom-up processing system proceeds in a “single direction from sensory input, through perceptual analysis, towards motor output, without involving feedback information flowing backwards from higher centres to lower centres” (Corbetta and Shulman, 2002 p.101). With bottom-up processing, the identifiable features such as a piece of sports equipment or the sporting location such as the track would most likely be perceived subconsciously and then used to guide motor

behaviour. The extent to which one or both of these processes transpires, regulates how an athlete manages their visual attention.

The bottom-up features of a sports object or location are the characteristics that stand out and do not require any conscious processing. Saliency is an important feature of bottom up processing. Salient features are intrinsically conspicuous (Itti and Koch, 1999) and affect pre-attention as well as the orientation of attention. A salient aspect occurs very quickly and is led by a bottom up approach. If a stimulus is suitably salient then it will stand out prominently from a visual setting. Saliency is therefore processed in a pre attentive fashion. The speed of this saliency is on the order of 25-50 msec per item (Itti and Koch,1999). When salient aspects are new or unusual they will demand urgent attention. In sports, salient features can be illustrated as: the spin of a ball, the orientation of a racket, and sudden movement of something on the track. These salient features can be used effectively in sport depending on whether an athlete is also able to use top down processing.

“During top down processing the flow of information is from higher to lower centres conveying knowledge derived from previous experience rather than sensory stimulation” (Corbetta and Shulman, 2002, p.201). Top down processing emanates from the higher cortical areas of the brain. It is influenced by previous experience and knowledge. Motor performance is influenced by both bottom-up factors such as something new and expected as well as by top down factors such as anticipation and expectancy. In sport, the degree to whether bottom-up or top down controls processing dominates is often debated. Experienced athletes train to ignore many bottom-up stimuli or distracters (such as opponents and crowds) and to focus on top down aspects. Amateurs often struggle in distinguishing between the two.

2.9 Reaction Time in Sports

The ability to process visual information fast is an important if not vital skill in various sporting activities such as cricket, boxing and drag racing. The advantage in having quick reaction times may be to instigate a quicker motor response or to make quicker

decisions. In some sports, of course, visual displays are of a very short duration such as in the reaction time needed in response to the start lights in motorsport. There is extensive evidence to support the fact that people vary in their ability to process short duration visual displays (Adam and Wilberg, 1992). Short-term visual storage or iconic memory is often debated in psychology (e.g. Kahnemann and Treisman, 1984) however it is usually agreed that these memories last for approximately 250 msec (Adam and Wilberg, 1992). In sport, success may also be linked with the ability to process visual information quickly. In cricket for example, successful batsmen were faster and more effective at picking up information from rapid visual displays than less successful batsmen (Deary and Mitchell, 1989).

Other studies in sport focus on specific skills or content dependent perceptual skills. Research has predominantly found that elite athletes have advanced perceptual skills in sport specific tasks. For example, in a study comparing basketball players to non-players, experienced players were significantly better than non-players at recalling structured game information (Allard and Starkes, 1980) The interaction between high level perceptual skills and sport specific structured displays suggests that an encoding of structure is vital to an elite athlete's successful performance (Allard, Graham and Paarsalu, 1980; Adam and Wilberg, 1992). The rate of visual processing in reaction time may also differentiate between top ranked athletes and bottom ranked athletes in basketball and hockey (Adam and Wilberg, 1992).

Evidence for whether physical activity or exercise can affect reaction time is mixed. Athletes or participants who are physically fit have demonstrated faster reaction times than non-participants (Welford, 1980). Those who maintain a heart rate of 115 bpm also have shown very quick reaction times (Levitt and Gutin, 1971).

There are a variety of factors that affect cognition and decision-making such as physical activity, order of presentation, health, impending stimuli and arousal. Easterbook's cue utilisation theory (1959) was devised to account for how differences in physical activity produce variations in cognitive functioning such as attention and decision-making. With low levels of exertion, cognitive processing may be weak as both relevant and irrelevant

cues are attended to. As exertion levels increase, attention narrows until it reaches the level when attention is directed towards cues that are relevant. If the physical requirements continue to increase and extend further than the individual's optimal level, then the ability to focus on task relevant stimuli may be inhibited affecting cognitive performance in a negative way.

2.10 Reaction Time and Cues

There is a sequential effect on reaction time when more than one stimulus is presented. If the presentation is a series of identical stimuli then reaction time is quicker than if the way the stimuli are presented varies. The shifting of attention between two types of stimuli or task produces an increase in reaction time to both. Welford (1980) and Broadbent (1971) reviewed studies showing that distractions increase reaction time. A warning stimulus presented prior to the testing of reaction facilitated faster times as long as the warning was no longer than approximately 0.2 sec (Brebner and Welford, 1980). The shorter the warning stimulus the quicker the reaction time (Bertelson, 1967) which may be explained by the fact muscular tension cannot be easily sustained for more than a few seconds (Gottsdanker, 1975).

Moderate amounts of caffeine decrease the time it takes to find a target stimulus and to prepare a response for a complex reaction time task (Lorist and Snel, 1997). Tiredness results in a reduction in reaction times especially when the task is complex (Singleton, 1953).

2.11 Reaction Time and Arousal

Arousal as a key factor affecting reaction time was mentioned by Eysenck et al. (1982) in a review paper. Reaction time is faster when a moderate level of arousal is present. When a participant is in a state of high arousal or low arousal then reaction time is at its slowest.

This is consistent with Yerkes Dodson's inverted U curve (Yerkes and Dodson, 1908). It illustrates that a moderate level of arousal is needed for optimal performance demonstrated by quick reaction time. This was utilised in sport by Hardy in 1997, and demonstrated that moderate arousal is best of optimal performance.

See figure 1 below.

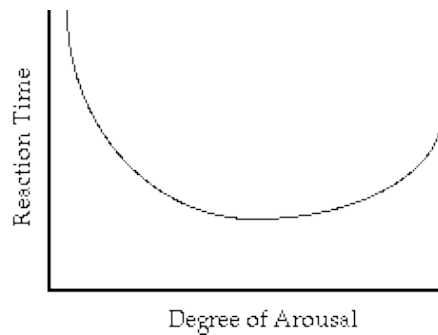


Figure 1 - A graphic display of the relationship between Degree of Arousal and Reaction Time. Yerkes-Dodson Effect, 1908.

There is an emotional link between anxiety and performance that is important to note in sport. Eysenck and Calvo (1992) pointed out that anxiety decreases performance efficiency and results in longer reaction times and that stress or anxiety reduces cognitive processing. Baddeley (1986) in his working memory model proposed that anxiety affects decision-making and results in poor responses. Anxiety can narrow attention (Easterbrook, 1959) and increase focus on distractions or irrelevant cues (Eysenck and Calvo, 1992). In drag racing how much does the anxiety of engaging in an 'extreme sport' affect reaction times? A study conducted by Janelle, Singer and Williams (1999) involved a simulated motor racing task where the participant had to 'drive' quickly while responding to relevant and irrelevant cues. The result revealed that anxiety affected peripheral narrowing and increased the focus on irrelevant cues. However, can anxiety and arousal, so much a part of extreme sport, actually help athletes to perform well?

Eysenck and Calvo (1992) proposed that when anxiety is high and the task is stressful – i.e. perception of ability to cope outweighs resources available, then performance efficiency and effectiveness decrease.

2.12 Reaction Time and Other Factors

There may be other factors, especially in sport, that impact on reaction time. Eysenck et al., (1982) suggested that when a participant feels there is a reasonable chance of success then effort is increased. Self-confidence along with an ability to see anxiety as facilitative or debilitating may also influence performance (e.g. Carver and Schier, 1988). Of course, the implementation of coping strategies can also help. Cognitive anxiety may improve performance due to increased motivation requiring optimal resource management (Hardy, 1997).

Decision making, particularly under stress, is an important skill for those in sport and particularly for participants of extreme sport who need to react appropriately in a very short time in order to avoid danger. Perceptual skills such as those that empower athletes to focus on relevant cues are key. Training in cognitive skills such as teaching athletes how to better anticipate what is going to happen, how to attend to relevant and critical cues, and overall the skill in becoming a more effective decision maker is therefore important. These cognitive skills are the very foundation required for the development of successful motor and tactical skills. The research in this thesis is intended to facilitate the training of athletes, coaches and other elites in sport specific reaction time training in order to enhance performance by understanding the relationship between personality and reaction time.

2.13 Conclusion

Research has so far identified that extraverts tend to search for stimulating events. As the environment does not always provide a choice of socially acceptable activities, so there is a strong probability that an individual will seek out risky behaviours in order to

satisfy a need for stimulation (Farley, 1971). The general consensus is that those involved in such high-risk activities, score significantly higher in sensation seeking and in extraversion than non-participants (Davis and Morgk, 1994). Therefore extreme sport may be an outlet for satisfying this high need for stimulation and a way of raising arousal levels through a socially acceptable means (Farley, 1971; Eysenck and Levey, 1972; Zuckerman, 1994).

There is a typical personality profile that is evident in sport and this is one, which demonstrates high extraversion and sensation seeking. There is also a tendency in sport for particularly successful athletes to be low on neuroticism. However, results are often inconsistent due to the lack of controls for moderating variables such as age and gender in the research. There are also issues with regards to the level of expertise and whether the sport is an extreme one or not that needs addressing in research.

Whilst much of the early research from Eysenck and Zuckerman (1978) suggested that there was a very strong link between sensation seeking and extraversion in sport, the results of studies into sensation seeking have generated mixed findings. Malkin and Rabinowitz (1998) found that high-risk sports showed a medium relationship with sensation seeking and other studies showed a low relationship with sensation seeking, i.e. Robinson, (1985), Goma-I-Freixanet (1991), and Wagner and Houlihan (1994).

Research studies on reaction time have predominantly failed to demonstrate a strong correlation between processing abilities and level of performance. Reaction time measures of processing speed are susceptible to accuracy biases (Pew 1969; Pachella, 1974). So the differences found in research on reaction times may not as adequately reflect difference in basic information processing as much as demonstrate differences in preferences for speed versus accuracy. Study into this area is needed, especially in extreme sport where reaction time is paramount to the successful completion of the activity and this in turn could reduce the risk of injury or even death.

The development and measurement of specific reaction time measures may be a key to the understanding of extreme sport. Visual information processing is an important determinant of sporting performance however, it is not the only determinant as other factors such as personality, gender, age and level of performance may account for the variations in performance (e.g. Adam and Wilberg, 1992). The next chapter will now move on to explore the latest research in these areas.

3.0 Chapter 3: Key Historical Research (post 2000) on the Relationship between Personality Traits and Sport

3.1 Preface

The use of a pre and post 2000 division on psychological research is, though somewhat arbitrary, being used to mark the difference between the earlier foundations in sport psychology research and the latest advances in sport psychology on its journey to become a recognised profession. Research into sport has shifted post 2000, and there is a generally movement towards multi and interdisciplinary sport science approaches which includes a stronger integration of psychology within sport and exercise science. This means that the emphasis on sport research, in this millennium, is more focused towards examining the whole athlete in terms of exercise, training, psychological readiness, injury prevention and performance. The British Association of Sport and Exercise Scientists (BASES) is raising the profile of sport and exercise through the issuing of expert statements on the application of scientific principles to sport and exercise science. Highly important, in the century, is the focus from the British Psychological Society and the Health Profession Council on the development and regulation of Sport and Exercise Psychologists. This chapter is therefore focused on post millennium research.

The study of personality in sport has risen in popularity since the start of the century, due to recent successes in predicting the likelihood of achievement (Aidman, 2007), performance motivation (Judge and Ilies, 2002) and leadership (Judge, Bono, Ilies, and Gerhardt, 2002). Aidman (2007) was 84% successful in predicting the transition of athletes from junior to senior teams over a 7-year period. These results were supported by another longitudinal study (Gee, Marshall and King, 2010), which confirmed the importance of personality testing with professional hockey players in predicting achievement. A meta-analysis provided evidence that some personality traits were consistently associated with leadership emergence and effectiveness (Judge et al., 2002). So, despite continuing concerns over methodology identified in the chapter 2, the

importance of personality as a viable area of in sport remains, for its value in predicting sporting success and also because of its strong link with performance (Raglin, 2001).

Sport psychology research, i.e. post 2000, has more of a combined sport and exercise focus. This is primarily due to the governmental health agenda, which aims to reduce obesity and to increase fitness levels in the UK population. The impact of these health targets have meant that relationship of personality to sport, as well as to exercise, has been examined in this thesis. For example, Rhodes and Smith (2006) reviewed studies from 1969 to 2006 on personality and physical activity (including sport). Extraversion was identified as a consistent personality trait though other personality factors were also examined. The review however, suggested that results of this relationship were still inconclusive, as potential moderators such sex and age are still not carefully controlled. The researchers also attribute this lack of findings due to the limited number of studies. In addition, sensation seeking as a personality trait received support as a key correlate of physical activity. Those high in sensation seeking may see physical activity as a way to meet their needs in taking on something new and challenging whilst those with low extraversion may avoid physical activity because of a contrary disposition.

The study of risk-taking has become practically synonymous with the sensation seeking theory and the sensation scale (Ferrando and Chico, 2001). A great deal of research has supported the relationship between sensation seeking and participation with risk taking behaviours, some have included risk-taking in sport (Zuckerman and Kuhlman, 2000; Llewellyn and Sanchez, 2008). However, in examining sensation seeking as a personality trait in high-risk activity, it appears that current studies are still only demonstrating a moderate correlation (Furnham, 2004). Yet, the sensation-seeking trait is associated with a variety of personality traits such as extraversion that can be of practical significance in identifying preference for risky and non-risky behaviours in alcohol use and sexual attitudes (Roberti, 2004). One socially acceptable way of expressing sensation seeking is through sport and particularly through extreme sport.

Post millennium, extreme sport is increasing in popularity with almost one in seven adults in the UK, i.e. 14 % participating (Campbell and Johnson, 2005). It is quite

popular to purchase extreme sport 'gift days' or to undertake extreme sporting events for charity. The proportion of individuals doing at least one extreme event has doubled between 2001 and 2003 to 5 % (Campbell and Johnson, 2005). The rate of participation in extreme sport is therefore increasing and besides personality traits it is apparent that those in extreme sport need certain skills to undertake these high-risk activities. Many sports, especially extreme sport, require athletes to have quick and accurate reactions whilst maintaining high levels of motor skill (Chmura, Nazar, Kaciuba-Uscilko and Pilis, 2002). However, there is limited research in examining sport and reaction time with the majority of reaction time studies examining the relation of exercise to cognition (e.g. Chumura et al., 2002). The results of reaction time and physical activity studies are mixed. In a study by Kashihara and Nakahara (2005), vigorous activity was shown to acutely increase reaction time. However, contradictory evidence was demonstrated in other studies (e.g. McMorris and Grayden, 2000; Tomporowski, 2003). In a meta-analysis into sex differences in simple reaction time, a decrease in gender differences was demonstrated and attributed to the fact that more females are now participating in 'fast action' sport (Silverman, 2006).

With the increasing interest into the subject of personality in the new millennium, studies are demonstrating that personality is still a viable area to research, that extraversion is still a consistent factor in sport, that sensation seeking is a correlate of sport and physical activity, that risk taking may still be integral to sensation seeking, that there is a rise in extreme sport and that reaction time studies need to examine gender change.

3.2. Personality and Sport (post 2000)

In examining contact versus non-contact sports, McKelvie et al., (2003) did not find a significant difference in extraversion between athletes and non-athletes or between contact and non-contact athletes though athletes were higher in extraversion than college norms. This is contrary to earlier studies (e.g. Newcombe and Boyle, 1995) mentioned in the previous chapter. With neuroticism, athletes were significantly lower than non-athletes (McKelvie et al., 2003) and this is consistent with previous research mentioned

in chapter 2 (e.g. Danio, 1985). What is still a typical weakness of their study, is the heterogeneous nature of the sample group that consisted of mixed groups of athletes, i.e. engaged in a wide variety of contact sports, such as American football, rugby, basketball and soccer. There was also a heterogeneous group of non-contact players, i.e. baseball, volleyball, track and golf. Finally, there was a non-participant sample, whose only criteria was whether they played sport for the university or not. The authors do acknowledge this as a flaw as this comparison group may have played a recreational sport or exercise in the gym or do no sport nor exercise at all.

Separating athletes by sport was addressed, post 2000, in some studies, which chose to use homogeneous sample groups. Tušak and Bednarik (2001) examined Slovenian ski jumpers and found them to be high in extraversion whilst Tušak, Burnik and Robiè (2001) demonstrated that divers possessed higher levels of extraversion than recreational athletes. The results of personality testing amongst American Footballers were compared to other sports (Schaubhut et al., 2006) using a commercial test called the California Psychological Inventory 260 (CPI 260). This personality test used in coaching, leadership development, and retention was sponsored by a business. The study contributed to the literature, as American Football, a very popular sport in the USA, is very much a contact sport and has not been researched hitherto. The study analysed a very large sample of 812 North American professional football players, though the results are difficult to compare to other international personality studies due to the uniqueness of this sport and the uniqueness of this personality test. Differences between different positions, i.e. offense and defence, with the sport were even accounted though the most significant difference was that football players score very high in leadership even when compared to world leaders.

This new millennium has seen the beginning of a growth of different personality tests in sport, such as the CPI 260 referred to in the above paragraph, the EPQ and the Five Factor Model (FFM). In a study on high-risk sport, Kajtna, Tusak, Baric, and Burnik (2004) deviated from the usual EPI/EPQ and utilized the FFM even though their study states, “this model is not generally recognized in modern (sport) personality research” (p.25). They compared 3 sample groups: high-risk sport, non-risk, non-athletes. The

group of 38 high-risk athletes was a heterogeneous group consisting of alpinists, skydivers, paragliders, white water kayakers, downhill mountain-bikers, motocross riders, downhill skiers and ski jumpers. The 38 non-risk athletes included those in a variety of sports such as swimmers, track athletes, sailors, flat-water kayakers, rowers, nordic skiers, climbers and karatekas. There were also 76 non-athletes. A strength of this study, was that age was controlled. However, the limitation of this research was the lack of control in the nature of sample groups including variables such as gender and performance levels, which was not consistently controlled.

The use of comparison groups is an issue that is raised in this thesis. Though the use of students or sport students as participants in psychological studies is not unusual, the type of students utilised needs careful consideration. Sport students may have a profile, which differs from other students and is more in line with the general heterogeneous sporting population. Recent studies from China compared the personalities of sport degree students with general university students. Xiangle (2009) found undergraduate sport students to be higher on extraversion than other students. Han, Meng, and Li (2005) showed that the more undergraduate students were involved with sport the higher their scores on extraversion. Alternatively, recent Iranian research (i.e. Nia and Besharat, 2010) compared sport students and club athletes from a variety of sports ranging from martial arts and boxing to water polo. They did not find any significant differences in extraversion or neuroticism between athletes and students though the researchers concluded that there were differences between those who played individual versus team sport. The majority (approximately 66%) of the participants were male, so gender was not an issue.

Studies emerging from new international research are using students as comparison groups, and comparing them to heterogeneous samples of sport participants. In the Watson and Pulford (2004) study into the personality of skydivers compared to non participants, 80% of the nonparticipant group were full-time students. The use of university sport students will be discussed later on in this thesis.

3.3. Personality and Sensation Seeking

Post 2000, the sensation seeking scale SSS-V is still commonly used in sensation seeking research (i.e. Zuckerman, 1994). Homogeneous studies have found specific sensation seeking profiles in sport. For example, Taylor et al., (2001) found that on SSS-V subscales recreational scuba divers were higher on Thrill and Adventure Seeking (TAS) and Experience Seeking (ES), yet lower on Boredom Susceptibility (BS) than the general population. There were not any overall differences in sensation seeking between the two groups. These results added the profile of scuba divers, to the sport psychology literature although only 30 divers were in the sample. The strength of this study contributes to the debate that sport specific studies with homogenous groups need to be undertaken.

Whilst a homogenous sample was used in the previous study, other important variables, such as level of performance, are rarely controlled for. In a study that did control for level of performance and experience, instructors were compared to amateurs in skydiving, hand gliding and rock climbing (Watson and Pulford, 2004). The results showed that instructors and amateurs were higher on extraversion and lower on neuroticism than non-participants. Once again the profile on the non-participants is questionable as most of the non-participants were students and the majority were also single. The researchers did acknowledge this as a weakness as unlike the non-participants the instructors (similar to the elites in this thesis) were older with families. It is interesting to see that different levels of performance, i.e. amateurs and instructors, could be a differentiating factor in examining extreme sport. The sample size was relatively small and only included 38 men and 28 women. The average age was 32.6 years. In extreme sport, age can be quite an important variable as experts are often older. In addition, extreme sports are not always opened to those who are young as they may be expensive and require a certain amount of skill, training and specialised equipment.

A study by Rhea and Martin (2004) controlled for age and level of experience. Experience ranged from 2 to 30 years with a mean of 10 years. Unfortunately, the study did not compare those more experienced to those less experienced. Participants were

from a wide range of sports ranging from 'alternative' to traditional sport. Their study included 50 participants in contemporary alternative sport which included wakeboarding, down hill race skiing/snow boarding, and even a drag racer. In addition, they studied what they defined as a traditional alternative sport, i.e. bull-riding. Finally, they examined traditional sports by studying 70 university sport science students involved on teams in tennis, volleyball, baseball, rugby and swimming/diving. The results showed no differences between the two alternative groups in terms of personality; however, the alternative groups were higher on sensation seeking than those in the traditional sports (tested on the SSS-V). The alternative groups were also more reserved and self-sufficient (assessed through Cattell's 16 PF). The study was conducted in order to assess whether the rehabilitative needs differ for each of the groups that has a more medical than sport performance focus. However, the comparison with other sports is interesting though the use of so many sports raises issues such as how dissimilar, for example, are rugby players (traditional) from snow boarders (contemporary alternative)? How similar are rugby players (traditional) to swimmers? How different are motor cross racers (contemporary alternative) from bull riders (traditional alternative)? Are there differences found specific in different sports?

Besides differences between types of sport, selected studies post 2000 have controlled for gender. Goma-i-Freixanet (1991; 2001) showed a clear link between extraversion and thrill and adventure seeking as a subscale of sensation seeking in males (Goma-i-Freixanet, 1997) and in females (Goma-i-Freixanet, 2001). In her 2001 study, she compared personality tests (i.e. SSS-V, EPQ-R) of occupational risk-takers, high-risk (HR) sport participants, prisoners and non-risk takers. The high-risk sport differed from the non-participants on all scales except boredom susceptibility (BS), which was expected though sports women did not differ from the anti-social group on any of the sensation seeking (SS) subscales. They differed significantly from the pro-social group on experience seeking (ES) and sensation seeking (SS). The high-risk sport group was lower than the anti-social group on neuroticism. This is contrary to her previous study on males (Goma-i-Freixanet, 1997). The high-risk sports women group differed from the control group on experience seeking (ES) and disinhibition (Dis) but did not differ from the anti-social group on the same variables. High-risk sport women had the most

homogeneous distribution on sensation seeking suggesting that they are quite similar as a group. However, again this study can be criticised as the sports group participants from a wide range of sports i.e. alpinism, mountain gliding, mountain skiing, pot holing, scuba diving, water skiing, aviation, parachuting, gliding, hang gliding, micro light flying, ballooning, motor racing, and multiathlon. The occupational group scored significantly lower than the risky sport group and anti-social group on experience seeking (ES) and total sensation seeking (SS). Controlling for gender was a strength in these studies because variations in gender with regard to risk-taking was found to exist (Kontos, 2004, Eagleton et al., 2007).

Other studies have focused specifically on one gender, e.g. women involved in risk-taking sports, non-risk sports and those who do not participate in risk-taking sport (Cazenave et al., 2007; Woodman, Hardy, Barlow and Le Scanff, 2010). The results of these studies showed that recreational high-risk sport participants scored significantly higher on the total sensation seeking (SS) and on the thrill and adventure (TAS) subscale. On the experience seeking subscale (ES) the recreational high-risk sport participants also scored significantly higher than non-participants. There are difficulties in comparing non-participants to those in high-risk sports however the use of a female only cohort, though it is not a means of controlling for gender, it is a useful comparison. The studies did not control for type of sport as various sports were included in either risk or non-risk sports. A further weakness of these studies was the lack of control for age that was found to be a significantly different between the groups. Non-participants in these studies were younger than recreational high-risk sport participants who were younger than elite risk-takers. Kontos (2004) demonstrated that age needs to be taken into account in research, as risk taking could be a correlate of age.

Recent studies on personality and sensation seeking continue to examine the differences in sport and extreme sport participants by comparing them to non-participants, i.e. students (often university or university sport degree students). Studies are mixed in controlling variables such as age, gender, performance level and homogeneity of sport, which is still a major criticism of current research.

3.4 Sensation Seeking Testing

Although, the sensation seeking scale (SSS) (Zuckerman, 1994) is still predominately used post 2000 in studies on risk and sensation seeking, the Arnett Inventory of Sensation Seeking (AISS; Arnett, 1994) mentioned in the previous section was used by Cazenave et al. (2007). They identified a major limitation with the AISS in not being statistically relevant and criticised the test for not selecting items on the basis of psychometric analysis or exploratory factor analysis. However, there is a major criticism over the internal consistency of the AISS (Roth and Herzberg, 2004), which was described as being one-dimensional compared to the SSS-V (Haynes, Miles and Clements, 2000). Cazenave et al., (2007) justified the use of the Zuckerman's (1994) sensation seeking scale in measuring sensation seeking.

3.5 Sensation Seeking, Sport, Risk and External occupational comparisons

Post 2000, the use of the sensation seeking scale is not exclusive to research in sport. Recent studies have utilised the test by comparing athletes in high-risk sport to those who encounter an occupational risk and, or emotional aspects of risk. The personality of inmates compared to the general population on sensation seeking (Herrero and Colom, 2008) showed inmates to be higher on all subscales of sensation seeking however not higher on extraversion. This is similar to the profile of those in high-risk sport who also demonstrated a high tendency towards extraversion.

Knust and Stewart (2002) supported the idea that personality traits are effective in explaining and predicting behaviour. Knust and Stewart (2002) see this debate as one of the most persistent in the 20th century with Zuckerman's sensation seeking theory and Eysenck's personality theory as crucial to the underpinning of this type of research. In analysing the results for their study into offenders, Knust and Stewart (2002) suggested that there is a distinction between socialised and unsocialised sensation seeking. This is a concept similar to that of Glicksohn and Abulafia, (1998) who proposed that thrill and adventure seeking (TAS) and experience seeking (ES) is a socialised sensation-seeking

trait whilst disinhibition (DIS) is an impulsive, unsocialised form of sensation seeking (ImpUSS). Unlike the general population, their sample of offenders had high levels of hostility. Glicksohn and Abulafia (1998) found experience seeking (ES) as a socialised trait in offenders. However, their research is not new as Zuckerman (1994) discussed how the subscales of disinhibition (DIS) and boredom susceptibility (BS) could be combined as a cluster of impulsive and un-socialised SS (IMpUSS). Disinhibition (DIS) has always been an un-socialised trait and experience seeking (TAS/ES) has been seen as socialised.

The studies above may not seem entirely relevant to this thesis which focuses on extreme sport participants however, the work of Knust and Stewart (2002) disputes that the sensation seeking traits are primarily linked with extraversion. Unlike extreme sport, it is natural to expect that anti-social risk takers would be lower in extraversion. Furthermore, these studies can be criticised for their small sample sizes.

Glicksohn, Ben Shalom and Lazar (2004) conducted a sensation seeking study, examining those in high-risk pro-social professions as opposed to anti-social offenders. As a predictive measure, the authors felt that the thrill and adventure seeking subscale could be predictive of those who would be suited to a high-risk occupation. In a comparison of a sample of bomb disposal experts to anti-terror operatives, the bomb disposal experts were found to be more independent. The personality profile of the high-risk, pro-social experts (experts due to occupation) was similar to sensation seeker with regard to emotionally stable.

In a study, which compared pro-social occupational risk takers to extreme sport enthusiasts, Goma-i-Freixant (2001) tested 4 groups of women in: the police, risk-taking sport, in prison (incarcerated). These groups were compared to non risk-taking participants. The results revealed that women who were classified in the anti-social, risk-taking group (incarcerated) scored significantly higher in sensation seeking than the pro-social group (those employed in risk taking occupations) or in comparison to those in high-risk extreme sport. Some research has shown that extreme sport participants have a preference for high-risk (non sport) activities (Franques et al., 2003; Diehmand

Armatas, 2004). It is important in any study to identify and thus define whom the high-risk participant is in order to study risk.

Risk taking has been regarded as pre-meditative with an element of uncertainty in which there are potentially negative consequences (Ades and Lejoyeux, 2004; Pedinielli, Rouan, Gimenez and Bertagne, 2005; Cazenave et al., 2007). However, taking the above idea of risk further, Ranieri (2009) dissects the idea of risk and distinguishes between positive risk and pathological risk. Pathological risk, he sees as 'extreme risk seeking' leading to 'deliberately seeking danger to arouse strong emotions as part of a pathological behavioural addiction'.

According to Woodman et al., (2010) participants of high-risk sports may have problems with their emotions and difficulties in relationships and therefore participate in high-risk activity as an agent of their emotions. However, Mischel et al., (2004) viewed risk-taking in women as a way to reduce boredom. Extreme sport participants however, do not fall into this boredom susceptibility category nor do they appear to participate in order to be anti-social. It seems apparent that there is a difference between those that participate in high-risk sport and those that undertake risk in other aspects of their lives.

Risk in sport is different from risk in occupation or through anti social behaviour. Risk or risk of injury is an accepted part of sport. However, risk infers uncertainty and lack of control, not necessarily of oneself but of environmental or external elements. In studies that examine extreme sport, it is often taken for granted that participants are risk takers. However, participants in extreme sport report that they see themselves as being in control. Risk as a factor for many participants is seen as a negative component rather than a driver (Brymer and Oades, 2009). This supports the premise that athletes tend to be low in neuroticism (Eysenck et al., 1982). Those that compete in high-risk sports have also been shown to be emotionally stable as well calm in difficult situations which is required for top level performance (Breivik, et al., 1994). In conclusion, research is still consistent that athletes (low and high risk) are lower in emotional control or neuroticism than non-risk athletes (Kajtna et al., 2004).

In the post 2000 literature, extreme sport participants were depicted as disciplined and focused. They lack a reckless or risk-taking temperament, a fact that seems to parallel the years of dedicated training needed to proficiently undertake many extreme sports. Indeed, many are devoted to their sports, possessing a real “sense of courage and humility” (Brymer, 2009, p.114). Some research has even taken this further to say that extreme sport participants engage for the holistic experience (Willig, 2008). This is true in some extreme sports where a spiritual focus may be needed, such as an endurance marathon through the Himalayas or base-jumping. In fact, this altered spiritual state of consciousness comes from having participated in the sport/experience and is a motivating factor, which drives extreme sport participants to continue. It is reinforcing in itself but may not a personality trait that predisposes someone to participate in extreme sport.

Research from the 20th century demonstrated that extreme sport participants tend to underestimate risk. This tendency has been well correlated with sensation seeking, as stated in the last chapter (Zuckerman, 1994; Rossi and Cereatti, 1993). More recently, Napier, Finley and Self (2007) introduced the theory of risk homeostasis in which each person has their own acceptable level of perceived risk. If this perceived risk becomes too great, then an individual will take action to reduce that risk in order to return it to an acceptable level. Similar perhaps to the cognitive dissonance theory where a dilemma or feeling uneasy is something that has to be resolved. If the level of perceived risk is too low, then the individual will seek risk in an attempt to increase the level of perceived risk and return it to the target level. Thus, a homeostatic effect is achieved through the continuous adjustment of perceived risk. Participants can see extreme sport as a positive way to ‘charge their batteries’ (Willig, 2008). The author of this thesis, however believes that extreme sport participants are very aware of the risks. Taking a risk is counter-intuitive to being safe and those in extreme sport report how their fear grows the more they participate in their sport and this linear relationship continues until such time as they withdraw from the sport or suffer from an accident or worse.

In conclusion, research on high-risk or ‘extreme sport’ has risen in popularity in the 21st century. Selected studies have focused on controlling one or two variables such as type

of sport or gender, demonstrating the importance of investigating these factors. Issues such as risk are being debated and studies have incorporated high-risk occupations and high-risk sample groups (prisoners) as a comparison. The issue of stability is being examined as an emotional control issue whilst, extreme sport as a holistic experience is debated. There is still lack of control over homogenous groups. The use of personality tests and sensation tests are still being used. Personality studies are growing internationally, e.g. China and Tehran. The use of personality studies to predictive sporting achievement is being researched. However, the need to control variables scientifically is emerging from this thesis as a vital requirement if literature is to grow in this area.

3.6 Reaction Time and Sport

Reaction time is a well-researched area in psychology; however, few studies have attempted to address a link between personality, sport and reaction time, although this was a relationship identified by Eysenck et al. in 1982. Reaction time studies in relation to personality have looked at extraversion, neuroticism and the differences between age and gender (Kosinsk and Cummings, 2010). In a gender-based study on personality and reaction time in a signal detection task, men were significantly faster and less variable than women, who were more sensitive to the stimuli. Men were higher in extraversion than women who were higher in neuroticism (Burton et al., 2010). This is consistent with Conner, Epstein, Angold and Klaric (2003) who found similar results for youth. Their study focused on vigilance using a Continuous Performance Task (CPT), which measured selective attention and impulsivity to maintain consistent focus while ignoring distracting stimuli.

Eysenck and Calvo's (1992) theory related that when anxiety is high and the task is demanding, resources are exceeded and performance efficiency plus effectiveness decreases. It could be inferred that as extreme sport continuously pushes the boundaries of human limitations it thereby impacts on performance. A study by Murray and Janelle (2003) presented neutral, distracting and relevant cues during a motor racing task. Performance efficiency did vary and the results were attributed to high trait anxiety (and

consequently high neuroticism). Few studies to date have examined this relationship of anxiety with reaction time in sport (Woodman and Hardy, 2001; Williams et al., 2002).

Williams et al., (2002), conducted a study on the effects of anxiety by placing participants in various anxiety provoking situations while undertaking a table tennis task. The study consisted of a very small sample of 10 players including 2 females with an average age just under 29 years old and playing time on average 1.8 times a week. Accuracy was taken as a measure of performance effectiveness and probe reaction as one of the measures of performance efficiency. They found that high levels of anxiety had a negative effect on performance efficiency and effectiveness in both low working memory – unexpected - and in high working memory tasks. This only partially supports Eysenck and Calvo's (1992) theory. In addition, participants had high levels of confidence, regardless of the levels of anxiety, unlike Eysenck et al.'s (1982) suggestion that perception of a successful outcome is an important motivating factor.

There is limited evidence to indicate that participation in sport affects reaction time (RT); however, recent studies have examined physical activity and its impact on RT, whilst controlling for variables such as age and sex (Silverman, 2006). A meta-analysis conducted by Reifschneider (1999) pointed out that participants over the age of 55 who exercised regularly had faster RT than people who did not exercise. This may be due to the effects of exercise on cognitive functioning (Tomprowski, 2003). Other recent studies have examined the impact of variables such as anxiety (as mentioned previously), moving objects, driving, caffeine and smoking on RT. Finally, studies which have related reaction time to specific factors such as fatigue, endurance, sleep, and advance warning to sport will also be discussed to add to the overall picture of reaction time and sport in the new millennium.

Investigating the psycho-physiological aspects of training and competition in sport is an important in the development of top-level athletes (Williams, Hodges, North and Barron, 2006). Lifestyle factors such as smoking can affect the reaction time of athletes. Smokers who were abstaining from cigarettes and wore a nicotine patch had faster reaction times on recognition reaction time tasks than non-smokers who, while wearing the patch, also demonstrated better accuracy (Froeliger, Gilbert and McClernon, 2009).

Drinking coffee or moderate amounts of caffeine will decrease the time it takes to find a target stimulus and the time needed to prepare a response for a complex reaction time task (Durlach, Edmunds, Howard, and Tipper, 2002). Caffeine was useful in enabling sleep-deprived soldiers to maintain their reaction times and marksmanship (McLellan, Kamimori, Bell, Smith, Johnson and Belenky, 2005). Sleep deprivation affects cognitive functioning. Studies often use exercise to measure the effects of fatigue on sport, as it is easier to control in an experimental situation (see previous studies) and because training or exercise is a key component of sport.

However tasks that included exercise resulting in voluntary exhaustion, did not produce any significant improvements in cognitive performance (Tomporowski, 2003). This review paper identified that the outcome of sub-maximal exercise leads to an improvement in cognitive functioning such as reaction time and memory. The review further suggests that maximal exercise tasks, requiring decision-making, generally lead to quicker response times with no change in the participants' error rates. The review did not include studies investigating the effect of fatigue on the performance of speed discrimination. Studies examining participants in target sports have coined the term "speed discrimination" (Clifford, Beardsley and Vaina, 1999; Huang, Lu, Zhou and Liu, 2008; Overney, Blanke and Herzog, 2008) as a perceptual skill required for accuracy and skill with moving targets.

The effect of acute exercise on the reaction time to a visual stimulus was examined in a study of 12 participants who were tested at rest and during cycling. An increase in exercise resulted in an increase in arousal level and resulted in a narrowing of attentional focus (Ando, Kokubu, Kimura, Moritani and Araki, 2008).

In a sports specific study, the reaction time of students who played baseball and basketball were compared to inactive students (Nakamoto and Mori, 2008). Results showed that the sports students had faster reaction times than sedentary students. In addition, the baseball players, most likely due to real experience, had faster reaction times to specific sport tasks than all other students. In a study by Kashihara and Nakahara (2005), vigorous exercise increased choice reaction time, but only in the short

term. This was supported in research demonstrating that exercise on a stationary bicycle improved reaction times (Davranche, Audiffren, and Denjean, 2006).

Contradictory results has been in shown in various other studies (cited in reviews by McMorris and Graydon, 2000; Tomporowski,2003). No significant increase in reaction time was demonstrated on a test of soccer skill as a result of exercise (McMorris and Graydon, 2000). Choice reaction time and error rate in soccer players were not affected by exercise on a stationary bicycle (Lemmink and Visscher, 2005). Exercise did not increase the reaction time of soccer players (Pesce, Tessitore, Casella, Pirritano and Capranica, 2007). Collardeau, Brisswalter, Vercruyssen, Audiffren and Goubault (2001) found that in runners there was no post-exercise effect, though exercise increased reaction time while exercising. The study attributed this to an increase in arousal during the exercise. In a study examining the RT of older people, results indicated that reaction times did not improve as a result of a 22-week water exercise programme (Lord, Matters, St George, Thomas, Bindon, Chan, Collings and Haren, 2006).

The idea that exercise may be facilitative or debilitating to those in sport is an important issue, as training is essential in order to be proficient at sport. It is therefore important that an exercise program in training is organized to be most efficient in order to allow athletes to gain maximum benefit. In many sports, there is an endurance element that requires athletes to engage in play over a long period of time or to compete in several qualifying competitions over a period of days. This endurance element necessitates athletes to sustain high levels of both motor performance and perceptual skill over the period of an event (Thomson et al.,2009). It is expected that fatigue will be experienced during a competition that can hinder performance (Aune, Ingvaldsen and Ettema, 2008).

Studies on the effect of fatigue in sport have shown that being tired, places limitations on both physical and perceptual skills (Royal et al., 2006). Muscular tension due to fatigue reduces the brain's ability to work quicker (Etnyre and Kinugasa, 2002; Masanobu and Choshi, 2006). However, physical activity/exercise increases arousal and therefore may enhance reaction time (Davranche et al., 2006). The results of a recent study measuring arousal in a continuous performance (Vaez, Mousavi, Barry and Clarke, 2009) showed that some participants' results match the Yerkes Dobson inverted

U curve (figure 1). Other studies demonstrated a linear relationship between arousal and reaction time (e.g. Hull, 1943). In a study of soccer players, cognitive results were enhanced while undertaking both moderate and maximal exercise than at rest though this resultant outcome was attributed to enhancement in decision making rather than improved accuracy (McMorris and Graydon, 1997). This is supported by a study conducted with Polish soccer players (Chmura et al., 2002) where improvement in choice reaction times occurred as a result of progressive workload cycling protocol. Advanced notice of a stimulus can increase the number of mistakes made prior to the presentation of the stimulus (O'Neill and Brown, 2007). When two stimuli are linked together, then the reaction time for the second event may be impeded by the presentation of the first due to conscious expectation (Perruchet, Cleeremans and Destrebecqz, 2006). However, according to a meta-analysis of reaction time by Silverman (2006) there is no relationship between sex, age with presence or absence of a warning signal arguably due to limited research. Many sports need participants to achieve quick yet accurate reaction times in order to perform effectively (Chumura et al., 2002).

The results of studies into the speed of decision-making as measured in speed and accuracy of perceptual task are inconsistent (Royal et al., 2006; Thompson et al., 2009). In a task requiring participants to discriminate the speed of a moving object following exercise, improvements in decision-making were demonstrated in terms of speed but not in improvements in accuracy. Post fatigue differences were only shown in relation to decision-making accuracy in a cohort of national level players. Decision-making decreased and errors increased in soccer elite, basketball and volleyball due to fatigue. This also illustrates the importance of controlling for level of performance. In a study by Ak and Kocak (2010) male tennis players made fewer mistakes than females in anticipation reaction time. So experience in decision-making in being quick yet accurate may be related to level of performance and other variables, moreover this may be an important relationship for those who participate in extreme sport.

3.7 Conclusion

In conclusion, studies on perceptual skill development for sports often vary according to the requirements for particular sports, e.g. ball skills, target skills. To date, no distinct pattern of difference has been established in the perceptual-cognitive processing skills of athletes participating in various sports (Thomson et al., 2009). The focus of sport research, often based on visual processing in relation to performance, varies. For instance, some research has examined choice reaction time in sports that have shown a positive relation with increasing exercise intensity until energy expenditure levels reach a maximal point (Tomporowski, 2003).

Alternative studies have utilised speed discrimination for e.g. tennis players outperformed triathlon competitors (Overney et al., 2008). In volleyball, significant differences were demonstrated between beginners and advanced players (level of performance) in estimating the speed and direction of a moving object. However, no differences were shown in relation to the amount of accurate responses associated with the recognition of the speed and direction of the moving objects (Kioumourtzoglou, Kourtessis, Michalopoulou and Derri, 1998). Finally, there is no evidence to indicate that speed in relation to driving has an impact on reaction time, as noted in the Silverman review (2006). This is important to note in relation to this thesis where a driving focused sport, namely drag racing, is being investigated.

In summation, extreme sport, post 2000, is on the increase and the integration of sport and exercise, post 2000, has contributed a variety of research studies and reviews into personality, risk taking, physical activity and sport. With respect to all of these studies, it is still evident that those in sport or who are physically active are more extraverted than non-participants. Literature on physical activity and personality has also demonstrated a significant relationship with sensation seeking though only a moderate correlation with high-risk activity.

There is a re-emergence of study into personality for its predictive nature and still a need for personality research to be more scientific as it is still lacking in terms of controlling for variables. It is essential that all new research can examine the core issues outlined in chapters 2 and 3 of this thesis. Studies also need to categorise extreme-sport not solely on the basis of risk but to examine homogeneous samples so that clear inferences can be explained. Chapter 4 will highlight and discuss these issues.

4.0 Chapter 4: Gender, Age, Level of Performance in Personality and Reaction Time

4.1 Preface

Overall, research progress in the area of personality has been weak, leaving many psychologists to question the significance of the relationship between sport, personality and reaction time. A consistent pattern of the sporting personality has therefore not yet been established, due to the lack of methodological rigour, whereby key variables such as gender, age, type of sport and level of performance have not been effectively controlled for. Furthermore, and of specific interest to this thesis, there has been lack of conceptual rigour as to the meaning of what is ‘extreme sport’ as a term that is often referred to as ‘high-risk’.

In sport, where predicting talent and sporting success is a growing ‘business’, being able to improve research outcomes in sport psychology is a particularly valuable exercise. Personality, sensation seeking and reaction time may be used to predict sporting capabilities and influence the likelihood of achievement in a particular sport. However, if sport psychology research is to be applied to sporting situations, then specific issues have to be identified and addressed. This chapter will discuss the variables, i.e. gender, age, level of performance, and the issue of comparison groups, which have been neglected in order to establish how personality and reaction time may influence sport.

4.2 Gender Differences

The fact that there are significant gender differences in personality trait scores is not new to the psychological literature (see Costa and McCrae, 2001; Chapman et al., 2007) but very little of the research in psychology has examined the differences between personality and gender in a sporting context. The following section highlights the key findings and the various inconsistencies in sport psychology research.

Gender differences in personality were compared (O'Sullivan et al., 1998) and results showed that sports women followed the typical trend of being higher in neuroticism than men. Feher, Meyers and Skelly (1998) found males as being less neurotic than females in rock climbing. Female body builders were less neurotic and higher in extraversion than population norms (Freedson, Mihevic, Loucks and Girandol, 1983). Contrary to this, Fuchs and Zaichkowsky (1983) found that males and females had similar personality profiles in bodybuilding.

It has been demonstrated that those who play in a team sport score higher on extraversion than those who participate in individual sport (Eagleton, et al., 2007). When comparing males and females who engage in team sport, females have scored lower on extraversion than males (Colley et al., 1985).

Evidence for potential moderators of personality with regards to gender and physical activity were inconclusive. Rhodes and Smith (2006), in a review of 33 studies conducted from 1969 to 2006, did not conclude any significant findings. The authors of this review paper attributed the lack of findings to the small number of studies available which have controlled for gender differences. Traits such as extraversion were evident, though a link between personality and physical activity was not concluded. The researchers suggested that future studies are required before any conclusions can be made.

Men and women are different when deciding whether or not to engage in risky behaviours, (Zaleskiewicz, 2001; Eckel and Grossman, 2002; Larkin and Pines, 2003). Kerr, Au and Lindner (2004) conducted a survey, which concluded there were significant differences between men and women on the desire to participate in high and low-risk sport. Males are typically more willing to engage in risky behaviour than females and concurrently perceive these risks as less serious (Spigner, Hawkins, and Loren, 1993). Kontos (2004) attributed this to the fact that females possessed a higher perception of risk, therefore participated in fewer risk taking behaviours, whilst males demonstrate a greater propensity for sensation seeking than females (Ballet al., 1984).

On measures of sensation seeking, males have demonstrated higher scores than females. The largest gender differences as measured by the sensation seeking scale (Zuckerman, 1994) have been shown on the sub-scales for thrill seeking and disinhibition (Zuckerman, 1994). However, studies have not considered the differences that may exist between women who compete in high-risk sport alongside men for example within drag racing.

Personality studies have demonstrated that those high in extroversion have fast reaction times and are less accurate, than those high in neuroticism who have slower reaction times and are more accurate (Brebner, 1980). With regard to gender, studies have predominantly shown that males have faster reaction times than females and even when training or practice is increased, this difference remains reliable (Welford, 1980; Thomas and French, 1985; Adam et al., 1999; Dane and Erzurumluoglu, 2003).

In actual terms, the mean time to press a key in response to a light stimulus, in males, is 220 msec and 260 msec for females. Reaction time to a sound stimulus is more similar between the genders, i.e. 190 msec for males and 200 msec for females (Bellis, 1933). In a study by Engel, Thorne and Quilter (1972), these times were slower, although there was still a clear difference of 227 msec for males and 242 msec for females.

A warning stimulus improves reaction time, although research on whether this differs between the sexes is very limited. Research examining the affect of warning stimuli on gender differences in reaction time, was conducted by Philip, 1934. In which with an impending signal, girls were significantly quicker than boys and although the differences were not significant. Boys were faster than girls without a warning stimulus. In his review paper, Silverman (2006) speculates that an impending stimulus, or warning, would appear to slow down females or slower respondents more than males or faster respondents.

So does the gap in reaction time between the genders appear to be changing? In the Olympics of 1928, the 100 meters sprint record was 10.8 seconds men and 12.2 for women resulting in a difference of 1.4 sec. In the Olympics of 2008, the records were 9.69 for men and 10.78 for women with a difference of 1.09 between the sexes. Since 1908 to 2008, the record in the women's 100 meters has dropped by 12% compared to

10% with men. There is also diminishing time differences between the genders in swimming, specifically in the crawl (Guttmann, 1991). The differences between males and females have decreased from a 12.41% difference in 1936 to a 5.2 % difference in 1980. However, in shooting sports research has found that men were quicker than women in aiming at a target, though women were more accurate (Barral and Debu, 2004). This may be due to more modern sport science training. However, if it were just due to training then differential between men and women would have stayed the same. Alternatively, the reduction in reaction time between the genders may be due to an increase in participation of females in sport (Silverman, 2006). The results of a survey conducted by the National Federation of State High Schools Association between 1972-2001 showed that female involvement in sport tripled during this 30-year period whereas male involvement only grew by 4%.

The research does show that there are clear gender differences and also that more women are now competing in sport. Studies, which do not account for gender can have inaccurate results. For example, a study by Christenson and Winkelstein (1988) can be criticized for having twice as many males in the 'athlete' group as opposed to the 'non athlete' group.

Developmentally, Thomas and French (1985) carried out a meta-analysis examining differences in gender for reaction time across childhood and adolescents. They did not conclude that there were significant differences across age for girls and boys. However, in a more recent study of handball players, boys demonstrated faster visual reaction times than girls (Dane and Erzurumluoglu, 2003). Some recent studies do find females to be quicker in reaction time than males within several age brackets (e.g. Sadeh et al., 2002; Hommel et al., 2004).

Culturally, Silverman (2006) in his meta-analysis of reaction time studies found a difference between women living in United States of America (USA) and women from 11 other countries. Silverman (2006) speculated that this difference could be due to the fact that American women are more actively engaged in motor performance activities such as driving and fast-action sports than women outside of the USA. Silverman (2006) predicted that continuing at the current pace, this differential could narrow substantially.

The above review, demonstrates that gender differences need to be taken into account when investigating into the role of personality on sporting performance. Personality studies in the past have inconsistently accounted for these differences though reaction time studies have more often taken gender into account.

4.3 Age

In regard to the relationship between personality/sensation seeking and age, adolescent athletes scored higher on extraversion and lower on neuroticism compared to non-participating adolescents. In studies on risk-taking, adolescents perceived situations as less risky than adults (Kontos, 2004) and sensation seeking declines with age (Zuckerman and Neeb, 1980; Ball et al., 1984).

Silverman (2006) in his review examined several cross sectional studies and concluded that there is lack of empirical support for the age-reaction time relationship. In a cross sectional study which utilized a go-signal reaction time measure, boys and men were faster than girls and women though the sex-age interaction was not significant. Therefore the study summarized that the sex difference in reaction time is steady across age (Williams, Ponsse, Schachar and Logan, 1999).

However, as age increases, reaction time decreases for both men and women and the differential between the two is maintained (Jevas and Yan, 2001). Measures on simple reaction time improve with age up until the late 20's and then slowly decrease until the 50's and 60's. By the 70's, reaction time has considerably deteriorated (Jevas and Yan, 2001; Der and Deary, 2006). This is especially more noticeable when undertaking tasks that are viewed as complex reaction time tasks (Luchies, Schiffman, Richards, Thompson, Bazuin, and DeYoung, 2002; Der and Deary, 2006). The reason for this reduction due to age, may be physiologically based, e.g. it could be a sign of Alzheimer's (Gorus, De Raedt, Lambert, Lemper and Mets, 2008), though it could be based on experience in processing as older people tend to be quicker at collating information (Myerson, Robertson and Hale, 2007) though more considered in their

response (Botwinick, 1996). Older people prefer concentrating on one task at a time rather than multitasking as younger people often do (Redfern, Muller, Jennings and Furman, 2002). Therefore studies need to isolate age, as this may be a significant factor.

4.4 Levels of Performance

Although there is an abundance of research investigating the differences between elite/expert and amateur/novice, there is very limited research on the differences in personality between these elites and amateurs, involved in extreme sport. According to research, professionals have more sophisticated and elaborate knowledge compared to amateurs. Elite participants recognise (Allard and Starkes, 1980) and recall more proficiently than amateurs (Williams, Davids, Burwitz, and Williams, 1994; Starkes et al., 1994). Research comparing elite to amateur, has shown that the elite are faster and quicker in anticipatory skills than the amateurs. Though distinguishing between different levels of performance in sport psychology studies is vital in the way in which different performance levels are differentiated is not always consistent. An example of once such study, was conducted by Egloff and Gruhn (1996) who identified endurance athletes as expert or novice according to the amount of training hours they pursued. Those undertaking 11 or more hours of training per week were classified as 'outstanding' athletes whereas those who participated less than 4 hours a week were designated as 'average' athletes. Another study into the high-risk sport of skydiving, conducted by Watson and Pulford (2004), distinguished level of performance by differentiating between expert-novice according to the role of the participant. They compared instructors, amateurs and non-participants, showing that the instructors scored significantly higher on extraversion and lower on neuroticism than non-participants in high-risk sport. Results indicated that all participants (both amateurs and instructors) of skydiving tend to be extroverts. In a study by Price and Bundesen (2003), novice skydivers experienced much greater emotional contrast from pre-jump to post-jump than did more experienced skydivers who were shown to be much more stable with a lower neuroticism score.

According to Celsi et al (1993), skydiving participation allows the committed participant to transcend everyday life. This is similar to Zuckerman's (1994) desire to seek out an activity in order to counteract boredom or Brymer's (2009) humanistic self-actualising reasons. Therefore elites and amateurs should also score higher on boredom susceptibility and experience seeking on the Sensation Seeking Scale (i.e. SSS-V) than non extreme sport participants.

In studies on reaction time, Thompson et al., (2009) noted that the differences between elites and amateurs need further investigation. Kioumourtzoglou et al., (1998) reported significant differences between samples of elite and novice volleyball players in the mean estimation time of speed and direction of a moving object using computer based stimuli. However, differences were not found between the groups in relation to the number of correct responses associated with the identification of speed and direction of the moving objects. As yet no researchers have found a clear pattern of differences in the perceptual cognitive processing skills of athletes involved in different sports (Williams, 2002).

The superior speed in reaction times demonstrated by elite athletes seems to be based predominantly on cognitive representations involving anticipatory skills as opposed to a faster processing nervous system (Abernethy, 1987). Professional Tennis players, for example, can anticipate the spot where an opponent's ball will land even before the opponent's racquet has touched the ball (Williams, Ward, Knowles, and Smeeton, 2002) by picking up subtle motion cues in their opponents.

In undertaking reaction time testing, it is important to consider that studies have demonstrated that participants who have spent time practicing tests of reaction time are more consistent than those who have limited practice undertaking reaction testing (Sanders, 1998). The advantage of practice, on tests of reaction time seems to diminish after 3 weeks (Ando, Kida and Oda, 2002). Also, if a participant makes mistakes, for example pressing the key before presentation of the stimulus, then subsequent reaction times are slower as the participant becomes more careful (Sanders, 1998). Feedback to participants about mistakes can inhibit reaction time testing (Koehn, Dickenson, and Goodman, 2008).

Experience or training can improve reaction time on complex tasks can improve accuracy (Visser, Raijmakers, and Molenaar, 2007). In karate, experienced performers had quicker reaction times than less experienced performers. However in volleyball, inexperienced players were shown to have quick reaction times than experienced players though they were also low on accuracy (Fontani, Lodi, Felici, Migliorini and Corradeschi, 2006).

In summary, research on sporting performance has provided evidence of personality differences between levels of performance amongst amateurs and instructors (Watson and Pulford, 2004) and demonstrated the importance of isolating level of performance in sport (Duffy, Baluch and Ericsson, 2004). Differentiating between level of performance in this thesis will allow a focus that could be crucial in examining the sporting personality. Furthermore, studies in extreme sport have been weak in comparing elite to amateur participants. Instead, athletes are often grouped together as a homogenous sample of 'extreme sport' participants. In this thesis, using the sport of drag racing, it was possible to control for level of performance, as there are both an amateur and elite classes. There is much evidence from the literature that the expert-novice relationship is indeed a useful division and that therefore this focus of elite-amateur may contribute to the understanding of sporting personality.

4.5 Comparison Groups and Homogeneity of Sports

Studies in sport frequently examine sport participants as a homogeneous group, combining anyone who participates in any type of sport. Watson and Pulford, (2004), for example, examined the personality differences of those who participated high-risk sport by grouping together participants from skydiving, hang gliding, paragliding, scuba diving, micro lighting and rock climbing. Breivik, et al., (1994) found personality differences between high-risk groups and suggested a filter system. They proposed that studies select participants from each sport and distinguish between levels of proficiency. In 1999, Breivik supported his proposal in finding that elite alpinists are low in neuroticism than amateur alpinists. On the basis of this finding he concluded that each high-risk sport should be investigated separately.

Finding a control group, who do not participate in sport or any physical activity, is difficult. In fact, Van Bottenburg (2002) indicated that those who do not participate in sport are also most likely to be sport spectators. However, spectators, according to researchers are frequently sport participants (White and Wilson, 1999; Thrane, 2001). In addition, according to Irlinger (1994) the more often people watched sport on television, the greater the likelihood that they will participate in an organised and competitive sport. In addition, spectators, as mentioned previously, are more likely to be score on sensation seeking (Heino, 2000). One of the comparison groups within this thesis, are university students who are all homogeneous in that they are undertaking sports degrees and all do some physical activity or sport. Trying to find a group of 'non-participants' who are individuals who do not participate in any form of sport, exercise or physical activity and who are not spectators would be extremely difficult.

4.6 Conclusion

There are several issues raised in this chapter concerning research in personality and reaction time in sport. Salient factors which emerge from the research which suggest the following points need to be considered: gender differences, differences between age groups, differences in level of performance and consideration of comparison groups. Due to the aforementioned points, sport psychology studies into the field of personality have been severely criticised due to the lack scientific rigour. These issues will be taken into account in the studies presented in this thesis in chapters 6 and 7. Prior to the experimental research for this thesis, the issue of what is 'extreme sport', which will be discussed in the chapter 5.

5.0 Chapter 5 - Defining Sport and ‘Extreme Sport’

5.1 Preface

If one is able to define X, then one is able to know whether or not you are predicting correctly anything about X. Therefore one is given extremely strong reasons for correctly defining any X which one desires knowledge of or about (Socratisc. 469 BC – 399 BC).

The present chapter is aimed at defining the term ‘extreme sport’. The term 'extreme sport' has been used as an overarching phrase to encompass all types of sports from skate boarding to base-jumping. This broad definition has therefore produced a muddled collection of research findings, which means that any kind of review of just ‘extreme sport’ is difficult as there is lack of consistency in the use of one term. In order to undertake a comprehensive search therefore, a researcher must first be familiar with the wide variety of synonymous terms. The most prevalent term used interchangeably is 'high-risk' which supports a premise for ‘extreme sports’ being a collection of activities which predispose one to a high chance of injury compared to sports with a normal risk where one is relatively safe from serious injury.

Palmer (2002) considered risk and death a defining feature of any ‘extreme sport’ definition. However, the implication that those who engage in extreme sport are all high-risk participants is an over simplification. In studying this novel group of drag racers, there were challenges in placing this cohort within the context of ‘extreme sport’ and in comparing the research to ‘high-risk’ sport and traditional sport. This is why the exploration of the definition of 'extreme sport' is worthy of investigation.

In what follows, are the concepts and definitions of sporting activity, which will be examined, followed by a new definition of what is ‘extreme sport’. A new definition is important in being able to address scientific inconsistencies in future chapters in this fast growing and important area of sport.

5.2 The Changing Definitions of Sport and ‘Extreme Sport’

The concept of sport is changing as new activities such as ‘base jumping’ and ‘extreme mountain ironing’ challenge our perception of ‘what is sport’. Eysenck et al. (1982), in their review paper began by highlighting the problems inherent in the definition of sport. Eysenck, et al. (1982) used the Collins dictionary to define sport as “amusement, diversion, fun, pastime, game... individual or group activity pursued for exercise or pleasure often involving the testing of physical capabilities...” (Eysenck et al.,1982), p.1). Arguably, this type of definition is overly inclusive, incorporating activities of amusement and pleasure whereby virtually anything that is non-work could be considered sport.

The current definition of ‘sport’ is “all forms of physical activity which, through casual or organised participation, aimed at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels” (Council of Europe’s European Sports (CEES) Charter, 1993, article 2). This broad definition of sport can encompass ‘traditional’ sports such as archery as well as those hitherto regarded as ‘extreme sports’ such as drag racing.

The term ‘extreme sport’ has been used interchangeably with a variety of other terminologies. The most prevalent terms used are descriptors and include high-risk sport, alternative sport, adventure sport, action sport, and lifestyle sport. Other categories such as whiz (Midol, 1993), panic sport, post-modern, posts-industrial, new sports, unconventional, and non-traditional have also been utilised (Rhinehart and Sydnor, 2003). Collectively, many of these terms are used interchangeably though there are distinct differences between them.

Historically, the CEES definition above is not entirely new, as sport has traditionally been accepted to represent a competitive task engaged in by an individual or a group, which requires physical exertion and is governed by rules. Mason (1989) defined sport as “a more or less physically strenuous, competitive, recreational activity ...usually...in the open air (which) might involve team against team, athlete against athlete or athlete

against nature, or the clock (CEES, pp. 4-5). Sport, performed by individuals or in a group, has been an organised, evaluative activity where the outcome of performance is judged by winning or losing. However, the inclusion of the word 'or' in the CEES definition changes the nature of what is considered to be sport. It implies that results in competition do not need to be present, as long as fitness, or social relationships exist. The modification of this definition allows activities such as recreational swimming or bungee jumping to be classified as sports.

The 2010 Winter Olympics not only included 'sport' but also used the classification of 'extreme sport' with events such as snowboarding, ski jumping, freestyle skiing, skeleton, luge, kayaking and windsurfing. The term 'extreme sport' is probably the most prevalent term used for these types of sports. According to the Webster's dictionary, the word extreme means "going to great or exaggerated lengths; exceeding the ordinary, usual, or unexpected." (p.332). Therefore, extreme, in sport, is going beyond what is normal or traditional and pursuing sport to the limits. The Oxford University Dictionary (OED on-line) defines 'extreme sport' as "designating or relating to (a version of) a sport or pastime performed in a hazardous environment or involving great physical risk". So the concept of 'going beyond' and 'risk' seem integral to what constitutes 'extreme sport'. Booker (1998) stated that 'extreme sports' were "far beyond the bounds of moderation; exceeding what is considered reasonable - i.e. radical" (p.20), and sports that are "situated at the farthest limit; i.e. outermost" (p 23). Breivik et al., (1994) defined extreme sport' as a high-risk sport' where "one has to accept a possibility of a severe injury or death as an inherent part of the activity" (page 9). So the components of these definitions include: going beyond the norm of what is considered reasonable and may result in severe injury or death.

So is 'extreme sport' just high-risk sport and if so where does the term "extreme sport" emanate from? What constitutes 'extreme sport' has been predominantly media led (Kay and LaBerge, 2002). This term, "extreme sport" has been based on the saleability in promoting non-traditional sport to the media and on the increase in consumerism and corporate interest. Sponsorships, endorsements, TV marketing and advertising all utilise the term 'extreme sport' for these reasons. By sifting through the research it is

also evident that there are a variety of interchangeable terms used by both media and academia, i.e. high-risk sport, adventure sport, alternative sport, lifestyle sport and action sport. These terms have been identified and are in use according to the Mintel Report (2000) on 'Sport Activity in the UK'. Interestingly enough, each definition or synonymous term also contains components that give insight into the personality and the motivation of 'extreme sport' participants. For example, adventure sport infers challenge along with uncertainty, whilst lifestyle sport implies camaraderie.

How does drag racing fit in to the definition of 'extreme sport'? Races are broadcast on 'extreme sport' channels and featured on 'extreme sport' programmes. However, does Drag racing fit into these definitions - i.e. going beyond what is reasonable, and/or accepting the possibility of 'severe injury' or 'death'?

5.3 High-Risk Sport

Is 'extreme sport' the same as a high-risk sport or is 'high-risk' just a descriptive warning that those that undertake these sports may be at a greater risk of injury or even death? Are traditional sports safer than 'extreme sport'?

According to statistics on accidents and deaths in motor sport, including sports such as formula 1, drag racing, dirt tracking, there have been at least 300 deaths (drivers, spectators and track workers) and close to 250 racing drivers deaths in motor sport in the USA between 1990 to 2003. This amounts to 25 people per year over a 13-year period. Researching into the statistics of extreme sport is a minefield as injuries, classification and mortality is reported in a variety of different ways. However, in examining injury and mortality statistics linked with 'extreme sports', scuba diving had 3.5 deaths per 100,000 participants, climbing showed 3.2 deaths per 100,000 and skiing/snowboarding revealed only .86 deaths (Whittmann, 2000). In comparing this to several mainstream occupations, this is quite low. For example, taxi driving has 324 deaths per 100,000, construction 13.9 and driving a car 15.2 (Fletcher, 2004, p.101). There were 1.8 injuries and .6 deaths reported per 100,000 participants from sport and recreation accidents in in motorcycling, power boating and equestrian sports (Gabbe,

Finch, Cameron and Williamson, 2005). So activities such as driving are far more high risk than 'high-risk' sport.

Another difficulty, in using statistics to set the parameters of extreme sport, is that traditional sports such as cheerleading and horse riding, due to their high annual incidence of catastrophic injuries, would need to be considered as high-risk sport (Turner and McCory, 2006). In the UK, football and rugby have similar statistics (Barclays spaces for UK sport study, 2005). In addition, in relying on injury and mortality statistics, the definition of what constitutes a high-risk sport is being decided by medical facilities and subsequently, insurance companies. For example in a study on scuba divers, the negative effects on neuro-functioning in terms of cerebral blood flow resulting in poor cognitive performance were demonstrated and the recommendation from this research was that scuba diving should be classified as a high-risk sport for the purpose of subjecting it to tighter controls and medical advice (Slosman, de Ribaupierre, Chicherio, Ludwig, Montandon, Allaoua, Gento, Pichard, Grousset, Mayer, Annoni, and de Ribaupierre, 2004). Other research suggests that whether a sport is extreme or not should only be determined by mortality rate (Schulze Richter, Schulze, Esenwein, Buttner-Janz, 2002).

Besides physical risk, May and Slinger (2000) suggest that there is psychological risk. According to these authors, 'extreme sport' can be mentally risky which leads to elevated stress levels, extreme competitiveness and excessive perfectionism. Therefore, it may be worthwhile to consider what constitutes a high-risk sport as something, which could be physical and/or mental. In a provocative statement, Slinger and Rudestam (1997) cited 'extreme sport' as an expression of a death wish. This instinctual, thanatological type 'extreme sport', labels these sporting activities as high-risk sport. In slightly different manner, Brymer et al., (2009) considered 'extreme sport' not to be about the expression of this risk but rather about the experience approaching the danger.

Finally, it is evident that most researchers conducting studies into sensation seeking have used the term 'high-risk' interchangeably with 'extreme sport' (e.g. Cronin, 1991; Goma-I-Freixanet, 1991; Wagner and Houlihan, 1994; Breivik, 1999).

5.4 Alternative Sport

In North America, the word 'alternative' is popularly used to denote any sport not American (Humphreys, 1997; Rinehart, 1998) whereas researchers such as Kay and LaBerge (2002) have utilised the term 'alternative sport' in a more universal way, to describe sports, which are non-traditional sports. However, the term 'alternative' is merely a transient one as how long is something 'alternative' until it becomes mainstream and then conventional? Howe (1998), for example, writes about how alternative sport depends on the masses for its continued existence. For once alternative sport become commercial and popularised by the public then it becomes mainstream. Rinehart and Sydor (2003) recognise this as an irony as they acknowledge that what is alternative, quickly becomes mainstream so a moving definition of 'extreme sport' due to perceptual changes would be needed. The term 'extreme sport' is therefore more accurate than the use of the term 'alternative sport'.

5.5 Action Sport

Action sports are an assortment of "risky, individualistic and alternative sports such as skateboarding, BMX biking, surfing, street luge, wakeboarding and motor cross" (Bennett and Lachowetz (2004) p. 239-243). Griffith (2002) in *Management Strategy* magazine (p 18) explores the definition of action sports as something that has evolved from the broad sport culture of surfing, skating, snow boarding and wakeboarding. Though she didn't attempt to define the term, her perspective from a business point of view does add to this discussion on definitions. Griffith sees the market as being very youth oriented, as a sport that doesn't require a group or team and therefore open to anyone who wishes to participate. This inclusiveness also makes action sport grass root or what she see as 'street or backyard level'. Most action sports, Griffith feels, have grown out of a non-competitive culture and with it, market trends and a retail market have also developed. Extreme sports are action oriented however, arguably so are traditional sports such as rugby. If 'extreme sports' were particularly youth oriented, then this term makes an immediate assumption that those who participate are all young. In drag racing, participants were on average over 35 and in other extreme sports this can

be the case as years of practice and experience are required. The term action sport is therefore, more of a descriptor than encompassing definition and not inclusive.

5.6 Adventure Sport

The term adventure sport is used a great deal commercially. The Mintel report (2000) noted a division in the reporting of sporting holidays as either hard or soft adventure. 'Hard' adventure holidays promote risk, danger, challenge and an adrenalin rush. Some of the sport holidays offer caving, mountaineering, white water rafting, skydiving. Adventure sport may be a commonly used term amongst holiday promoters as the words themselves denote excitement and fun. Adventure sports also depict lifestyle sports, as they are a leisure time pursuit with not only physical, but also mental exercise. They are journeys through which participants face their own limits of fear, exhaustion and risk. Adventure sports are based more however, based on individual achievement than traditional sports. The competition element is lacking between athletes and teams though it is evident that 'competition' exists between individuals and nature. This is actually quite an all round word and one commonly used in the tourism industry. However, for the sake of academic research, it is limiting as sports such as base jumping or stunt cycling or even drag racing does not really fit into the category of adventure sports.

5.7 Lifestyle Sport

The term lifestyle as utilised in the Mintel Report (2001) identifies specific sports through an examination of the link between the participants, the activity and the environment. Their popularity is a bottom-up approach steeped in grass root participation that is welcoming to all who want to participate. Those who have been alienated by traditional school-based and institutional sport are often attracted to lifestyle sports (Wheaton, 2004). Affiliation gives those that participate a membership

into an exclusive club – which includes equipment, clothes, like-minded people, books, web sites etc. and can create a social group and sub-culture. It's sharing the enthusiasm for sport with others who share the same passions and yearn for the same excitement. 'Extreme sports' have a sense of camaraderie as participants learn from each other, there is a sense of dress (e.g. skateboarders), specific and general 'extreme sport' web sites as well as shopping for specialised equipment.

Tomlinson, Ravenscroft, Wheaton and Gilchrist, (2005) considered the lifestyle definition to be ambiguous and problematic. They defined lifestyle as a "way in which individuals interpret their lives for themselves and for others" (p. 33). In using that definition to distinguish between sports, would require a differentiation between each person's motivational reasons for participation in sport. Lifestyle sports relate to those sports pertaining to individual or personal factors. It is more of a descriptor than an encompassing way to describe a variety of sports. Those that do undertake extreme sport however may agree that participation in extreme sport does become a sort of lifestyle when they are with others who are also engaging in their sport.

5.8 A Spatial Dimension

Spatial dimensions are based on 'extreme locations – wilderness, remoteness, the forbidden' (Tomlinson et al., 2005). Sport where participants compete with the natural elements in locations with snow, hills, canyons, islands, mountains, rivers or volcanoes would then fit within this category, e.g. extreme skiing and white water rafting. Brymer et al. (2009) labelled high-risk sport as being undertaken in the natural environment. However, not all 'extreme sports' meet this criterion. Drag racing, for example, takes place on a man made track. Skateboarding can be performed inside or outside and may involve a ramp designed and manufactured specifically for the performance of sport. So though this could be true of many extreme sports, it is not categorically accurate for all 'extreme sports'.

5.9 An Emotional and Individualistic Dimension

Robinson (1992) saw extreme sport as an activity based on a cognitive and emotional component. Extreme sport was defined as “a variety of self-initiated activities that generally occur in natural-environment settings and that, due to their always uncertain and potentially harmful nature, provide opportunity for intense cognitive and affective involvement” (Robinson, 1992, p. 90). Tomlinson et al. (2005) recognised an ‘emotional dimension’ component within ‘extreme sport’ which can be identified as a sensation of wholeness. This is akin to the concept of flow, which Csikszentmihalyi (1975) described as a conscious state of being completely absorbed in a situation or sport. The sense of elation and peace experienced in extreme sport may be a result of the adrenalin rush and release of endorphins, which are endogenous mood enhancers.

Does ‘extreme sport’, include a component of individualism? ‘Extreme sport’ can be a way of striving for self-actualisation. Those who are self-actualised according to Maslow (1987) has a sense of self acceptance and the thrill in living for the moment. Researchers examining these terms for ‘extreme sport’ have focused on the psychological motivation of the participants need to: find ‘self-actualisation and spiritualism’ (Bordon, 2001), promote a ‘positive personal change’ (Brannigan and McDougall, 1983) or fulfil the desire of a ‘powerful life wish’ (Brymer and Oades, 2009).

Puchan (2004) suggests that underlying the growth of ‘extreme sports’ are societal factors such as computer games and websites. These cultural signs of the time encourage individuals to test themselves against great odds without having to leave the safety of their sitting room. However, in an effort to escape what Puchan (2004) calls boredom and mediocrity, individuals search for outlets where the self can be rediscovered. The concept of extreme sport as an answer to boredom fits in with the idea of boredom as a factor in Zuckerman (1994) subscale of sensation seeking.

Demographically however, participants are aged between 15-24, single and without children (Mintel 2003 -Extreme Sport) so it is that they are really already bored with

life? As developmentally this age group is in a period of transition from adolescence into adulthood, there may be an individualistic nature to 'extreme sport' because it is part of a modern rite of passage (Groves, 1987). Perhaps 'extreme sport' has such a great appeal, as it requires one to take on a challenge during a period (in western culture) when the uncertainty of adulthood is approaching. So this also adds to why there is a strong self or narcissist focus.

Wheaton (2004) discussed this narcissistic focus as a need for isolation. So while traditional sports promote the ideal of teamwork, 'extreme sports' proffer individual goals. A more personalised way of challenging oneself without an organised winning or losing concept. The emphasis is mostly on self-competition through personal challenge and the idea of just 'doing it' (Tomlinson et al, 2005). For this reason the term 'extreme sport' is often synonymous with 'individualistic sport' (Puchan, 2004). Whereas, traditional sport focuses on the challenge of competition, extreme sport more often focuses on individual achievement.

5.10 A Transgressive Dimension

'Extreme sport' can be seen as a contradiction to 'normal' behaviour, which seeks safety and avoids high-risk (Fletcher, 2004). The idea that participants choose to 'accept the possibility' of injury or death contradicts theories, such as Maslow (1987) which stress that safety is a primary, innate need. Baudry (1991) writes that 'extreme sport' is paradoxical in nature, as it requires one to contest his/her mortality through a strategy of premeditated suicide. This challenges normative thinking. It infers that 'extreme sport' goes beyond official regulations and safety precautions and can even place the participant in a potentially fatal situation. It means that 'extreme sport' is dangerous, unregulated and even may involve breaking laws or safety regulations, e.g. trespassing is often a part of the sport of base jumping.

5.11 Drag Racing as an 'Extreme Sport'

Drag racing informally began back in the 1950's, as young men driving American muscle cars, raced up and down the local main streets in an attempt to assert their independence. These unauthorised racing activities were soon relocated outside the town centres and the nature of the activity often resulted in clashes between this wild generation and the police. Any straight road became the site for a dual between two fast cars where young men could demonstrate their fearlessness.

From those early and humble beginnings, drag racing developed and matured as a sport, firstly in America and then around the world. In the UK, the Motor Sports Association (MSA) and in Europe the FIA (Federation Internationale de l'Automobile) formalised drag racing into a sport. For example, tracks were constructed to measure a quarter of a mile (1320 ft-402.336m) though some are even an eighth of a mile (660ft-201.168m). The race is effectively an acceleration contest over a fixed distance and would commence with a series of lights that flash sequentially on an electrical device called a 'Christmas Tree'. The race ended at the finish line. The car's performance was to be measured by the ET or Elapsed Time and which would also determine handicaps during competitions. The objective would be that the first one over the line would be judged the winner.

Today, races are organised in a series of two car eliminations and knockouts. They are based on Elapsed Times or ET or handicapped racing (based on ET brackets). Qualifiers occur during the first day and second days of what is usually a three-day competition. The qualifying races will decide the seeding for day two which is elimination races. The last day is race day where qualifying drivers in each class are ranked and then compete in a seeded competition. The one who beats off all the competition within their designated group is declared the winner. Prize money is awarded to winners in the elite classes. Drag racers are subject to extreme G forces at both the start of a run, and at the end of a run when parachutes are deployed to stop the vehicle overrunning the end of the racetrack. The dangers of fire and explosion from the race engines, as well as the risks of injury and death from crashes are always present. This is the fastest and the

quickest motorsport in the world. The physical and psychological challenges facing a driver who has to control a machine that can reach over 300mph in a little over 4 seconds, and then stop the machine safely, are extreme.

FIA and MSA drag racing is divided into different classifications, which are based on fuel type and engine size. Top Fuel, Top Methanol Dragster, Top Methanol Funny Car and Pro Stock in the FIA and additional classes such Pro Mod and Super Mod in the MSA. The top fuel dragsters use V8 engines with enormous superchargers that run on nitro-methane and they are capable of reaching speeds of over 330 mph in 4.4 seconds. With over 6000 brake horsepower they are easily the world's fastest accelerating vehicles. Top methanol dragsters are recognisable as dragsters due to their long shape. Funny cars are diminutive versions of top fuel or top methanol cars covered with carbon fibre or fibreglass replica car bodies. They can also reach speeds of over 300 mph in less than 5 seconds. The Top Methanol dragsters fuelled by methanol, typically reach speeds of over 250 mph in just over 5 seconds. Pro-Modified cars are full-bodied cars noticeable by their smoky burnouts that run at speeds in excess of 200 mph with elapsed quarter-mile times of just over 6.5 seconds. There are also many different classes of extremely high performance motorcycles that take part in drag racing.

A perfect reaction time in the elite classes from the start of the initial yellow Christmas tree lights to the green starting light is .400 second-a sportsman reaction time is .500 seconds. These times are recorded for each racer as well as the elapsed time from first activating the beam on the starting line to the finish beam. A beam at the finish line also records top speed. When a driver reacts quicker than .400, thus speeding away from the start line before the green light, a red light violation has occurred and the car is disqualified from that race.

As in any sport, psychological factors always exist. In drag racing in particular, the event is a psychological roller coaster for the teams. There is the stress of hard work in preparing the car for a deadline. There is the anxiety of trying to assess what may need readjusting or repairing. There is the feeling of uncertainty every time the driver goes out on the track whilst the team prays for a good run. The team is nervous awaiting

either feelings of elation or despair. Elation means that the team gets an adrenalin rush after a winning run and everyone is on a high whilst preparing for the next race. A poor run defined as being a slow run or one that results in major engine damage, depresses everyone as the team struggles with the 'oh well next time' attitude. If a run is 'rained off' (racing is stopped as soon as there is any sign of moisture on the track), the team copes with boredom and prolonged feelings of stress in anticipation of a run. Everyone returns to the routine of the work preparing for the next run. One of the important skills for a driver is being able to produce the combination a fast reaction time with perfect control of the vehicle so he/she can get off the start line without red-lighting, and reach the finish line before the competitor. With these vehicles reaching in excess of 100mph in less than a second, there is no room for error when it comes to personal safety and winning.

5.12 A Definition of 'Extreme Sport'

"The formation of a problem is often more essential than its solution" (Albert Einstein).

The term 'high-risk' sport appears to be used interchangeably with 'extreme sport' in research literature. High-risk sport is defined as 'any sport where one has to accept a possibility of a severe injury or death as an inherent part of the activity' (Brevik, 1994). However, part of the difficulty in being able to define 'extreme sport' is, as according to Kay and LaBerge (2002), because there are so many 'contradictory factors' aside from risk. The author of this thesis suggests that there are spatial, emotional, individualistic and transgressive dimensions to consider these sports. Terms such as alternative, action, adventure and lifestyle are all aspects of the 'extreme sport' however none of these terms categorically encompasses what extreme sport is all about. Tomlinson et al.(2005), concluded that there were "no universally agreed terms to describe the sports (extreme sports), no agreed categorisations through which to order and understand them and little in the way of governance structures to regulate them"(p.25). Yet 'extreme sport' because it has yet to be fully defined has been a creation by the media complete with a "marketing strategy, an ethic, a vocabulary, an attitude, and a style" (Kay and LaBerge,

2002, p.381.) The dimensions presented by Tomlinson et al. (2005), are useful: spatial, emotional, transgression beyond the norm. However, according to Rinehart and Sydnor (2003), in order to distinguish between these classifications one needs to examine the meaning attributed to each. In addition, there is a degree of individualism versus competition, the natural environment versus a contrived urban site, safety in rule adherence versus risk in rule breaking. Finally, the word extreme used within the term “extreme sport” includes an intense thrill and excitement (Rinehart, 2000) attributed to an increase in adrenalin (Lambton, 2000).

At this point in the thesis, the author would like to propose that ‘extreme sport’ is a specific term for certain identifiable sports that differs from action sport. It can also be considered as a lifestyle sport similar to the way a conventional sport can be viewed (e.g. football). Specifically, ‘extreme sport’ is a competitive (comparison or self-evaluative) activity within which the participant is subjected to natural or unusual physical and mental challenges such as speed, height, depth or natural forces and where fast and accurate cognitive perceptual processing maybe required for a successful outcome. An unsuccessful outcome is more likely to result in the injury or even fatality of the participant than in a ‘non-extreme sport’.

5.13 Conclusion

This chapter therefore has explained the difficulties in researching ‘extreme sport’ due to the lack of information as to what constitutes ‘extreme sport’ and see drag racing as fitting into this definition so that the study of these racers is seen as different from traditional sports. It also attempts to improve the academic debate with a new workable definition of ‘extreme sport’ for psychological and sport literature. However, this objective has been problematic as the definition of ‘extreme sport’ was ill defined. A variety of terms have been used interchangeably such as alternative and action sports. The lack of consistency with these terms means that those wishing to study in this field were forced to create their own criterion in a less than scientific approach.

As definitions are important to the start of evidenced based research or argument, this chapter focused on explaining what words are being used to represent 'extreme sport' in order to distinguish between the various terms. The dimensions presented were spatial, emotional and transgression beyond the norm. In addition, other research has raised the idea of alternative, adventure, lifestyle and rite of passage. This chapter has proposed another way in which the word 'extreme sport' may be considered so that ambiguity within research is reduced in the future.

A new definition was designed in order to find coherency and meaning from the disparate terminology. This author proposes that 'extreme sport' is a specific term for certain identifiable sports that differ from action sport. It can also be considered a lifestyle sport similar to those who follow conventional sport (e.g. football supporters). Putting drag racing into this definition helps to crystallise the definition by alluding to the physical challenges of acceleration, speed and g forces, in addition to the possibility of injury and death.

This chapter intends to give rise to the debate of what is meant by 'extreme sport', a term often interchangeable with 'high risk'. If researchers are to compare studies then the definition needs to be consistent. 'Extreme sport' is one of the fastest growing areas in sport in this century. It captures the interest of the media and yet should not be media led. Defining 'extreme sport' should help to drive the scientific process of for research forward.

6. Chapter 6: Personality and Sensation seeking

6.1 Preface

As discussed in chapters 2 and 3, personality has been one of the leading areas of research in psychology since the start of the 20th century and it is developing countless applications to the sport and exercise environment (Eysenck et al, 1982; Koelega, 1992; Rhodes and Smith, 2006). However, the validity of personality studies in psychology have been debated and scrutinised for their lack of scientific consistency, particularly in controlling for confounding variables. Regardless, there is overall agreement that personality is significantly correlated with performance in sport (Piedmont, Hill and Blanco, 1999) and more recently, can be utilised successfully in predicting sport success (Aidman, 2007).

This concept that the interaction of personality traits with the environment can facilitate a personality state and is a strong predictor of behavior is not new (e.g. Allport, 1937). Yet, personality research needs to recognize the uniqueness of various sports (e.g. drag racing) as studies examining homogenous groups of sport participants is rare. In 'extreme sport' in particular, this is most likely due to the lack of a clear definition for extreme sport. Thus in defining extreme sport, as in chapter 5, the following studies in this thesis are able to place drag racers as a homogenous group of 'extreme sport' enthusiasts within the scientific literature. The use of personality tests on introversion and extraversion is predominantly due to the consistency of extraversion as a personality trait in sport research and as evidence has been shown that extraversion may continue to remain stable over a lifetime (e.g. Hampson and Goldberg, 2006). Extraversion was also linked with sensation seeking, which is recognized as a personality trait related to risk (and therefore extreme sport). In analyzing the novel group of drag racers as an extreme sport, results have been juxtaposed to the comparison group of university sport science students in the first two studies. However, in placing drag racing as a 'extreme sport' on a 'sporting continuum' - with reasons that will be explained further in this chapter- the

fourth study will examine personality of drag racers to archers. Archers, engaged in a target sport that is under researched, are a more appropriate comparison group.

This chapter will examine 3 studies conducted for this thesis. Studies 1 and 2, which compared drag racers and university sport science students on personality and sensation seeking. Study 3 which, compared drag racers, archers and university sport science students on tests of personality and sensation seeking.

6.2 Study 1: The Relationship between Personality and Sporting Performance: Evidence from Drag Racers and University Sport Science Students

6.2.1 Background and Aims

As mentioned in chapter 2, historically researchers have made a direct comparison of personality traits of participants involved in a particular sport with non-sporting participants (mainly students) as a control group (Eysenck et al., 1982). Whilst it was argued that criticisms might apply to the validity of such a comparison it is also very appropriate to see what would have been the outcome if drag racers (as a previously not investigated sport) were the subject of such investigation. These were the aims of the first two studies reported in this chapter.

The aim of the first study is to compare the Eysenck Personality Inventory (Eysenck and Eysenck, 1982) measures, namely extraversion and neuroticism between drag racers and university sport science students. As previously argued based on the available literature (i.e. Eysenck et al., 1982), one would expect that drag racers involved in a risk taking, high sensation seeking, sport would have lower neuroticism scores when compared to university students. Furthermore, drag racers are expected to have higher extraversion scores than university sport science students.

6.2.2 Hypotheses

HA1 - There will be a significant difference between drag racers and university sport science students on extraversion (as measured on the EPI)

HA2 There will be a significant difference between drag racers and university sport science students on neuroticism (as measured on the EPI)

6.2.3 Methodology

Design- A quasi-experimental design was used. The independent variables were participants (drag racers and university sport science students) and gender. The dependent variables were measures of extraversion and neuroticism scales from Eysenck's Personality Inventory (Eysenck and Eysenck, 1982).

Participants- The participants were 144 drag racers (mean age= 31, SD =12.27): 108 males, 36 females, 41 elite and 103 amateurs. There were 82 university students (mean age=22.9, SD = 2.99): 44 males, 38 females, 14 elite and 68 amateurs. Table 6.1 presents the breakdown for mean age and standard deviation as by gender, level of performance for drag racers and university sport science students.

Level of performance criteria

Drag Racers - The distinction between elite and amateur, for drag racers, were based on FIA classifications. Elite drag racers were classified as those who compete in the elite classes and were licensed drag racing drivers who receive monetary rewards when placing in the top 3. Elite classes included those who compete in categories of cars such as Top Fuel, Top Methanol Dragster, Funny car, and Pro Stock. Drag racers in other categories which included Comp, Super Stock, and Stock were classified as amateurs.

Students - those who maintained sporting activity at national or international level were classified as elite. Those who were any of a combination of the following were classified as amateurs: recreational sport, fitness participants, university team players.

Materials- The Eysenck Personality Inventory (Eysenck and Eysenck, 1982) used in these studies measures extraversion (24 items) and neuroticism (24 items). It also contains a lie scale (9 items). Respondents are required to answer yes or no to each question. The questions are easily understandable (Furnham, 1990) with an internal consistency and test re-test reliability for extraversion and neuroticism. According to the manual (Eysenck and Eysenck, 1982) this significance ranges from .81-.97 and the split half reliability ranges from .74 to .91 (Boyle, Matthews and Saklofske, 2004). The lie scale measures 'faking good' and high scores for this scale are obtained when respondents attempt to give a 'good impression'. A score above 4 or 5 may question the

truthfulness of answers given on extraversion and neuroticism (Eysenck and Eysenck, 1982). The results of these individuals should be viewed with caution. However, it is more common to utilise the lie scale when undertaking individual testing rather than testing for research purposes (See Appendix I for a copy of the questionnaire).

Justification for the use of Eysenck's Personality Inventory (EPI)

The EPI was chosen over the Eysenck Personality Questionnaire (EPQ, 1985) as the EPQ is criticised for falling short in producing the same theoretical and structural relationships found in previous EPI studies (Bullock and Gilliland, 1993). Rocklin and Revelle (1981) pointed out that extraversion as measured by the EPQ was no longer an adequate measure of the arousal theory of extraversion. Revelle (1997) noted different patterns of correlations for using the EPQ as opposed to the EPI and therefore the choice of test is vital in order to ensure the most appropriate results (Furnham, Eysenck and Saklofske, 2008).

The EPI test is similar and highly correlates to the EPQ. The important difference between the two tests is that while both tests measure sociability, the EPI also measures impulsivity (Rocklin and Revelle, 1981). The EPI can therefore be identified as multidimensional while the EPQ is one-dimensional. The two tests correlate highly though this is due to the sociability factor. Impulsivity includes relationships such as vigilance decrements (Thackery, Jones, and Touchstone, 1974), caffeine-induced stress and verbal performance (Revelle, Humphreys, Simon, and Gilliland, 1980) driver safety (Loo, 1979) and conditionability (Eysenck and Levey, 1972). Finally and perhaps most importantly, is that impulsivity which is included on the EPI has been shown to have relationships relevant to the arousal theory of extraversion whilst sociability (solely measured on the EPQ) has not (Rocklins and Reville, 1981).

Over the past two decades, the study of personality has been dominated by the five-factor model (Rhodes and Smith, 2006). However, the application of the five-factor model (FFM) model (Costa and McCrae, 1990) to the study of personality in sport has been to date been very limited in research within the sport and exercise field (Allen, 2008). Tests such as the EPI/EPQ are more frequently used within sport personality

research (Lane, Milton and Terry, 2005). One exception to this has been a study by Hughes, Case, Stuempfle and Evans (2003) examining trekkers racing to the North Pole. The FFM is similar to other models in describing personality as individual differences that are consistent in feelings, thoughts and actions. According to the FFM, these differences can be described in terms of five dimensions that are labelled as extraversion (outgoing, active and energetic), neuroticism (vulnerability to feelings of depression and anxiety), openness to experience (high intellect and openness to new ideas) agreeableness (associated with generosity, altruism and caring) and conscientiousness (linked to goal directed and achievement).

Procedure- Ethical approval for the study was granted by Middlesex University. Data was gathered in two ways: online or from a hard copy of the tests. The online survey was administered through ‘Survey Monkey’ and links to the site were advertised on sites such as Eurodragster. Eurodragster, as a web site, was chosen as it is the premier website for information on drag racing in Europe. Though the researcher only provided Eurodragster with the online link, a magazine article about the researcher and this survey was picked up by Motor Sport News shortly after and therefore the link was also ‘advertised’ there. The use of an online survey was chosen as it was felt that anonymity would increase participation and yield unbiased results. Another strength of using an online survey was that as the drivers reside all over Europe, it would be time consuming and expensive to interview this number of drivers on an individual basis.

University sport science students were recruited through the sport science degree programmes at Middlesex University during one of the second year modules. Hard copies were distributed and students were given time to fill in the tests used for the study. All participants were asked to give their consent. Procedures for the gathering of results, collecting of results and storing of results all follow the ethical guidelines required by the University and set out by the BPS.

Surveys can be used to collect a large amount of information and are a time efficient method. A problem with surveys can be whether or not participants are telling the truth though the EPI does include a lie factor component.

6.2.4 Results

An independent groups t-test was conducted on the data. The results showed a significant age difference between the 2 groups with $t(226) = 5.9, p < 0.0001$. It was thus decided to use age as covariate in all the analysis in which it is expected to have a significant relationship with variables under investigation. A Pearson's Correlation Coefficient was conducted between age and extraversion and neuroticism. There was a negative, significant correlation between age and extraversion ($r = -0.14, p < 0.03$). There was a significant gender effect with neuroticism.

Furthermore, it was decided to conduct a series of 2 by 2 Factorial ANOVA's using participant category and gender as the two independent variables on one occasion and participants and level of performance as the two independent variables on a separate occasion instead of a 3 way factorial ANOVA (participant by gender by level of performance) this was in view of having much smaller cells for some of categories (see table 6.1 below).

Table 6.1 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers and university sport science students

Participants	Gender N=Number of participants	Mean Age	SD
Drag racers Male	Amateur N=76	29.75	12.12
	Elite N=32	35.37	13.4
Female	Amateur N=27	27.85	10.28
	Elite N=9	29.88	10.73
Total Drag Racers	144		
Students Male	Amateur N=38	22.94	2.61
	Elite N=6	22.83	3.71
Female	Amateur N=30	23.2	3.6
	Elite N=8	21.87	1.55
Total Students	82		
Total Sample	226		

Participant category and gender

A series of 2 participant (drag racer, student) by 2 gender (male, female) Factorial ANOVAs were conducted with personality traits as dependent variables.

Table 6.2 - Mean extraversion scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	13.54	4.33
	Female N=36	12.47	4.04
Students	Male N=44	14.80	4.37
	Female N=38	14.42	4.91
Overall mean	N=226	13.76	4.44

Extraversion (E)

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female) Factorial ANOVA and age as a covariate was conducted on the data which showed no significant main effect for participants with $F(1, 221) = 3.348$, $p = 0.069$, no significant gender effect with $F(1, 221) = 1.484$, $p = 0.225$ and no significant interaction with $F(1, 221) = 0.329$, $p = 0.567$.

*Neuroticism (N)***Table 6.3** - Mean neuroticism scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	11.03	4.94
	Female N=36	11.74	5.97
Students	Male N=44	11.42	3.32
	Female N=38	13.21	3.89
Overall mean	N=226	11.59	4.73

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed no significant main effects for participants with $F(1, 221) = 2.405$, $p = 0.122$, no significant gender effect with $F(1, 221) = 3.373$, $p = 0.068$ and no significant interaction effect with $F(1, 221) = 0.543$, $p = 0.462$.

Participant Category and Level of Performance

Extraversion (E)

Table 6.4 - Mean extraversion scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	13.14	4.24
	Elite N=41	13.61	4.44
Students	Amateur N=68	14.78	4.59
	Elite N=14	13.86	4.75
Overall mean	N= 226	13.76	4.44

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) Factorial ANOVA was conducted which showed no significant main effect for participants with $F(1, 221) = 0.294$, $p = 0.588$, no significant level of performance effect with $F(1, 221) = .012$, $p = 0.912$ and no significant interaction effect with $F(1, 221) = 1.271$, $p = 0.261$.

*Neuroticism (N)***Table 6.5** - Mean neuroticism scores and corresponding standard deviations by participant and level of performance

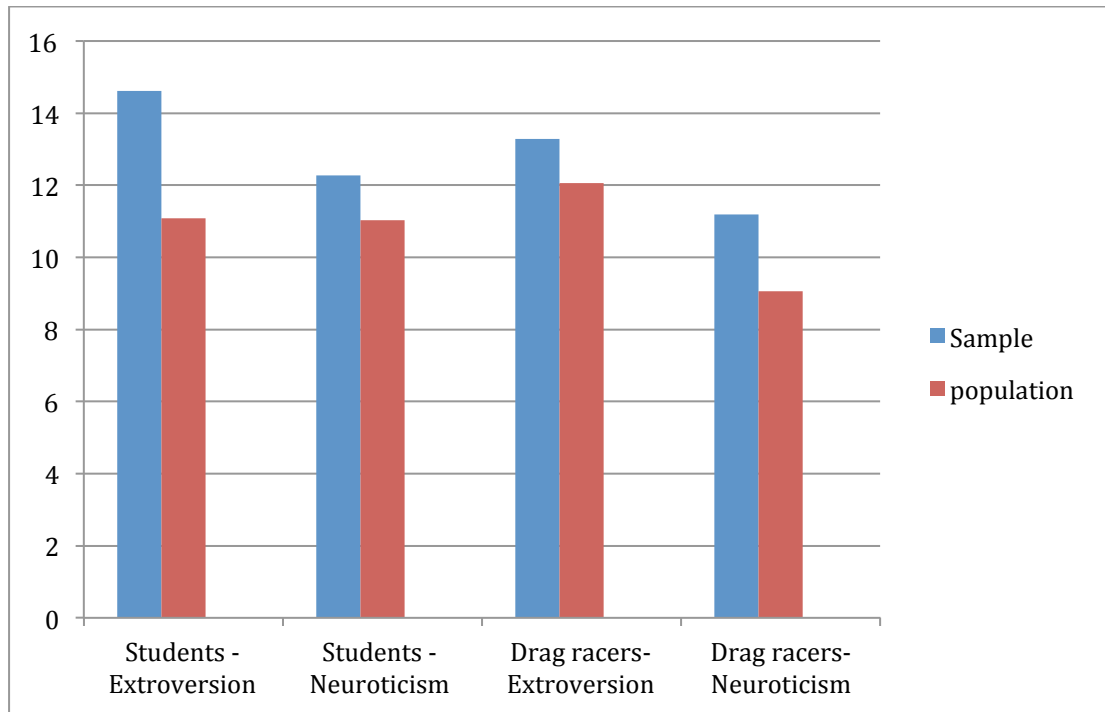
Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	11.60	5.22
	Elite N=41	10.29	5.17
Students	Amateur N=68	12.16	3.64
	Elite N=14	12.50	3.76
Overall mean	N=226	11.59	4.73

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) Factorial ANOVA was conducted which showed a significant main effect for participants with $F(1, 221) = 4.291, p = .039$, the mathematical means for the two participant groups were:

— —
 $\bar{X}(\text{students}) = 12.22 > \bar{X}(\text{drag racers}) = 11.22$. No significant effect for level of performance with $F(1, 221) = .536, p = .465$ and no significant interaction effect with $F(1, 221) = 1.234, p = 0.268$.

Results in comparison to the Population Norms (Eysenck and Eysenck, 1982).

Figure 2- Bar chart representing the comparison of personality measures of university sport science students and drag racers with the population norms



As can be seen in the above figure 2 the sample of university sport science students scored higher on extraversion than the normal population of students and scored higher in neuroticism than the normal population of students. Drag racers scored higher than normal population in both extraversion and drag racers scored lower than sport university sport science students on both extraversion and neuroticism.

6.2.5 Discussion

The aim of study 1 was to compare EPI (Eysenck and Eysenck, 1982) measures, namely extraversion and neuroticism, between drag racers and a comparison group of university sport science students. The results of this study 1, did not demonstrate a significance difference in extraversion between the groups. Based on available literature (Goma-i-Freixanet, 1991) one would have expected that drag racers involved in ‘extreme sport’

would be demonstrate higher scores in extraversion than the comparison group. There were no significant differences in extraversion even when controlling for gender though male students were higher in extraversion than either male or female drag racers. On the whole, males were slightly higher than females. In examining level of performance, though there were no significant differences, though the descriptive statistics showed that students classified as amateurs scored highest in extraversion whilst amateur drag racers scored the lowest on extraversion. Elite drag racers were higher in extraversion than amateur drag racers whilst in the university sport science group this was in reverse, i.e. amateurs were higher on extraversion than the elite.

In comparison to the population norms, students and drag racers scored higher on extraversion in relation to these norms, which supports research with similar findings (Morgan and Pollock, 1977; Kirkcaldy, 1982; Egan and Stelmack, 2003). In a more recent study, ‘extreme sport’ participants in a 100-mile race in Alaska revealed higher levels of extraversion than normative scores (Hughes, et al., 2003). However, one study, showed that alpinists were lower on extraversion than the general population (Breivik, 1999). So while the majority of studies have found high extraversion in those who engaged in extreme or high-risk sport to be higher than the population, there are variations with ‘extreme sport’ as a whole and these different profiles may be unique to each sport. Generalising personality in sport therefore, does not help progress the literature. There may be variations between sport and extreme sport, requiring a need to develop specific profiles so that predictive performance, as well as appropriate techniques to enhance performance, can be developed to enhance research and professionalism within the field

The results of study 1, were also contradictory to research, which has demonstrated that participants of high-risk sport scored higher in extraversion than sport participants (e.g. Goma-i-Freixanet, 1991; Zuckerman, 1994; Watson and Pulford, 2004). The literature reviewed in chapter 2 and 3 suggests that higher extraversion is typical of those in sport as extroverts rely on increased arousal to stimulate successful management of a sporting situation (e.g. Gray, 1982; Zuckerman, 1994). However, as those scoring too low on extraversion would find the thrill of ‘extreme sport’ interferes with their behaviour or

rather upsets a physiological need (e.g. Wilson and Daly, 1985), it may be that a certain level of extraversion is required for extreme sport. Vanden Auweele et al., (1993) suggests whether or not there is an average level of extraversion, which is typical of elite athletes. Perhaps an 'average' may be indicative of an extreme sport, which demands a personality not requiring extreme arousal but a more moderate level of extraversion (maybe even similar to the inverted U theory).

There is a tendency for athletes, particularly outstanding ones, to score low on neuroticism (Eysenck et al., 1982; O'Sullivan et al., 1998; Zuckerman, 1994). However, there was not a significant difference in level of performance to indicate that elites (i.e. those outstanding) were lower on this measure. Study 1, did not demonstrate any significance between elite and amateurs, however elite drag racers did show lower levels of neuroticism, according to the descriptive statistics, than amateur drag racers. Low neuroticism by elite (and male) participants in an 'extreme sport' supported research by Watson and Pulford (2004), which demonstrated that sport instructors had significantly lower neuroticism scores in comparison to the non-participant group.

There was a significant difference for neuroticism demonstrated between participants where students were higher than drag racers. Drag racers demonstrated lower levels of neuroticism than university sport students. Research has identified extreme participants as lower in neuroticism and therefore, more emotionally stable in comparison to other sports and /or non-participants (Ogilvie, 1974; Goma-i-Freixanet, 1991; Burnik and Tusak, 1999). Lower neuroticism may be necessary in 'extreme sport' as it is vital to control emotions. A miscalculation in 'extreme sport' can lead to a severe injury or death. It is would be hard to be irrational in a potentially dangerous sport. Yet this has been disputed in skiers whom it was found cannot be too relaxed or they are more susceptible to injury (Raglin, 2001). Therefore, there are discrepancies in 'extreme sport', which need to be identified if personality is to be useful as a tool in the future.

In accounting for gender, there was no significant difference in neuroticism, though according to the descriptive statistics females scored higher than males. Female students ranked the highest on this scale while male drag racers demonstrated the lowest scores.

Females do generally score higher on neuroticism than males (Fanous, Garndner, Prescott, Canco and Kendall, 2002). It has also been demonstrated that there are differences between male and female students when using university students as participants (Roberts, Scott and Baluch, 1993). Though it does raise the question as to whether male drag racers are less likely to have an injury or risk death as they have lower levels of neuroticism or whether female drag racers are safer in extreme sport as they take fewer risks due to their higher levels of neuroticism.

Drag racers did score higher on neuroticism than the general population norms presented by Eysenck and Eysenck (1982). Other studies have demonstrated, contrary to study 1, that athletes display lower neuroticism in comparison to normative data (Morgan and Pollock, 1977; Kirkcaldy, 1982) supported by an even more recent study that individuals who climbed Mount Everest had lower scores on neuroticism than the normative sample (Egan and Stelmack, 2003).

Generalisation of one personality in sport is difficult as there is an uniqueness between sports (Vealey, 1992). Drag racing is an 'extreme sport' and its' racers may have a different personality profile to those in traditional sports. Methodological inconsistencies in earlier research have led researchers to question the usefulness of personality tests in distinguishing between level of performance and gender. These variables were controlled for those there were not significant differences demonstrated.

Finally, the use of students in psychological studies has been debated before in psychological literature. However in sport studies, students who major in sport are still being used as both participants of sport and as comparison cohorts. They have been useful in this study as representative of heterogeneous groups of sport participants and the results that they have demonstrated show some commonality with sports participants in general, i.e. high extraversion.

The EPI measures two traits, extraversion and neuroticism, may be predictive of athletic success (Aidman, 2007). Extraversion is also positively correlated with coping strategies (Smith, Smoll, and Ptacek, 1990) and so this demonstrates another way in which

personality may impacts on sporting performance. However, this research is not suggesting that knowledge of personality in terms of extraversion and neuroticism should be used solely for distinguishing and predicting successful performance or even for talent selection. Rather that, understanding personality is a part of a process for understanding athletes, which may provide psychologists with insight in matching optimal sport psychology techniques to players within specific sports. The relationship between personality and participation also raises the question as to whether someone with a specific performance profile should be ‘allowed’ to participate in ‘extreme sport’ and whether identifying the ‘optimal extreme sporting personality’ would help reduce the number of serious injuries and deaths per year. Finally, understanding personality would enable coaches and psychologist to develop techniques, which move participants successfully on from amateur to elite.

Students as a cohort have shown to be high in extraversion in comparison to population norms (e.g. Eysenck and Eysenck, 1982). So, are students a valid comparison group in sport and even more specifically sport students the best comparison group? Sear (1986) pointed out that students represent a very ‘narrow data base’. The debate is first whether or not students as subjects pose a problem for a study’s validity and secondly, whether the use of sport students specifically pose a problem for sport science researchers.

In a working paper, Druckman and Kam (2009) highlighted that using student samples only generated difficulties as there “is an underlying heterogeneous effect and if the students differ from the target population with regard to the distribution of the moderating variable” (p. 22). This lead to the question of just how often student subjects empirically differ from a more representative cohort. The greater those differences, the more likelihood that problematic inferences will result. Druckman and Kam (2009) suggested that perhaps researchers just need more guidance to warrant appropriate generalization of results from student subjects. They encouraged researchers to consider dual samples consisting of students and non-students. The few studies that explicitly compared samples (e.g. Peterson, 2001; Mintz, Redd, and Vedlitz, 2006; Pura, Nayga Jr., Wu, and Laude, 2009), while sometimes reporting variations, don’t seem to have identified the reasons for these distinctions (Druckman and Kam, 2009).

Sport Science as a relatively new area of research utilises sports students as comparison group on a regular basis (Ma, Ji and Gu, 2004; Cui, Sun, Xing and Feng, 2009; Xiangle, 2009). Yet, differences between students and sport students seem to be emerging (Han, Meng, and Li, 2005; Fengcai and Peng, 2009). Han et al., (2005) compared personality traits of university students and found that the personality traits of Physical Education (PE) graduates were significantly different from other degree students. Yet Ma et al., (2004) did not find any differences in extraversion between PE and non-PE majors. However, in study 1 of this thesis, there were no significant differences in extraversion between the participants. According to the descriptive statistics, male students were the highest in extraversion and female drag racers were the lowest on this measure. There was a significant difference between students and drag racers on neuroticism. In examining the descriptive statistics, female students were higher in neuroticism than male students. Sport science students and drag racers as participants of extreme sport have demonstrated a certain profile in study 1 which is not consistent with psychological literature.

6.3 Study 2: The Relationship between Sensation Seeking and Sporting Performance: Evidence from Drag Racers and University Sport Science Students

6.3.1 Background and Aims

As explained in chapters 2 and 3, sensation seeking has primarily been investigated in psychological literature in relation to high-risk sports (Zuckerman, 1994). Results of studies have shown that those involved in mountain climbing and scuba diving score higher on sensation seeking than those involved in low-risk sports such as bowling, or than non-participants (Zuckerman, 1994). Generally, however, samples of high-risk or 'extreme sport' participants are grouped together from a variety of sports. The homogeneity of a sport and its specific differences are not considered in most of the research moreover, students or non-participants are often used as comparison. In addition, moderating factors are not always controlled for, i.e. level of performance, gender and age (Zuckerman, 1994, Feher et al., 1998; Slovic, 2000; Butkovic and Bratko, 2003; Eagleton et al., 2007). Finally, the use of sensation seeking as a predictor of performance in various sports is not evident in any of the new research being conducted and yet what is considered 'extreme sport' is growing within sport and society.

The aim of study 2 is to follow the historical footsteps of previous research in which sensation seeking measures were used in studies comparing the participants engaged in high-risk sports with students or non-participants. The novelty of this thesis studies is that not only is there homogeneity of 'extreme sport' participants, but this research is examining the sport of drag racing, which hasn't been studied psychologically like this before. If in study 2, those in 'extreme sport' score high sensation seeking and if this is indeed an indication of their sporting activity then students should score lower on sensation seeking in comparison. Absence of such differences may call into question reported studies on personality traits and sporting activities.

6.3.2. Hypotheses

HA1 There will be a significant difference between drag racers and university sport science student on sensation seeking (as measured on the SSS-V)

HA2 There will be a significant difference between drag racers and university sport science student on subscales of sensations seeking (as measured on the SSS-V), i.e. thrill seeking, experience seeking, disinhibition and boredom susceptibility

6.3.3 Methodology

Design- A quasi-experimental design was employed, in which the independent variables are gender, age and level of performance (amateur vs. elite) and the dependent variables are the scores from a sensation seeking scale.

Participants- The participants were 144 drag racers (mean age= 31, SD =12.27): 108 males, 36 females, 41 elite and 103 amateurs. There were 82 university students (mean age=22.9, SD = 2.99): 44 males, 38 females, 14 elite and 68 amateurs. The breakdown for mean age and standard deviation as by gender, level of performance for drag racers and students can be seen in table 6.6.

Level of performance criteria

Drag Racers - The distinction between elite and amateur, for drag racers, were based on FIA classifications. Elite drag racers were classified as those who compete in the elite classes and were licensed drag racing drivers who receive monetary rewards when placing in the top 3. Elite classes included those who compete in categories of cars such as Top Fuel, Top Methanol Dragster, Funny car, and Pro Stock. Drag racers in other categories which included Comp, Super Stock, and Stock were classified as amateurs.

Students - those who maintained sporting activity at national or international level were classified as elite. Those who were any of a combination of the following were classified as amateurs: recreational sport, fitness participants, university team players.

Materials- The Sensation Seeking Scale (SSS-V) was utilised for this study. This was developed by Zuckerman (1994) and designed on the premise that there are individual differences in optimal levels of stimulation and arousal. Sensation seeking is defined as the seeking of varied, novel, and intense stimuli and the willingness to take risks for the sake of such experience (Zuckerman, 1994). The SSS-V was revised in collaboration with data from a large-scale study that Zuckerman carried out with Eysenck and Eysenck in 1978. The Sensation Seeking Scale (SSS-V) being used in this study (Zuckerman, 1994) has been validated by numerous studies in sport psychology research (Levenson, 1990; Rossi and Cereatti, 1993; Breivik, 1999). The SSS-V internal reliabilities of the total score in sensation seeking range from .83 to .86; the ranges of reliability for the subscales are: thrill and adventure seeking .77 to .82; experience seeking .61 to .67; and Dis .74 to .78 and BS .56 to .65. (Zuckerman, 1994 -see appendix II for a copy of the SSS-V).

Procedure-The SSS-V was available to participants online through Survey Monkey and provided as a hard copy. Drag racers were recruited from the main European drag racing website known as Eurodragster and also at a drag racing event during a race weekend. Students were recruited through a second year university module on the sport science degree programme. All ethical procedures were complied with in accordance with the University's ethical committee (i.e. withdrawal, data protection, confidentiality, research use of data, contact details of researcher) and as set out by the British Psychological Society (BPS). This included informed consent.

6.3.4. Results

Table 6.6 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers and university sport science students

Participants	Gender N=Number of participants	Mean Age	SD
Drag racers Male	Amateur N=76	29.75	12.12
	Elite N=32	35.37	13.4
Female	Amateur N=27	27.85	10.28
	Elite N=9	29.88	10.73
Total Drag Racers	144		
Students Male	Amateur N=38	22.94	2.61
	Elite N=6	22.83	3.71
Female	Amateur N=30	23.2	3.6
	Elite N=8	21.87	1.55
Total Students	82		
Total Sample	226		

Sensation Seeking (SS)

The descriptive statistics, mean and standard deviation, for sensation seeking on the SSS-V by participant category and gender are shown in Table 6.7. The higher the score indicated the higher the level of sensation seeking.

Table 6.7 - Mean sensation seeking scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N= 108	21.93	6.61
	Female N= 36	21.14	5.39
Students	Male N= 44	21.70	6.91
	Female N= 38	21.34	5.59
Total	N=226	21.61	6.33

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female) using age as a covariate for sensation seeking (SSS-V) Factorial ANOVA which showed no significant main effects for participants with $F(1, 222) = .493, p = .483$, and no significant gender effect with $F(1, 222) = .409, p = .523$ and no significant interaction effect with $F(1, 222) = .061, p = .805$

Thrill and Adventure Seeking (TAS)

The descriptive statistics, mean and standard deviations, for the thrill and adventure seeking subscale on the SSS-V by participant category and gender are shown in Table 6.8. The higher the score indicated the higher the level of thrill and adventure seeking.

Table 6.8 - Mean thrill and adventure seeking scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	6.71	2.86
	Female N=36	7.03	2.32
Students	Male N=44	6.61	3.11
	Female N= 38	7.34	2.75
Overall mean	N=226	6.82	2.82

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female) using age as a covariate for the subscale of Thrill and Adventure Seeking. A Factorial ANOVA was conducted, which showed no significant main effects for participants with $F(1, 222) = .103, p = .74$, no significant gender effect with $F(1, 222) = 1.737, p = .18$ and no significant interaction effect with $F(1, 222) = .18, p = .66$

Experience Seeking (ES)

The descriptive statistics, mean and standard deviations, for the experience seeking subscale on the SSS-V by participant category and gender are shown in Table 6.9. The higher the scored indicated the higher the level of experience seeking.

Table 6.9 – Mean experience seeking scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	5.27	2.12
	Female N=36	5.14	1.97
Students	Male N=44	5.18	1.85
	Female N=38	5.00	2.00
Overall mean	N= 226	5.15	1.99

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female), using age as a covariate for the subscale of experience seeking Factorial ANOVA was conducted, which showed no significant main effects for overall participants with $F(1, 222) = .760, p = .469$, no significant level of gender effect with $F(1, 222) = 1.442, p = .231$ and no significant interaction effect between participant and gender with $F(1, 222) = .347, p = .707$.

Disinhibition (DIS)

The descriptive statistics, mean and standard deviations, for the disinhibition subscale on the SSS-V by participant category and gender are shown in Table 6.10. The higher the score indicated the higher the level of disinhibition.

Table 6.10 - Mean disinhibition scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	6.10	2.42
	Female N=36	5.39	2.48
Students	Male N=44	6.29	2.56
	Female N=38	5.53	2.31
Overall mean	N=226	5.92	2.45

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female) using age as a covariate for the subscale DIS Factorial ANOVA was conducted which showed no significant main effects for overall participants with $F(1, 222) = .389$, $p = .533$. with significant gender effect with $F(1, 222) = 4.698$, $p = .031$. The mathematical means for male and females were :

\bar{X} (males) = 6.14 > \bar{X} (females) = 5.46. Males scored higher than female.

There was and no significant interaction effect between participant and gender with $F(1, 222) = .001$, $p = .972$.

Boredom Susceptibility (BS)

The descriptive statistics, mean and standard deviations, for the boredom susceptibility subscale on the SSS-V by participant category and gender are shown in Table 6.11.

Table 6.11 - Mean boredom susceptibility scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	3.82	2.36
	Female N=36	3.58	2.18
Students	Male N=44	3.59	2.13
	Female N=38	3.47	2.67
Overall mean	N=226	3.68	2.33

Formal analysis of the data using a 2 participant (drag racer, student) by 2 gender (male, female) using age as a covariate for the subscale boredom susceptibility Factorial ANOVA was conducted, which showed no significant main effects for overall participants with $F(1, 223) = .239, p = .625$, with no significant gender effect with $F(1, 223) = .261, p = .610$ and with no significant interaction effect between participant and gender with $F(1, 223) = .029, p = .866$

Sensation Seeking (SS)

The descriptive statistics, mean and standard deviations, for sensation seeking on the SSS-V by participant category and level of performance are shown in Table 6.12.

Table 6.12 - Mean sensation seeking scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	21.83	6.50
	Elite N=41	21.49	5.91
Students	Amateur N=68	21.16	6.35
	Elite N=14	23.36	5.88
Overall mean	N=226	21.61	6.33

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) using age as a covariate for the sensation seeking scale (SSS-V) Factorial ANOVA was conducted which showed no significant main effects for overall participants with $F(1, 222) = .054, p = .816$, with no significant level of performance effect with $F(1, 222) = 1.293, p = .257$ and with no significant interaction effect between participant and level of performance with $F(1, 222) = .626, p = .430$.

Thrill Adventure Seeking (TAS)

The descriptive statistics, mean and standard deviations, for the thrill and adventure seeking subscale on the SSS-V by participant category and level of performance are shown in Table 6.13.

Table 6.13- Mean thrill and adventure seeking scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	6.74	2.88
	Elite N= 41	6.93	2.45
Students	Amateur N=68	6.79	2.97
	Elite N= 14	7.71	2.87
Overall mean	N= 226	6.82	2.79

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) using age as a covariate for the subscale of thrill and adventure seeking Factorial ANOVA was conducted, which showed no significant main effects for participants with $F(1, 222) = .009, p = .923$, no significant effect for level of performance $F(1, 222) = 2.196, p = .140$ and no significant interaction effect with $F(1, 222) = .103, p = .749$.

Experience Seeking (ES)

The descriptive statistics, mean and standard deviations, for the experience seeking subscale on the SSS-V by participant category and level of performance are shown in Table 6.14.

Table 6.14 - Mean experience seeking scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	5.30	1.93
	Elite N=41	5.07	2.43
Students	Amateur N=68	5.07	1.91
	Elite N=14	5.21	1.97
Overall mean	N=226	5.17	2.02

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) using age as a covariate for the subscale of experience seeking Factorial ANOVA was conducted on the data, which showed no significant main effects for participants with $F(1, 223) = .006, p = .938$, no significant level of performance effect with $F(1, 223) = .006, p = .938$ and no significant interaction effect with $F(1, 223) = .228, p = .633$

Disinhibition (DIS)

The descriptive statistics, mean and standard deviations, for the disinhibition subscale on the SSS-V by participant category and gender are shown in Table 6.15.

Table 6.15 - Mean disinhibition scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	6.05	2.53
	Elite N=41	5.61	2.22
Students	Amateur N=68	5.77	2.54
	Elite N=14	6.71	1.90
Overall mean	N=226	5.92	2.44

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) using age as a covariate for subscale of disinhibition Factorial ANOVA was conducted which showed no significant main effects for overall participants with $F(1, 222) = .013, p = .910$, with no significant level of performance effect with $F(1, 222) = .902, p = .343$ and with no significant interaction effect between participant and level of performance with $F(1, 222) = 1.49, p = .233$.

Boredom Susceptibility (BS)

The descriptive statistics, mean and standard deviations for the boredom susceptibility subscale on the SSS-V by participant category and level of performance are shown in Table 6.16.

Table 6.16 - Mean boredom susceptibility scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	3.82	2.38
	Elite N=41	3.63	2.15
Students	Amateur N=68	3.53	2.41
	Elite N=14	3.57	2.31
Overall mean	N=226	3.68	2.33

Formal analysis of the data using a 2 participant (drag racer, student) by 2 level of performance (amateur, elite) using age as a covariate for subscale of boredom susceptibility Factorial ANOVA was conducted on the data, which showed no significant main effects for overall participants with $F(1, 223) = .177, p = .674$, with no significant level of performance effect with $F(1, 223) = .026, p = .871$ and with no significant interaction effect between participant and level of performance with $F(1, 223) = .071, p = .791$.

6.3.5 Discussion

Psychology research into sport has consistently shown that those involved in sport score higher in extraversion than non-participants and in addition those who are high in extraversion also tend to be high in sensation seeking (Eysenck et al., 1982). In general those who engage in sport tend to demonstrate higher sensation seeking scores than non-participants. Drag racers were not significantly different than university sport science students who engage in a variety of more traditional sports. The only major finding of this study 2 was that there was a significant difference in gender for the subscale of disinhibition.

There were no significant differences between drag racers and the university sport science students in overall sensation seeking as measured by the total score on the SSS-V. This was not even significant when gender or level of performance was taken into account. Research consistently identifies sport participants as higher in sensation seeking than non-participants (Goma-i-Freixanet, 2004). In this study 2, those in extreme sport were no different than those in sport degrees, who all engage in some type of sport or activity. However, in a review study that spanned from 1991 to 2001, significance in sensation seeking between 'high-risk' participants and non-participants was found in 22 out of 25 studies (Goma-i-Freixanet, 2004). Drag racing is a high-risk sport and therefore drag racers should in line with research score higher than sports students. However, this was not the case.

The lack of gender differences between drag racers and university sport science students overall, was similar to Gundersheim (1987) who, in comparing college team athletes and non-participants, did not find any gender differences in terms of sensation seeking. However, he did identified differences between sports, finding baseball players were lower than lacrosse and wrestlers on sensation seeking as well as on the subscale of thrill and adventure seeking. Gundersheim concluded that these differences might be due to the whether a sport is classified as a contact or non-contact sport. This difference between sports was also supported by Potgieter and Bisschoff (1990) in their comparison of rugby players to marathon runners. They concluded that contact sports, due to the increased demand for aggressive behaviour, are higher in sensation seeking

than other sports. Drag racing in comparison to the general traditional sports that the university students participate in would not be classified as contact so therefore could be considered to have lower scores than other sports. Extreme sports in general are low in contact. This may account for why there was not a significant difference between the university sport science students who engage in both contact and non contact sport and drag racers.

Motor racers compared to controls or non-participants were not significantly higher on SS, ES, DIS or BS as measured by the SSS-V but did find difference on the TAS (Straub, 1982). Study 2 of this thesis, did not find any significant differences between drag racers and university sport students on the subscales of SS, TAS, ES or BS as measured by the SSS-V. There were however, differences between the drag racers and students on the DIS scale when gender was controlled. Male were higher than females and male drag racers scored particular high on this scale.

Studies on thrill and adventure seeking are mixed as motor racers have demonstrated higher scores on thrill and adventure seeking in comparison to golfers and runners though they rank lower on thrill and adventure seeking than hang gliders, skydivers and mountaineers (Jack and Ronan, 1998). The overall results of this study 2, contradict typical findings (20/25 studies) where high-risk sport participants score consistently higher on thrill and adventure seeking (see review paper -Goma-i-Freixanet, 2004).

The questions on the thrill and adventure seeking subscale of the SSS-V can be criticised. The thrill and adventure seeking questions ask if the athlete or non-athlete if they would like to engage in various sports that provide sensations. Perhaps these questions are not suitable in identifying thrill and adventure seeking in those who already engage in an 'extreme sport'. The most recent SSS-VI, focuses even more on intention than the SSS-V, which was used in this study. Drag racers are already involved in a thrill seeking sport and may answer the question from the perspective of not wanting to take on any additional 'extreme sport' situations.

The review paper by Goma-i-Freixanet (2004) showed a tendency for high-risk athletes to have high experience seeking subscale scores (13/25 studies). Contrary to her review paper, this study 2 showed no significance difference between the two participant groups. However, do questions on the SSS-V such as 'preferring to meet people who are homosexual' or 'dressing in an individual way no matter how strange' really measure or reflect drag racers sense of experience seeking? Drag racers tend to wear uniforms for their teams and car related clothes that identify them as a 'conformist' group at a track meet and yet they are a 'non-conformist' group of motor heads outside the track. Perhaps it is not surprising that women drag racers are ranked higher in experience seeking than female students. There are relatively few women in motor sport, as this may be seen as a less than stereotypical feminine pursuit. The comparison group in this study may be experience seekers due to their younger age. This may have impacted on the lack of significant difference between the drag racers and comparison group.

Based on the results from her review paper (Goma-i-Freixanet, 2004) the subscale of DIS was significant in only 10/25 or 40% of studies comparing high-risk participants to non-participants. In this study, there were no differences between the two groups except with regard to gender. University students are known for their desire to 'party', and for example to take illegal drugs or abuse alcohol. Male students scored the highest on DIS. Though there was not any difference between the two groups of participant, students are known for their experimental behaviour into drink and drugs and usually score high on this measure. In 'extreme sport' where an unsuccessful completion could result in an injury or death, it is palpable that drag racers would not engage in substance abuse and reckless to contemplate this type of behaviour. Though, it is evident that males engage more in this type of behaviour. After race drinking is quite common in the drag racing culture.

In Boredom susceptibility (BS) there were no significant results demonstrated. In the review paper (i.e. Goma-i-Freixanet, 2004) there were only 9 out of 25 studies (36%), which demonstrated significant differences between high-risk participants and control groups. Drag racing may, in fact, be seen as an integral part of participants' lives, i.e. a

lifestyle sport. There is a very strong camaraderie in drag racing and those who compete are part of an exclusive club. It also may be seen as part of a life-work balance. Drag racers identified that they are often employed in very repetitive jobs and that the racing on the weekends prevents them from getting bored. This is contrary to research, which suggests that those who participate in risk taking sports are interested in a wide range of thrill seeking activities due to boredom.

Elites were no different than amateurs on any measures. Though some studies, which have compared experts to those less experienced have found experts high on all sensation seeking scales (Zuckerman, 1994). Research in sport primarily however, distinguishes between achievement (e.g. Olympic contenders or gold medallists) or position (instructors or competitors) rather than according to skill.

Studies, which control for gender are limited, though the results of sensation seeking studies in high-risk sport have demonstrated that both men and women differ in overall sensation seeking (Goma-i-Freixanet et al., 2001). This was not found in this study though there were significant differences found between the genders on disinhibition, which supported research (Goma-i-Freixanet, 1991; 2001).

When age is controlled for, 'extreme sport' athletes score higher on sensation seeking and all subscales except for boredom susceptibility (see review Goma-i-Freixanet, 2004) compared to control groups with 'low-risk' or no risk. This study did not find that age was a correlate with all the subscales. When controlling for age, high-risk sports participant in comparison with the general population also score high on disinhibition. This may be less clear when sports students are used as a control as college students are typically younger than the elite sports persons. Sensation seeking also declines with age. The older elite sports participant scores higher in comparison to their age group though this may not seem to be so high in comparison to students, unless age is controlled. Previous studies have shown that high-risk athletes as compared to the general population score higher on disinhibition when variables such as age are controlled (Goma-i-Freixanet, 1991; 2001).

Sport students are often used as controls in sports research (e.g. McKelvie et al., 2003). They form a homogenous group as they all participate in some exercise or sport and have the love of sport. Yet students as a comparison group may not be the best group to use especially if moderating variables, such as age, level of performance and gender are not controlled for.

The uniqueness of student populations is noticeable in sensation seeking when students who engage in contact are compared to those in non-contact sport (McKelvie et al., 2003). University students engaged predominantly in non-contact sports demonstrated higher scores than general university controls on experience seeking and disinhibition though not on thrill and adventure seeking (Hartman and Rawson, 1992). There is also an accepted negative correlation between SS scores and age (Zuckerman et al., 1972). The identification of contact and non contact sport was not controlled for in the university student cohort. However, if students do typically score higher on experience seeking then this may account for why there was not a significant difference on experience seeking between the drag racers and the students.

Comparison groups are difficult in sport as it is unusual to ever find a group that has never participated in sport. Students may not be the optimal comparison group for studies on sensation seeking but then neither are non-participants who may be identifiable as sport spectators (Van Bottenburg, 2002). In terms of age, spectators are often older as age increases participation in sport decreases. However, watching sports is still thrilling and non-participant spectators are often high in sensation seeking (Heino, 2000). Research has also shown that most non participants are spectators and that most spectators are typically involved in sport (White and Wilson, 1999).

The results of this study 2 have identified that 'skill levels' as a variable and 'gender' may not be important keys in distinguishing drag racers in 'extreme sport' from university sport science students. This may be because sport students are higher in sensation seeking than non-participants (i.e. review paper by Goma-i-Freixanet, 2004).

Morgan (1980) stated 'various personality traits have consistently been observed to account for 20-45% of the variance in sport performance' (p.72). The results of this study showed the lack of importance of sensation seeking as a personality factor within 'extreme sport'. This study clearly demonstrated that there may be a unique personality profile in drag racing which does not include sensation seeking. Age, gender and level of performance were controlled for however not useful in detecting differences. It can also be concluded that students (and in this case, specifically sports students) are not an ideal comparison group. Druckman and Kam, (2009) suggest that perhaps researchers just need more guidance to warrant appropriate generalization of results from student subjects. They encourage researcher to consider dual samples consisting of students and non-students. It seems that as suggestion by Peterson, (2001), the importance of replicating research based on college student subjects with non-student subjects before attempting any generalizations is best practice. The importance of using extreme groups when researching is suggested by Kolega (1992) in his review, where he attributed the failure to include extreme groups as a reason for inconsistencies in research. For these reasons, study 3 will now examine personality factors adding the comparison another sport, Archers, who if placed on a continuum, which ranges from extreme to 'non-extreme sport' would be completely on the other end of the scale or 'opposite' to drag racing.

6.4: Study 3 -The Relationship between Personality, Sensation Seeking and Sporting Performance: Evidence from Drag Racers, University Sport Science Students and Archers

6.4.1 Background and Aims

Recently, there has been a rise in the popularity of studies examining the relationship between personality and sporting performance (Han, et al., 2005; Xiang, 2009) as sport psychology becomes more proficient in predicting and improving successful outcomes in sport (Piedmont et al., 1999; Aidman, 2007). Talent recognition in sport has become a mainstream business and psychology can make a significant contribution to this. Inconsistent research however, can lead many psychologists, coaches and sport teams to be wary of its predictive potential (Deaner and Silva, 2002). Recently however, predictive personality testing is gaining in popularity as sports teams search for the advantage through effective talent identification in order to predict long term success (Gee et al., 2010). However, significant controls are required to ensure that research is scientific and not methodologically flawed as in the past (Eysenck et al., 1982; Furnham, 1990; Rhodes and Smith, 2006).

This study will examine personality using the ‘extreme sport’ of drag racing by testing racers on extraversion/neuroticism (Eysenck and Eysenck, 1982) and the sensation seeking scale-V (Zuckerman, 1994) in comparison to archers and university sport science students. In doing so, significant controls will be in place. The need to control gender is evident, as men and women vary in sensation seeking depending on whether or not they are involved in risky sports, high risk occupations, or lead a risky lifestyle (Goma-i-Freixanet, 1997; 2001). On the thrill and adventure seeking subscale of the sensation seeking scale, significant differences between males and females have been demonstrated (Goma-i-Freixanet, 2004) though this study included a wide range of high-risk sports, which were examined as one group. Level of performance is another important factor in determining the personality typology of specific groups of athletes i.e. amateur versus elite. There has been research analysing expert performance within hockey, baseball and basketball (Garland and Barry, 1991; McPherson, 1993; Starkes et

al., 1994; Williams and Davids, 1995). However, there is very little research on the differences between elites and amateurs involved in extreme versus traditional sport which (Donnelly, 2006) says, in a study on snowboarders, undermines the authenticity of the research. A study on dart players also demonstrated the importance of isolating level of performance (Duffy et al., 2004).

The majority of studies use students as a comparison group (e.g. Xiangle, 2009), and while students are an interesting cohort, sport students have their own specific identity. Generalising results from students alone is not recommended and in fact use of non-student groups in order to make replication of research more scientific is encouraged (Peterson, 2001; Druckman and Kam, 2009).

There is lack of empirical research into personality on the comparison of 'extreme sport' and other traditional sports (Zuckerman, 2007). From 1974 to 2001, only 2 studies were identified (see review by Goma-i-Freixanet, 2004) as comparing 'extreme sport' to medium risk sports: i.e. rugby to marathon (Potgieter and Bisschoff, 1990); karate to tennis (Canton and Mayor, 1994). Research has demonstrated a need to profile specific groups of sports as variations in personality exist, e.g. adventure racers are high in extraversion and high in sensation seeking (Schneider, Butryn, Furst, and Masucci, 2007) Skydivers are higher in extraversion than alpinists (Brevik, 1999).

There is a wide-ranging amount of research on the relationship between sensation seeking and 'extreme sport' and the majority of it has included sports such as skiing, surfing and skydiving. However, more 'extreme sports' such as bull riding have recently captured the interest of researchers (e.g. Rhea and Martin, 2010). Although these studies demonstrate that participants tend to have a preference for risk, studies indicate that various sport specific profiles may exist (Diehm and Armatas, 2004; Kajtna et al., 2004; Willing, 2008; Rhea and Martin 2010). Sensation seeking scores in traditional sports are lower than in 'extreme sports' suggesting that risk may be a relevant variable with participation in these 'extreme sport' (Zuckerman, 1994; Diehmand and Armatas, 2004). However, very few studies have examined commonalities between those who compete in traditional and alternative sports. Studies tend to include many 'extreme

sports' within one cohort (e.g. Kajtna et al., 2004; Rhea and Martin, 2010). The author of this thesis has identified archers and sport students as homogenous comparison groups in order to overcome some of the criticisms coming from previous research.

Studies on archers are limited and have predominantly focused on personality variations during training. An early study of archers, using the Catell 16PF, showed that archers were less assertive than other athletes, i.e. rowers, cross country runners, judo players and canoeists (Dolphin et al., 1980). A more recent 10-year longitudinal study, found subtleties in the personality of female archers which suggested that training methods impact on the personality characteristics of archers (Yan, 2004). This study, however, can be criticized for its very small sample size of 5. Finally, a study using the Maudsley Personality Inventory to examine personality, found differences between younger archers and older archers on the Polish National Archery team. The authors' suggested that personality would change during years of training though this study can be criticized for a cross-sectional analysis (Parzelski and Mienkowska, 2007). In addition there is limited, if any, differentiation between males and females who compete in side by side in designated sports such as is common to both drag racing and archery.

The overall aim of this study was to investigate the relationship between Eysenck's personality dimensions and Zuckerman's sensation seeking scales comparing 'extreme sport' participants (drag racers), traditional sport participants (archery) and university sport students. This study was designed to assess whether using sensation seeking plus extraversion and neuroticism scales can identify a particular personality profile of drag racers. The outcomes of the proposed study would be the first reported research on extraversion/neuroticism and sensation seeking measures taken from drag racers and from archery players. Drag racers are a 'extreme sport' group that have never been personality profiled before and have never been compared to any other sport in this way. In addition, this study hopes to engage new researchers in personality to address controlling variables so that personality profiling and talent identification can emerge in a more scientific way into the new millennium. The results together with previously obtained data from drag racers should make a strong contribution to the 30 year-old

debate on whether there is a relationship between personality traits and the nature of sporting activity in so far as sensation seeking and risk taking aspects of the sports are involved.

The aim of the present study was to control moderating variables, i.e. gender, age, level of performance whilst examining personality and sensation seeking. In addition, as outlined above, this research controlled the use of its comparison groups, in order to overcome previous deficiencies identified in study 2. The extreme sport participants used in this study 3 are not one-off 'extreme sport' event participants such as those who undertake extreme activities as a part of 'red-letter' days. It examines drag racers that are both amateurs and elites. Archery, seen as a traditional and a 'non-extreme' sport (in terms of sensation seeking and injuries) may be argued to be a most appropriate benchmark in terms of sporting activity to examine possible relationships between personality traits, sensation seeking and other variables, namely gender and level of performance. Furthermore, both archery and drag racing are considered as individual sports with men and women having the chance of competing against each other. Finally, by selecting drag racers and archers, two groups that have never been compared, this study aims to progress the literature by using a novel group, i.e. drag racers and an under studied group, archers.

6.4.2 Hypotheses

HA1 There will be a significant difference between drag racers, archers and university sport science student on extraversion (EPI)

HA2 There will be a significant difference between drag racers, archers and university sport science student on neuroticism (EPI)

HA3 There will be a significant difference between drag racers, archers and university sport science student on sensation seeking (SSS-V)

HA4 There will be a significant difference between drag racers, archers and university sport science student on subscales of sensations seeking (SSS-V). i.e. thrill seeking, experience seeking , disinhibition and boredom susceptibility

6.4.3 Methodology

Design- A quasi-experimental design was employed in which the independent variables are gender, age and level of performance and the dependent variables are scores from extraversion, neuroticism and sensation seeking. A series of t-tests and MANOVA's will be used to analyse the data.

Materials- Participants completed two questionnaires (see Appendix for a copy of the questionnaires). The first questionnaire was the Eysenck Personality Inventory (Eysenck and Eysenck, 1982), which measures extraversion (24 items) and neuroticism (24 items). It is a forced-answer questionnaire, which required a yes or no to each question. The internal consistency and test re-test reliability for extraversion and neuroticism, according to Eysenck and Eysenck (1982), ranged from .75-.90.

The second questionnaire is the Sensation Seeking Scale (SSS-V) developed in 1994 by Zuckerman (1994), on the premise that there are individual differences in optimal levels of stimulation and arousal. Sensation seeking overall is defined as the seeking of varied, novel, and intense stimuli and the willingness to take risks 'or the sake of such experience (Zuckerman, 1994). The SSS-V was revised in collaboration with data from a large-scale study that Zuckerman carried out with Eysenck and Eysenck in 1978. The SSS-V is a valid and reliable method for identifying an individual's behavioural expression of sensation seeking traits (Zuckerman, Eysenck and Eysenck, 1978; Zuckerman, 1994). The Sensation Seeking Scale (SSS-V) being used in this study (Zuckerman, 1994) has been validated by numerous studies in sport (Levenson, 1990; Breivik, 1999). The SSS-V internal reliabilities of the total score range from .83 to .86; the ranges of reliability for the subscale thrill and adventure seeking .77 to .82; experience seeking .61 to .67; and disinhibition .74-.78 and boredom susceptibility .56 to .65. Test re-test reliability for the four subscales as well as the total sensation seeking score over a three-week duration ranged from .61 to .93 (Zuckerman, 1994). The internal consistency coefficients for the four subscales (SSS-V) for American males ranged from .67 to .84 (Zuckerman, 1994). There are no separate scales for sensation seeking for

women and men. Ball et al., (1984) support the existence of the four distinct subscales of sensation seeking (Zuckerman's SSS-V) in their sample of 335 females and 363 male Australians.

Participants- There were 271 participants who completed both the EPI and the SSS-V. This totalled 144 drag racers, 45 archers and 82 university sport science students. The 144 drag racers (mean age= 31, SD =12.27) were 108 males: 36 females, 41 elite and 103 amateurs. There were 82 university students (mean age=22.9, SD = 2.99): 44 males, 38 females, 14 elite and 68 amateurs. There were 45 archers: 30 male archers, 15 females, 16 elite and 29 amateurs (see table 6.17 for breakdown for mean age and standard deviation by gender, level of performance for drag racers, archers and university sport science students).

Level of performance criteria

Drag Racers - The distinction between elite and amateur, for drag racers, were based on FIA classifications. Elite drag racers were classified as those who compete in the elite classes and were licensed drag racing drivers who receive monetary rewards when placing in the top 3. Elite classes included those who compete in categories of cars such as Top Fuel, Top Methanol Dragster, Funny car, and Pro Stock. Drag racers in other categories which included Comp, Super Stock, and Stock were classified as amateurs.

Students - those who maintained sporting activity at national or international level were classified as elite. Those who were any of a combination of the following were classified as amateurs: recreational sport, fitness participants, university team players.

Archery - archery players who competed at either international or national level were classified as elite. Those club members who played regularly in competitions but were not in the elite category were classified as amateur.

6.4.4 Results

Table 6.17 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers, university sport science students and archers

Participants	Level of performance N=Number of participants	Mean Age	SD
Drag racers Male	Amateur N=76	29.75	12.12
	Elite N=32	35.37	13.4
Drag Racers Female	Amateur N=27	27.85	10.28
	Elite N=9	29.88	10.73
Archers Male	Amateur N=18	32.83	8.62
	Elite N=12	40.75	14.82
Archers Female	Amateur N=11	38.72	12.79
	Elite N=4	36.75	10.11
Students Male	Amateur N=38	22.94	2.61
	Elite N=6	22.83	3.71
Students Female	Amateur N=30	23.2	3.6
	Elite N=8	21.87	1.55
Total	N=271		

Procedure- Ethical approval for the study was granted by Middlesex University's ethical sub committee in psychology and as set out by BPS. Informed consent was obtained from all participants and the institution under which this was conducted approved the protocol. There was an introduction to the test that included all required ethical details (i.e. withdrawal, data protection, confidentiality, research use of data, contact details of researcher).

Both the EPI and the SSS-V were available online or in a hard copy. As mentioned previous, drag racers were recruited through the website Eurodragster and at race meets. Archers were recruited through archery clubs and archery websites.

Participant category and gender

A series of 3 participants (drag racer, archer and student) by 2 gender Factorial ANOVAs were conducted with personality (extraversion/neuroticism) and sensation seeking, as dependent variables. Age of participants was used as a covariate to avoid any confounding outcomes due to significant age differences amongst participants.

Extraversion (E)

The descriptive statistics, mean and standard deviations, for extraversion on the EPI by participant category and gender are shown in Table 6.18

Table 6.18 - Mean extraversion scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	13.54	4.35
	Female N=36	12.47	4.04
Archers	Male N=30	12.23	4.10
	Female N=15	12.20	3.55
Students	Male N=44	14.80	4.37
	Female N=38	14.42	4.91
Overall mean	N=271	13.51	4.39

Formal analysis of the data for extraversion using a 3 participant (drag racer, archer and student) by 2 gender (male, female) Factorial ANOVA and age as a covariate was conducted which showed no significant effects for participants with $F(2, 264) = 2.025$, $p = .134$, no significant gender effect with $F(1, 264) = .602$, $p = .439$ and no significant interaction effect with $F(2, 264) = .378$, $p = .686$.

Neuroticism (N)

The descriptive statistics, mean and standard deviations, for neuroticism on the EPI by participant category and gender are shown in Table 6.19

Table 6.19 - Mean neuroticism scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	11.00	4.95
	Female N=36	11.91	5.97
Archers	Male N= 30	10.00	5.37
	Female N=15	13.20	4.71
Students	Male N=44	11.48	3.30
	Female N=38	13.08	3.86
Overall mean	N= 271	11.50	4.82

Formal analysis of the data for neuroticism using a 3 participant (drag racer, archer, student) by 2 gender Factorial ANOVA with age as a covariate was conducted on the data which showed no significant main effects for participants with $F(2, 264) = .568, p = .567$, highly significant gender effect with $F(1, 264) = 7.68, p = .006$. The overall mean for neuroticism for females =12.6 which was higher than the overall mathematical mean for males= 10.95. There was no significant interaction effect with $F(2, 264) = .843, p = .432$.

Sensation Seeking (SS)

The descriptive statistics, mean and standard deviations, for sensation seeking on the SSS-V by participant category and gender are shown in Table 6.20.

Table 6.20 - Mean sensation seeking scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	21.93	6.61
	Female N=36	21.14	5.39
Archers	Male N=30	19.17	7.89
	Female N=15	17.27	5.68
Students	Male N=44	21.70	6.91
	Female N=38	21.34	5.59
Overall mean	N=271	21.14	6.55

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender Factorial ANOVA for sensation seeking was conducted which showed a significant main effects for participants with $F(2, 265) = 4.30, p = .015$. The mathematical mean for the groups was: drag racers=21.73, students=21.54 and archers=18.53. There was no significant gender effect with $F(1, 265) = 1.186, p = .277$ and no significant interaction effect with $F(2, 265) = .189, p = .828$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = 1.099$, $p = 0.004$ and for students and archers $SE = 1.194$, $p = 0.01$. There was no difference between drag racers and students $SE = 0.89$, $p = 0.82$.

Thrill and Adventure seeking (TAS)

The descriptive statistics, mean and standard deviations, for the thrill and adventure seeking subscale on the SSS-V by participant category and gender are shown in Table 6.21.

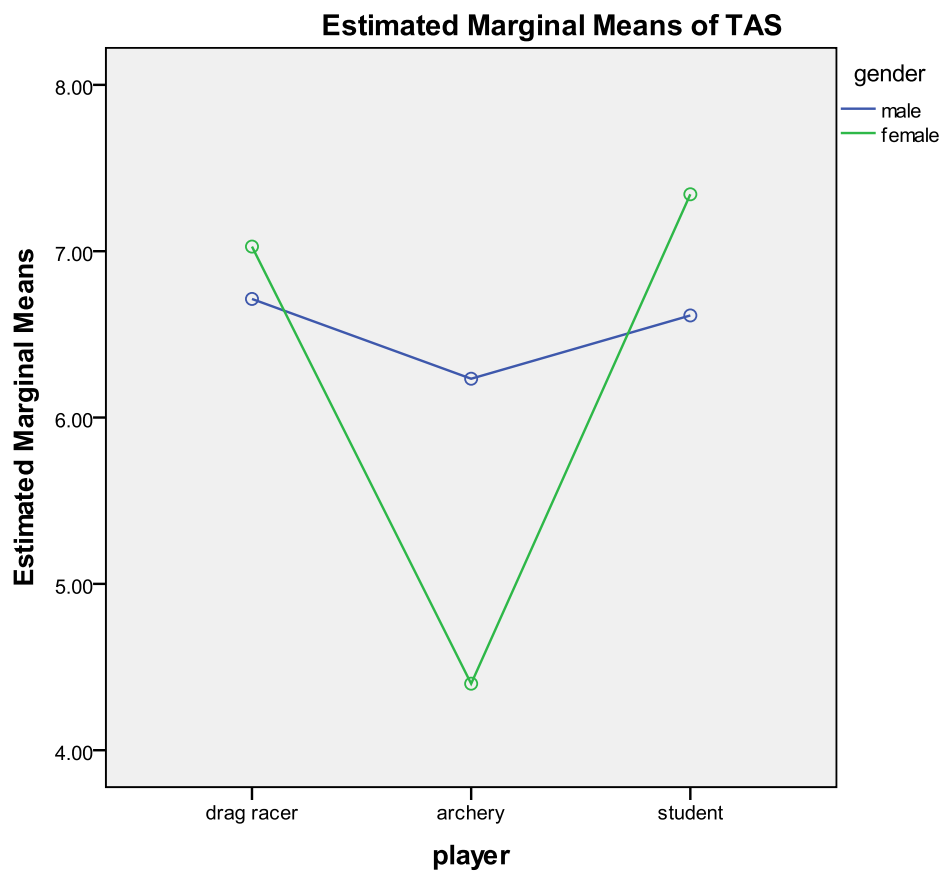
Table 6.21- Mean thrill and adventure seeking scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	6.71	2.86
	Female N=36	7.03	2.32
Archers	Male N=30	6.23	2.76
	Female N=15	4.40	1.88
Students	Male N=44	6.61	3.11
	Female N=38	7.34	2.75
Overall mean	N =271	6.65	2.81

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed highly significant main effects for participants with $F(2, 222) = 5.55, p = .004$. The overall mathematical means for the participant groups were: students=6.95, drag racers=6.79 and archers=5.62. There were no significant gender effect with $F(1, 265) = .438, p = .509$ and significant interaction effect with $F(2, 265) = 3.04, p = .049$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = .473$, $p = 0.014$, and for students and archers $SE = .514$, $p = 0.01$. There was no significant difference for drag racers and students with $SE = 0.383$, $p = 0.677$.

Figure 3- The graphic display of the interaction effect (TAS and gender)



Analysis of simple effects showed a significant difference gender difference for archers with $t(43) = 2.3$, $p = 0.02$ but no significant difference for drag racers $t(142) = 0.59$, $p = 0.55$ or students $t(80) = 1.1$, $p = 0.26$.

Experience seeking (ES)

The descriptive statistics, mean and standard deviations, for the experience seeking subscale on the SSS-V by participant category and gender are shown in Table 6.22.

Table 6.22 - Mean experience seeking scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	5.27	2.12
	Female N=36	5.14	1.97
Archers	Male N=30	5.93	2.10
	Female N=15	5.20	1.66
Students	Male N=44	5.18	1.85
	Female N=38	5.00	2.00
Overall mean	N=271	5.27	2.01

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender Factorial ANOVA was conducted, which showed no significant main effects for participants with $F(2, 265) = .760, p = .469$, no significant gender effect with $F(1, 265) = 1.442, p = .231$ and no significant interaction effect with $F(2, 265) = .347, p = .707$.

Disinhibition (DIS)

The descriptive statistics, mean and standard deviations, for the disinhibition subscale on the SSS-V by participant category and gender are shown in Table 6.23.

Table 6.23 - Mean disinhibition scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	6.10	2.42
	Female N=36	5.39	2.48
Archers	Male N=30	4.70	1.99
	Female N=15	4.33	2.32
Students	Male N=44	6.27	2.56
	Female N=38	5.53	2.31
Overall mean	N=271	5.70	2.44

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed highly significant main effects for participants with $F(2, 265) = 4.963, p = 0.008$. The overall mathematical mean for the participant groups were: students=5.93, drag racers=5.92 and archers =4.58. There was no significant gender effect with $F(1, 265) = 3.148, p = .077$ and no significant interaction effect with $F(2, 265) = .096, p = .909$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of

the means using LSD found significant differences for drag racers and archers $SE = .407$, $p = 0.001$, and for students and archers $SE = .443$, $p = 0.003$. There was no significant difference for drag racers and students with $SE = 0.330$, $p = 0.992$.

Boredom Susceptibility (BS)

The descriptive statistics, mean and standard deviations, for the boredom susceptibility subscale on the SSS-V by participant category and gender are shown in Table 6.24.

Table 6.24 - Mean boredom susceptibility scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=108	3.82	2.36
	Female N=36	3.58	2.18
Archers	Male N=30	3.50	1.89
	Female N=15	3.33	1.63
Students	Male N=44	3.59	2.13
	Female N=38	3.47	2.67
Overall mean	N=271	3.64	2.25

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data, which showed no significant main effects for participants with $F(2, 265) = .280$, $p = .756$, no significant gender effect with $F(1, 265) = .288$, $p = .592$ and no significant interaction effect with $F(2, 265) = .018$, $p = .983$.

Participant category and level of performance

A series of 3 participant (drag racer, archer and student) by 2 level of performance (amateur, elite) Factorial ANOVAs were conducted with personality (extraversion/neuroticism) and sensation seeking (including total SS and subscales: TAS, ES, DIS, BS), as dependent variables. Age of participants was used as a covariate to avoid any confounding outcomes due to significant age differences amongst participants.

Extraversion (E)

The descriptive statistics, mean and standard deviations, for extraversion on the EPI by participant category and level of performance are shown in Table 6.25.

Table 6.25 - Mean extraversion scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	13.14	4.24
	Elite N=41	13.61	4.44
Archers	Amateur N=29	11.93	3.68
	Elite N=16	12.75	4.30
Students	Amateur N=68	14.78	4.59
	Elite N=14	13.86	4.75
Overall mean	N=271	13.51	4.39

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (amateur, elite) Factorial ANOVA was conducted on the data, which showed no significant effects for participants with $F(2, 265) = 2.27, p = 0.105$, no significant level of performance effect with $F(1, 265) = .034, p = .855$ and no significant interaction effect with $F(2, 265) = .551, p = .577$

Neuroticism (N)

The descriptive statistics, mean and standard deviations, for neuroticism on the EPI by participant category and level of performance are shown in Table 6.26.

Table 6.26 - Mean neuroticism scores and corresponding standard deviations by participant and level of performance

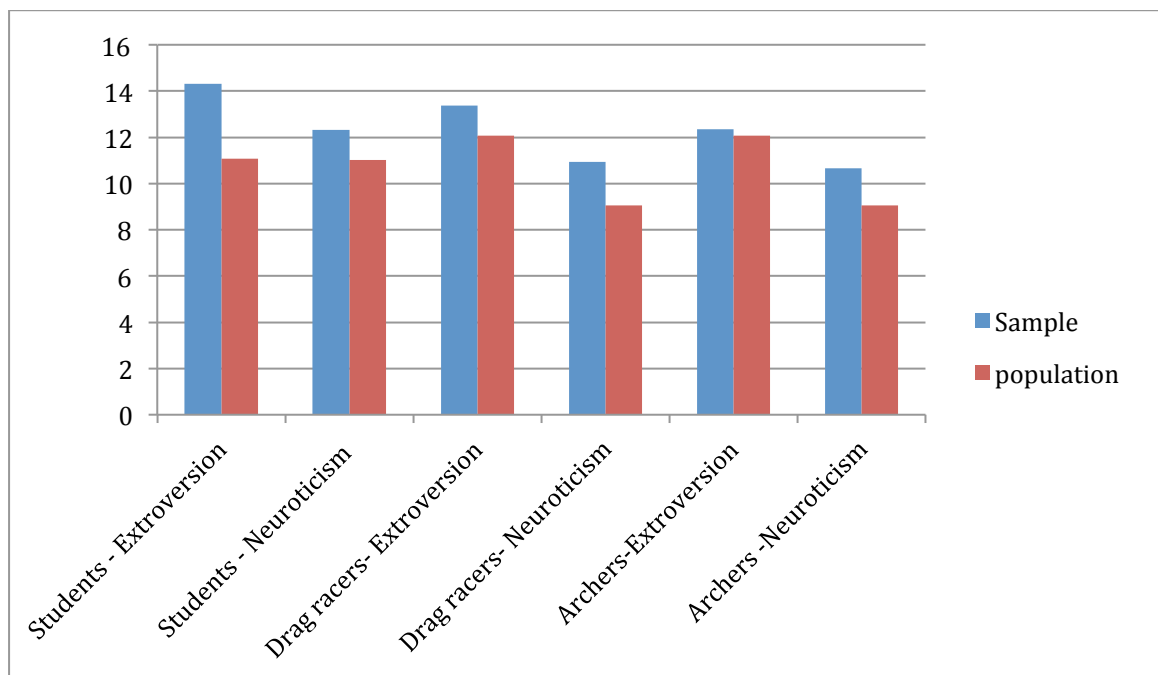
Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	11.60	5.22
	Elite N=41	10.29	5.17
Archers	Amateur N=29	12.07	5.40
	Elite N=16	09.25	4.84
Students	Amateur N=68	12.16	3.64
	Elite N=14	12.50	3.76
Overall mean	N=271	11.50	4.82

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant effects for participants with $F(2, 265) = 1.718, p = .181$, no significant level of performance effect with $F(1, 265) = 2.878, p = .091$ and no significant interaction effect with $F(2, 265) = 1.192, p = .305$.

Population Norms

A comparison of EPI measures on extraversion and neuroticism in drag racers, students and archers compared to population norms (Eysenck and Eysenck, 1982).

Figure 4 - Bar chart representing the comparison of personality measures of drag racers, university sport science students and archers with the population norms



Sensation Seeking (SS)

The descriptive statistics, mean and standard deviations, for the Sensation Seeking subscale on the SSS-V by participant category and level of performance are shown in Table 6.27.

Table 6.27 - Mean sensation seeking scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	21.83	6.50
	Elite N=41	21.49	5.91
Archers	Amateur N=29	17.07	6.01
	Elite N=16	21.19	8.59
Students	Amateur N=68	21.16	6.35
	Elite N=14	21.79	6.54
Overall mean	N=271	21.14	6.55

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) in sensation seeking Factorial ANOVA was conducted on the data which showed significant effects for participants with $F(2, 265) = 3.041, p = .049$. The overall mathematical mean for the participant groups was: drag racers=21.73, students=21.54 and archers=18.53. There was a significant level of performance effect with $F(1, 265) = 3.967, p = .047$. The mathematical means for level of performance were: professionals=21.79 and amateurs=20.91. There was however, no significant interaction effect with $F(2, 265) = 2.031, p = 0.133$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = 1.099$, $p = 0.004$ and for students and archers $SE = 1.194$, $p = 0.01$. There was no difference between drag racers and students $SE = 0.89$, $p = 0.82$.

Thrill and Adventure Seeking (TAS)

The descriptive statistics, mean and standard deviations, for thrill and adventure seeking subscale on the SSS-V by participant category and level of performance are shown in Table 6.28.

Table 6.28 - Mean thrill and adventure seeking scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	6.74	2.84
	Elite N=41	6.93	2.45
Archers	Amateur N=29	5.14	2.17
	Elite N=16	6.50	3.20
Students	Amateur N=68	6.79	2.97
	Elite N=14	7.71	2.87
Overall mean	N=271	6.65	2.81

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) on thrill and adventure seeking Factorial ANOVA was conducted which showed significant effects for participants with $F(2, 265) = 3.119$, $p = .046$. The overall mathematical mean for the participant groups was: students=6.95, drag racers=6.79 and archers=5.62. There was a significant level of performance effect with $F(1, 265) = 3.638$, $p = .058$ with an overall mathematical mean for amateurs=6.53 and professionals=6.99. There was no significant interaction effect with $F(2, 265) = .785$, $p = .457$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = .475$, $p = 0.014$, and for students and archers $SE = .516$, $p = 0.01$. There was no significant difference for drag racers and students with $SE = 0.384$, $p = 0.679$.

Experience Seeking (ES)

The descriptive statistics, mean and standard deviations, for the experience seeking subscale on the SSS-V by participant category and level of performance are shown in Table 6.29.

Table 6.29 - Mean experience seeking scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	5.30	1.93
	Elite N=41	5.07	2.43
Archers	Amateur N=29	5.38	1.80
	Elite N=16	6.25	2.21
Students	Amateur N=68	5.07	1.91
	Elite N=14	5.21	1.97
Overall mean	N=271	5.27	2.01

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant effects for participants with $F(2, 265) = 1.670$, $p = .190$, no significant level of performance effect with $F(1, 265) = .697$, $p = .405$ and no significant interaction effect with $F(2, 265) = 1.142$, $p = .321$.

Disinhibition (DIS)

The descriptive statistics, mean and standard deviations, for the disinhibition subscale on the SSS-V by participant category and level of performance are shown in Table 6.30.

Table 6.30 - Mean disinhibition scores and corresponding standard deviations by participant and level of performance.

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	6.05	2.53
	Elite N=41	5.61	2.22
Archers	Amateur N=29	4.41	1.55
	Elite N=16	4.88	2.85
Students	Amateur N=68	5.77	2.54
	Elite N=14	6.71	1.90
Overall mean	N=271	5.70	2.44

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted which showed highly significant effects with participants with $F(2, 265) = 5.363, p = .005$. The overall mathematical mean for the participant groups was: students=5.93, drag racers=5.92 and archers=4.58. There was no significant effect for level of performance $F(1,265) = .760, p = .384$, and no significant interaction with $F(2,265) = 1.585, p = .207$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = .409$, $p = 0.001$, and for university sport science students and archers $SE = .444$, $p = 0.003$. There was however no significant difference between drag racers and students $SE = 0.331$, $p = 0.992$.

Boredom Susceptibility (BS)

The descriptive statistics, mean and standard deviations, for the boredom susceptibility subscale on the SSS-V by participant category and level of performance are shown in Table 6.31.

Table 6.31 - Mean boredom susceptibility scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=103	3.82	2.38
	Elite N=41	3.63	2.15
Archers	Amateur N=29	3.38	1.64
	Elite N=16	3.56	2.10
Students	Amateur N=68	3.53	2.41
	Elite N=14	3.57	2.31
Overall mean	N=271	3.64	2.25

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted which showed no significant effects for participants with $F(2, 265) = .233, p = .792$, no significant effects for level of performance with $F(1, 265) = .002, p = .967$, and no significant interaction effect with $F(2, 265) = .113, p = .893$.

6.4.5 Discussion

The results in this study demonstrate that there were no significant differences between drag racers, archers and university sport science students in extraversion with regard to gender or level of performance. In terms of neuroticism, there was a significant gender effect. There were also significant differences between participants in overall sensation seeking, thrill and adventure seeking and disinhibition. Post hoc analyses, showed that that on all these 3 measures (SS, TAS, DIS), there were significant differences between drag racers and archers as well as between students and archers however there was no significant differences between drag racers and students. This would account for the lack of significant results in earlier studies found in this thesis. There was a significant effect in sensation seeking, thrill and adventure seeking when controlling for level of performance. On the subscale of thrill and adventure seeking, there was also an interaction effect, which showed that there were significant differences between male and female archers. No significant findings were found on the subscale of boredom susceptibility. Methodological weaknesses highlighted in previous research (e.g. Eysenck et al., 1982; Koelega, 1992; Goma-i-Freixanet, 2004; Silverman, 2006;) i.e. gender and level of performance, were controlled for. Age as a covariate was controlled for, as age negatively correlated with the scores of the subscales of extraversion and neuroticism as well as sensation seeking (Farre et al., 1995) and the drag racers as well as the archers were on average older than the university sport science students.

Extraversion/Neuroticism

Extraversion is consistently found to be a typical personality trait in those who participate in sport (Rhodes and Smith, 2006). However, this study 3 did not find any significant difference in extraversion between drag racers, archers and university sport science students.

In examining the descriptive statistics, drag racers demonstrated higher scores in extraversion than archers. This is similar to research which showed British bobsleighers were higher in extraversion compared to cyclists (Eysenck et al., 1982). There is clearly a difference in the skills required in drag racing as opposed to archery, which may

account for this slight discrepancy. In comparison to university sport science students, drag racers scored lower on average in extraversion than university sport science students. This is contrary to research where, though university sport science students were higher than the norm, they were lower on extraversion than those in high-risk sport, e.g. mountain climbers were higher in extraversion compared to sport students (Fowler et al, 1980). The student group in study 3 is a mixed cohort of those who participate in university sport, recreational sport and physical activity. Male physical education students were shown to have extremely high mean extraversion scores in comparison to the population norm (Eysenck and Eysenck,1982) so it is not unusual that this group would be high, however it is unusual that they would be higher than an 'extreme sport' group such as drag racers. Students, and in particular generalised sports participants, may not be the best sample group. In addition, research has shown that physically active students were on average more extraverted due to a favourable attitude to 'exercise' (Rhodes and Smith, 2006).

Eysenck et al. (1982) also points out that outstanding performers are higher in extraversion than average athletes. However, on measures of extraversion and neuroticism there were no significant difference in this study 3 in level of performance, i.e. between elites and amateurs. According to Eysenck et al. (1982), gender may also be an important variable as women are better adjusted in sport and therefore their personality is more similar to males. However, there was a lack of significance demonstrated in study 3 between the male and female participants.

The only difference on the EPI scale was that there were significant gender differences in neuroticism. The results in this study found highly significant differences in the personality traits of neuroticism between genders. Females were higher in neuroticism which is consistent with the review by Eysenck et al. (1982). According to the descriptive statistics, female archers were much higher in neuroticism than male archers, who scored the lowest. Neuroticism is according to the literature predominantly lower in athletes and also declines with age (e.g. Eysenck et al., 1982). Age, however, was controlled for in this study.

In this thesis, there were no significant differences in neuroticism between amateurs and elites. Outstanding athletes are lower in neuroticism according to Eysenck et al., (1982).. In examining the descriptive statistics, drag racers and archers were the lower in neuroticism than students. Elite archers were the lowest which is consistent with the research. The results for neuroticism demonstrated that those who participate in drag racing are not significantly higher in neuroticism, compared to students.

According to Eysenck et al., (1982), extraverts are more likely to take up sport because their low arousal levels make them want to seek sensory stimulation and they will be more venturesome and more involved in risk taking. So drag racers were not shown to be high in extraversion, nor low in neuroticism then are they high in sensation seeking?

Sensation Seeking (SS)

There were significant differences between the participants with regard to level of performance with elites scoring higher than amateurs. Amateur drag racers were the highest of all the amateurs and amateur archers were the lowest. Of the elite, students were the highest in sensation seeking and archers the lowest.

By sport, results in a post hoc LSD analysis, demonstrated that there were significant differences between archers and drag racers. Archers scored the lowest of the three participant groups, which is what could be expected in this non-risk taking sport. University sport science students were however, slightly higher than drag racers.

With regard to gender, male drag racers were slightly higher than university sport science students. Archers were the lowest, particularly female archers. These results are consistent with research on how high sensation seekers are attracted to conditions of heightened arousal function (Zuckerman, 1994) such as high-risk sport (in this case drag racing). The results are also similar to a study by Goma-i-Friexanet (1997), in which males scored highest on sensation seeking. Descriptive statistics pertaining to females, female students were the highest of the females on sensation seeking. This may support research by Cowles and Davis (1987) that student volunteers (though this would be males and females) tend to be high on sensation seeking.

According to Zuckerman (1994) the thrill and adventure seeking scale (TAS) is the only subscale scale on which high and low-risk sport participants should differ. This is because the overall sensation seeking score is a combination of all the subscales. The thrill and adventure seeking scale on its own therefore can be a marker of thrill seeking. In study 3, there was a significant difference between the cohorts, which was also supported by a post hoc analysis, which identified a significant difference between drag racers and archers as well as between students and archers. Students scored the highest on TAS followed by drag racers followed by archers. There was also an interaction effect, which illustrated a significant difference between male and female archers.

In relation to level of performance, there was a significant difference between amateurs and elite. Overall, elite athletes were higher on TAS than amateurs though this was not the case with students. However, the results of the sensation seeking above showed that elite drag racers were the second highest in sensation seeking. Amateur drag racers were only moderate in their level of thrill and adventure seeking. The results do show drag racers are higher than archers and that students may distort the significance of this relationship between sensation seeking and thrill and adventure seeking. The results in this study showed no significant effects in experience seeking (ES) between participants, with regard to level of performance or between genders.

The results in study 3 found significant differences between the three groups on the subscale of disinhibition. A post hoc LCD analysis showed a significant difference between drag racers and archers and between students and archers. Disinhibition identifies a desire to engage in activities that go against society such as substance abuse, additive gambling, or wild sex parties. University sport science students scored the highest out of the 3 groups on this measure and archers scored the lowest. In recent research, women who engage in risk taking sports have scored significantly higher than non-participants in the subscales of disinhibition. Most athletes' lead conforming lifestyles and disinhibition is not usually a discriminating measure of sensation seeking for people in sport (Straub, 1982). This type of behaviour may be more typical of students.

The results in this study found no significant differences in the personality traits of BS between the three groups. Risk taking, measured on the SSS-V, could be one way of reducing boredom and there is some evidence that some people do participate in high-risk activities as a way of regulating their emotions (e.g. Levenson, 1990; Cazenave et al., 2007). Risk-taking may be linked to a propensity for boredom and sport may be perceived as a safe way of satisfying a need to stimulate arousal from the mundane activities of every day life. Drag racing males were the highest on boredom susceptibility according to the descriptive statistics and drag racing females were the next. This is similar to a previous study on women by Goma-i-Freixanet (2001) where women who engaged in high-risk rank high on boredom susceptibility. However, no significance was found in study 3.

Age

In controlling for age it was difficult to match for age and gender when comparing sporting participants with the student population, as they are so much younger. Indeed, using age as a covariate it was found that the results showed no significant difference for extraversion but a significant difference for neuroticism. Despite trying to control the potential effects of age, the covariance analysis could not control for other variables such as technical skill in being able to compete as an expert in 'extreme sport'. Therefore in previous research it is hard to confirm whether the differences between the groups are based on age or other factors as mean age can differ dramatically in examining sensation seeking (Zuckerman, 1994).

In terms of life span, sensation seeking increases with age into adolescence and then decreases throughout adulthood as adults prioritise different things such as family and decrease their desire for risk-taking activities (Kish and Donnenwerth, 1969; Zuckerman, 1994). Sensation seeking is therefore negatively correlated with age post adolescence. Zuckerman et al., (1978) found significant decreases in sensation seeking amongst English participants ranging from 16 to 70. There were also age related decreases on the thrill and adventure seeking, the Dis and on the total sensation seeking results. The same age related scores were also found with American participants (Zuckerman, et al., 1978).

In this study, the mean age of the drag racers was higher than archers and university sport science students. Therefore it cannot be confirmed that age was a significant contributor to the differences between the groups in sensation seeking. The racers were approximately 17 years older on average than the university sport science students so their sensation seeking scores should have been lower.

Students as a comparison group

The use of non-student groups in order to make replication of research more scientific is encouraged (Peterson, 2001; Druckman and Kam, 2009). The question raised in this research, was also whether a student group as a comparison group was adequate in undertaking sport psychology research. This particular student group was quite homogenous as they are all sports students and therefore all engage in a variety of sports. Though in using students it was difficult to match age and level of performance. It is acknowledged that students are generally more extravert than the general population (Eysenck et al., 1982). According to Han et al., (2005) the more undergraduate students participate in sport, the more extravert they appear to be though another study did not find any differences between sports students and non-sport students in extraversion though there was a difference in neuroticism (Ma et al., 2004). College students also showed differences in sensation seeking (LeGrand, Goma-i-Freixanet, Kaltenbach, and Joly, 2007) in a study, which targeted students who spend time in the bars. The personality profile of student volunteers was also identified to be higher in sensation seeking (Farre et al., 1995).

To overcome some of these weaknesses in the research, study 3 included Archers as a more accurate comparison group. So the use of archers as a second comparison group was seen to be most beneficial as this group is quite ‘opposite’ to drag racers.

The findings of this study can nevertheless be criticized for certain limitations. The drag racers were approached both through the internet and in person. Self-reported measures may be biased as ‘extreme sport’ participants may for example, exaggerate the extent of their thrill seeking. The ‘yes and no’ nature of the response requires respondents to force

an answer even if they may feel slightly unsure. Qualitative information on participants was not gathered though details on experience were collected. This researcher had worked with drag racers for 6 years and therefore was able to access this group. However, as some of the research was undertaken at International race meetings, some members of the sample did not use English as their first language.

The sensation-seeking questionnaire may not be as pertinent today as it was in 1994. 'Extreme sport' is less unusual than it used to be. The marketing of extreme experiences by commercial organisations such as 'Red Letter Day' has made such experiences more accessible. This commercialisation of extreme experiences may undermine the validity of the SSS-V test. For example, a question on the SSS-V such as "whether you would like to try skydiving" may not actually measure an extreme attitude any more. The terminology of other questions may also not be as relevant today where attitudes may have changed. For example, the question "would you like to meet people who are homosexual" may no longer be seen as an extreme experience. In fact, this author had an email from an archer who took offense to this question. In addition, several of the questions referred to activities requiring a certain amount of fitness and physical strength (e.g., skiing, mountain climbing). Respondents are answering questions based on whether they would like to do these activities and not on whether they feel they are able to undertake these activities due to age or lack of fitness. (Roth and Herzberg, 2004).

In conclusion, the results of this study show that there were significant differences between groups in SS, TAS, and DIS. SS, TAS and DIS was significant between participants between drag racers and archers and then students and archers on all three of these measures and obviously due to the addition of archers. There were significant differences in genders for N. There are significant differences in level of performance for SS and TAS. There were not any significant findings with E, ES or BS. Gender and level of performance were important variables. As this study calls into question previous research on sensation seeking, neuroticism and extraversion in 'extreme sport', the next study will look to add a more objective measure of reaction time to see if this additional measure may help in providing a better understanding of 'extreme sport'.

7.0 Chapter 7: Reaction Time Latencies and Sport

7.1 Preface

Eysenck et al. (1982) remarked that the trade-off between speed and accuracy was related to extraversion-introversion though there is an absence of evidence on this relationship. Extraverts tend to react fast to stimuli at the expense of accuracy. Eysenck et al, (1982) described a study by Coleman (1979), where prone shooters, who take their time to react to a stimulus, were the least extravert compared to rapid-fire shooters, who reacted quickly to stimuli and were extremely high in extraversion. In spite of this early interest into the link between personality traits and 'reaction time', it was not until recent years that the topic entered into a new dimension exploring personality traits and sporting behaviour. This chapter defines 'reaction time' in the context of sporting behaviour, its significance as a subjective measure and reviews recent published studies on the relationship between personality and reaction time.

The experimental investigation in study 4 will investigate if any differences exist between personality and 'reaction time' on drag racers, students and archers. The combination of personality tests along with an experimental measure of reaction time could be of considerable importance in understanding the relationship between sport and personality as long as variables such as age, gender and level of performance are controlled for.

'Reaction time' is the interval of time between the presentation of a stimulus until the response. Arguably, in particular circumstances it is an important measure of performance as it demonstrates the speed and accuracy of a decision. Having fast 'reaction time' is a key element in the sport of drag racing as it is vital that drag racers are quick off the starting line. Success depends on the speed in which the racer can identify a change in the starting lights and initiate the forward movement of the car. Being able to minimize reaction time latency is therefore an advantage and contributes to winning the race. Because reaction time is such a fundamental component of sport it is not surprising that this is an area which has been identified to complement the

research presented in this thesis. Reaction time is a skilled component of the winning of a race and is an exciting component for drivers, teams and spectators. This is because the winner of a race with two cars of identical performance as measured by elapsed time, will be the driver who has the faster reaction time. Eysenck's et al., (1982) review paper queries whether reaction time and movement times link with personality traits and whether they are linked to motor skills.

Extreme sport is a prime example of an area that does not fit within the theory of the speed accuracy-trade off. Extreme sport is defined by this author as “a competitive activity within which the participant is subjected to unnatural or unusual physical and mental challenges... and where fast and accurate cognitive perceptual processing maybe required for a successful outcome...”. Extreme sport often requires speed in response as well as accuracy otherwise the participant could be in an uncompetitive dangerous situation. Measuring reaction time in extreme sport warrants an analysis of different sports within the extreme sport category in order to identify the specific skill set required for each area. Methodologically, studies examining ‘reaction time’ have varied, making analysis in this area of research difficult. Silverman (2006) in a review paper, concluded that it is difficult to conclusively summarise results from ‘reaction time’ studies due to the inconsistencies in reaction time variables such as the use of warning stimuli, number of trials, number of imperative stimuli, inclusion of fast or slow responses, for example.

7.2 Study 4: The Relationship between Personality Traits and Reaction Time Latencies to Simple and Sport Specific Tasks amongst Drag Racers, University Sport Science Students and Archers

7.2.1 Background and Aims

‘Reaction time’ studies commenced in the 1800’s though most of these studies have involved identifying mathematical formulae, which can calculate the average amount of time required by subjects to perceive a stimulus and react with a simple movement.

Eysenck et al., (1982) was one of the first authors to extend the debate on the possible relationship between personality traits and sporting performance with actual behaviour. In his review paper, Eysenck et al., (1982) identified ‘reaction time’ as a dispositional determinant within personality. He made reference to ‘reaction time’ in sports (i.e. prone target and rapid-fire shooting). Eysenck et al., (1982) maintained that reaction time measures would correlate with extraversion and neuroticism. Those scoring high on extraversion and low on neuroticism would be quicker in ‘reaction time’ though more prone to errors (Brebner, 1980; Welford,1980) as well as less accurate (Eysenck et al., 1982).

The research literature examining the relationship between personality and reaction time is mixed. A recent study has shown that extraversion correlates positively with significantly faster ‘reaction time’ (Canli, 2004) whilst in a study by Stahl and Rammsayer (2004) introverts were quicker in stimulus analysis compared to extraverts. Their study did not demonstrate any differences in extraversion nor in speed of response as measured in LRP (lateralised readiness potential) and EMG (electromyogram). College students, high in neuroticism, were less consistent in their reaction times than their less neurotic peers (Robinson and Tamir, 2005). In another recent study examining the relationship between gender, personality and several basic mental performances in undergraduate students, neuroticism was positively correlated with logical reasoning, yet negatively related with the performance of simple reaction (Cui et al., 2009). Predominantly, studies on response time still correlate positively with personality traits (Kashihara and Nakahara, 2005; Robinson and Tamir, 2005).

There are also factors, relevant to sport, which can influence 'reaction time'. Eysenck and Calvo (1992) produced an efficiency theory identifying high anxiety as the primary factor in decreasing performance efficiency and effectiveness. Studies recently conducted in sport to test this theory have shown changes in performance, though not necessarily as a result of anxiety; instead due to other variables, such as distraction (Murray and Fisher, 2002) or memory capacity (Vickers, Livingston, Umeris, Holden, 1999). Extreme sport is an area where fear and high levels of arousal are evoked. Therefore, minimising the emotional distraction by developing racers concentration through sport specific reaction time training may be useful.

Reaction time studies often compare sport participants to students. In a recent paper by Nakamoto and Mori (2008), baseball and basketball college students were juxtaposed with sedentary students. Palpably, sports participants demonstrated faster reaction times than sedentary students. However, one criticism applied to many studies in general is the lack of an appropriate sports comparison group. The student population, whether sport students or non-athletes, is not necessarily a good match for sport research, as mentioned throughout this thesis.

Reaction Time and Level of performance

Level of performances seems to be intrinsically linked to sporting success. Studies focusing on sport specific skills or content dependent on perceptual skills have found that elite athletes have advanced perceptual skills in sport specific tasks. For example, in a study comparing basketball players to non-players, experienced players were significantly better than non-players at recalling structured game information (Allard et al., 1980). In a study by Allard and Starkes (1980) comparing three sports, there were significant differences between beginners and advanced players. Volleyball players were better on perceptual speed and in estimating speed and direction of a moving object accurately, expert water polo players were better on visual reaction time and basketball players were better on selective attention. Their study demonstrated how various sports can strongly affect perceptual abilities and how differences between experts and amateurs exist (Kioumourtzoglou et al., 1998).

The interaction between high-level perceptual skills and sport specific task suggests that an encoding of structure is vital to an elite athlete's 'elite level' performance (Allard and Starkes, 1980). Nakamoto and Mori (2008) compared college sports students to general students and demonstrated that the more experience students had in their sport the quicker their reaction times were to sport specific stimuli.

Reaction time and gender

Studies of gender differences and 'reaction time' in sport have been limited. Typically, females are not separated out within the studies. Yet, research has shown that males are higher in extraversion and therefore quicker in reaction times than females who were higher in neuroticism (Conner et al., 2003). In a study by Ak and Kocak (2010) male tennis players made fewer mistakes, than females in anticipatory reaction time.

Reaction time and sensation seeking

Participants with higher scores on the sensation seeking scale have demonstrated a stronger reflex to visual stimuli (Zuckerman, 1994). He describes a single visual stimulus presented 10 times followed by a complex visual stimulus that was also repeated 10 times. Those scoring high in sensation seeking had stronger skin conductance change responses on the first presentation. A similar study was conducted using auditory stimuli and the same results were demonstrated. Zuckerman (1994) concluded that high sensation seekers have strong arousal or reactions when first presented to new stimuli.

Reaction time and sport

Studies examining participants in target sports have focused on the term 'speed discrimination' as a perceptual skill required for accuracy and skill with moving target (Clifford et al., 1999; Huang et al., 2008). Differences between sports are evident in 'reaction time', e.g. tennis players outperformed triathlon competitors (Overney et al., 2008). However, no distinct differences in the perceptual skills between various sports have been consistently evidenced (Thompson et al., 2009). It is palpable that sport could benefit from bespoke reaction time tests. For this reason, study 4 has designed a test using SuperLab, which is specifically designed around drag racing lights. Sport

specific measurements for 'reaction time' are vital if sport science is to progress and make vital contributions to the literature. Studies on perceptual skill development need to specifically address the skill required for the sport concerned- i.e. ball skills or target skills or skills related to speed.

There is limited 'reaction time' research into sports where speed is an important component, as in drag racing. Kioumourtzoglou et al., (1998) did not find any differences in relation to the amount of accurate responses associated with the recognition of the speed and direction of moving objects in basketball, water polo and volleyball. In a review on 'reaction time' in physical activity, Silverman (2006) concluded that there is no evidence to indicate that driving has an impact on 'reaction time'.

The ability to process visual information quickly is an important, if not vital skill, in various sporting activities such as boxing and motor racing. In some sports such as drag racing, visual displays are of a very short duration. For example, drag racers need to accelerate off the starting line as quickly as possible without causing a red light for a pre-mature start. They need to watch and respond in a matter of milliseconds to the lights on the Christmas Tree which is located on the start line of the drag strip. There is extensive support for the premise that people vary in their ability to process short duration visual displays (Adam and Wilberg, 1992). In sport, success appears to be linked to the ability to process visual information quickly. In cricket for example, successful batsmen were faster and more effective at picking up information from rapid visual displays than less successful batsmen (Deary and Mitchell, 1989).

Reaction time and accuracy

Whereas a quick reaction time seems to be important in most sports, accuracy is of the utmost importance. In the fulfilment of tasks within an extreme sport, it can mean the difference between life and death as well as providing the key to sporting success. Results from studies into speed and accuracy of perceptual tasks, are inconsistent (Royal et al., 2006). For example, in a post-exercise task, participants were tested on their ability to discriminate the speed of a moving object. The results indicated an

improvement in decision-making but not in accuracy. Post-fatigue differences were shown in relation to accuracy in elite soccer, basketball and volleyball players (Thompson et al., 2009).

Drag racing, reaction time and accuracy within the sport

In the start line area, the drag racer must first contend with the light stimulus known as the Christmas tree. This is a series of lights comprising 3 parts that is linked to an infrared beam that is two inches off the ground and about 6 inches from the start line. There is a second infrared beam on the start line. The top of the Christmas tree holds two sets of double yellow lights on each side. These lights signal to the driver that he/she is moving towards the start line and constitute what is known as 'pre-staging'. The second set of lights indicates to the driver when he/she is located on the start line in a position ready to race. This is the 'staging' phase. The next section of the Tree contains 3 sets of amber lights. In most racing classes, these lights will go on sequentially in half second intervals. This is known as a 'full tree'. Some classifications instead use a Pro tree where all 3 amber lights go on simultaneously with a 4/10ths of a second delay between them until the green light. The final two lights in the Christmas tree are the red and green lights. The green light will come on after the amber lights unless the driver jumps the lights in which case a red light will appear disqualifying the driver. With the full tree, the reaction time of the driver is measured from the start of when the third amber light comes on. As there is a half second or .500 second delay until the appearance of the green light, then a .500 reaction time is perfect. With those racing against the Pro Tree a .400 reaction time is perfect. The reaction timer ceases when the car crosses the starting line.

Drag racing, due to the nature of the sport, requires a very fast reaction time for superior performance. In particular, a very rapid reaction time is required from the time the green light illuminates, to the time the vehicle leaves the start line. In contrast, fast reaction times are not required and play no role in superior archery performance. The issue examined, is whether archers and drag racers with different levels of skill, vary in simple (non-sport specific e.g. response to a letter being upper case or lower case) and task specific (sport related) reaction times. An example of a sport-specific reaction time

test for drag racers would be a test that measures the correct response latency to seeing a green or amber light. If indeed, there were differences in both simple and task specific measures, this would indicate that there are fundamental differences in 'reaction time' latencies between drag racers and archers. However, if the differences were only with task specific measures, this would demonstrate that reaction times are specific to each sport. Absence of any of the above effects would call into question the relationship between sporting behaviour and 'reaction times'.

The results from previous established research would therefore suggest that those who are high in extraversion are also high in sensation seeking (Eysenck et al., 1982; Zuckerman, 1994). In addition, this would also mean that extraverts who are also high in sensation seeking also have fast reaction times and are low in accuracy (Eysenck et al., 1982; Zuckerman, 1994).

Aims

The aim for this research was to conduct carefully designed experiments in which reaction time latencies and errors (non-task specific) and task specific are measured for drag racers, sport students and archers. Of particular interest is to examine if reaction time to task specific stimuli (e.g. responding to a green light) was related to accuracy. For those involved in drag racing accuracy is kept as is having fast reaction times. In archery, accuracy is key however reaction time is less important. Furthermore, the relationship between reaction time and accuracy with personality traits and sensation seeking scores will be examined.

7.2.2 Hypotheses

HA1- There will be a significant difference between drag racers, archers and sport students in relation to personality measures namely extroversion, neuroticism and sensation seeking.

HA2- There will be a significant difference between drag racers, archers and sport students in relation to general and sport specific reaction times.

HA3- There will be a significant difference between drag racers, archers and sport students in relation to general and sport specific accuracy measures.

7.2.3 Methodology

Design- A quasi-experimental design was adopted in which the main independent variables are participants (drag racers, archers and university sport science students), gender and level of performance (elite and amateur). The main dependent variables are reaction time latencies and error data to simple and sport specific tasks.

This study examined the effect of a sport specific colour related task on the reaction time of extreme sport participants (i.e. drag racers) compared to traditional target sport (i.e. archers) and sport students. Reaction time was measured in relation to the speed of response in seeing computer images of red and green lights on a black background. A yellow light was used as a holding or warning image in between the images. The use of a warning stimulus as an impending stimulus can facilitate reaction time (Brebner and Welford, 1980) and in the sport of drag racing a yellow light is used (at various intervals) to ready the driver before the green light signals the start of the race. See appendix III for a copy of the red and green screens used in the test.

Participants- A total of 138 participants represented drag racing, archery and sport students. There were 40 drag racers: 29 males, 11 females, 16 amateur, 24 elite. There were 39 archers: 26 males, 13 females, 25 amateurs and 14 elite. There were 59 students: 34 males, 25 females, 50 amateurs and 9 elite. See Table 7.1 for the breakdown of participants by gender and age.

Level of performance criteria

Drag Racers - The distinction between elite and amateur, for drag racers, were based on FIA classifications. Elite drag racers were classified as those who compete in the elite classes and were licensed drag racing drivers who receive monetary rewards when placing in the top 3. Elite classes included those who compete in categories of cars such as Top Fuel, Top Methanol Dragster, Funny car, and Pro Stock. Drag racers in other categories which included Comp, Super Stock, and Stock were classified as amateurs.

Students - those who maintained sporting activity at national or international level were classified as elite. Those who were any of a combination of the following were classified as amateurs: recreational sport, fitness participants, university team players.

Archery - archery players who competed at either international or national level were classified as elite. Those club members who played regularly but were not in the elite category were classified as amateur.

Left hand vs. right-handers - When examining drag racers there may be a distinction, between those who are right handed and those who are left handed. Studies have shown that those who are left handed are faster at reaction time involving spatial criteria (Boulinquez, Bartlemy, and Debu, 2000). Left-handed players appear to have an innate advantage in sports involving reaction time (e.g. Dane and Erzurumluoglu, 2003). Miller and Van Nes (2007) however found that responses involving both hands were faster when the stimulus was presented to both hemispheres of the brain simultaneously. The decision was taken to present those who presented as left hand dominant with the opposite key board instructions to those who were right handed in line with Dane and Erzurumluoglu, (2003).

Materials - A SuperLab 4.0 software programme was used for the presentation of stimuli. A bespoke programme was designed with predominantly red and green lights. A yellow light only on a black screen was shown in-between the stimuli. Some singular lights displayed on a screen of black and others in the formation of a drag racing Christmas Tree formation. Cedrus was used as to review the data and this programme calculated speed of RT and percentage success rate. SPSS was used for statistical analysis.

Considerations for the testing of 'reaction time'

Though reaction time is considered to be the length of time between the onset (or offset) of an important stimulus and the start of a specified response, the definition fails to consider that there are different types of reaction time and therefore different types of experiments or studies. There are simple and complex or choice reaction time studies. In simple reaction time experiments there are short reaching and long reaching variants.

The simple type of experiment involves only one stimulus and one response and when a participant or subject see or hears the stimulus, he/she responds and that reaction time is measured. Visual or auditory reaction time can thus be measured this way. Within

simple reaction time there are two variants. In the majority of studies, (see review by Silverman, 2006) the participant presses or releases a button, key, or switch (manipulandum), which can be contacted within a short distance. In the other variant, the manipulandum is located further away from the hand and therefore necessitates a longer reaching response. In choice or complex reaction time studies, the participant is presented with a choice to which there is only one correct response. Once again these can be visual or auditory. Choice reaction time studies require the participant to press a letter or key that corresponds or matches the one that appears on the screen.

Simple reaction time has been shown to be on average 220msec (Schmidt,1991). In comparison, choice reaction time takes a longer time with complex stimulate (e.g. several letters on symbol recognition vs. one letter) eliciting the slowest reaction time (Brebner and Welford, 1980). Finally, Miller and Low (2001) concluded that the time for motor preparation (e.g. tensing muscles) and motor response (in this study, pressing the spacebar) was the same in all three types of reaction time test, illustrating that the differences in reaction time are due to processing time.

Reaction time increases as a result of the response complexity, i.e. simple versus complex choice according to Khan, Lawrence, Buckolz and Franks (2006). Methodically, studies examining 'reaction time' have varied and therefore analysis of research is difficult.

Procedure – This was consistent within the groups though there were some variations as below.

Drag racers - Participants for the study were recruited through Eurodragster and also at the track on a race weekend. The links to online copies of the EPI and SSS-V were available through Survey Monkey. Drag racers who indicated that they would be interested in participating in the reaction time study were able to tick a box on the detail section of the online surveys. These participants were contacted and invited to participate at trackside. Reaction time testing took place over a 3-day race weekend. Additional participants for the study were recruited over that weekend and were either directed to the online survey link or provided with a hard copy of the surveys.

Students – Those studying on sport science degrees were recruited through a sport science module. They represented university students but also those who participate in various sport. As a group they are heterogeneous in their choice of sport and they played sports such as rugby, netball, tennis and soccer. The reaction time test took place during seminar slots. They were asked over a 3-week period to participate in the reaction time testing. Hard copies of the sensation seeking tests and EPI were available and in addition links were provided for those who preferred to do the testing online.

Archers – This group of participants were contacted via archery club websites. An email was sent to the clubs with a link to the online surveys. Those who indicated an interest in the reaction time study were then approached through the clubs or individually. Hard copies of the sensation seeking tests and EPI were available and in addition links were provided for those who preferred to do the testing online.

Amateurs and elites - The distinction between elite and amateur for drag racers, was based on FIA classifications. Elite classes, according to the FIA, are based on the type of vehicle, safety regulations, licence requirements and set allocation of prize money. Elite classes include cars such as Top Fuel, Top Methanol Dragster, Funny car, and Pro Stock. The amateur class includes Comp, Super Stock, and Stock. For university sport science students, the term elite was used based on whether they were engaged in national or international. Amateur included those playing recreational and university sport or engaged in physical activity (i.e. worked out in the gym).

Amateur class includes those not in the elite category as identified by the FIA. Archers, who played competitive for county, GB or internationally were classified as elite. The amateur category was used for those who compete locally or who play recreationally.

Participants were asked about their preferred hand so as to control for handedness. The same keys were used for all dominant and non-dominant hands for all participants as mentioned above (though obviously in reverse for left handed participants).

Following the taking of details and the ethics clarification on the study participants for the 'reaction time' test was read the instructions presented on the first screen. A practice trial of 10 lights then ensued and understanding of the task was reviewed again prior to the start of the first trial. The study was conducted in a quiet area.

The study included two trials. The first experimental trial was 20 lights presented in a random order with a yellow light not requiring any action between each stimulus slide. The second experimental trial was the same and was averaged in with the results of the first. There were two trials in order to minimize error and ensure that the results were accurate and reliable.

Results of the 'reaction time' test were calculated and displayed through the software CEDRUS. The researcher marked the EPI survey using the relevant answer key from the test manual borrowed from the University Psychology Testing collection.

7.2.4 Results

Table 7.1 - The breakdown for mean age and standard deviation by gender and level of performance for drag racers, students and archers

Participants	Gender N=Number of participants	Mean Age	SD
Drag racers	Male N=29	45.82	8.56
	Female N=11	42.72	8.33
Archers	Male N=26	35.53	11.93
	Female N=13	38.92	11.68
Students	Male N=34	22.82	2.62
	Female N=25	23.08	3.36
Total	N= 138	33.20	12.33

As was apparent in Table 7.1, and inevitably unavoidable, when data was collected drag racers (avg. 44yrs) and archers (avg. 37yrs) were older than university sport science students (avg. 23yrs). In view of this, a one way ANOVA with LSD post hoc testing was conducted on the data and showed a significant age difference between the 3 groups with $F(2, 135) = 95.79, p < 0.0001$. Post hoc comparisons of the means showed a significant difference between drag racers and archers $SE = 1.79, p < 0.0001$, between archers and students $SE = 1.64, p < 0.0001$ and between drag racers and students $SE = 1.63, p < 0.0001$.

It was thus decided to use age as covariate in all the analyses in which it is expected to have a significant relationship with variables under investigation. A Pearson's Product Moment Correlation Coefficient test was conducted between age and the following variables: extraversion, neuroticism, sensation seeking, reaction time and accuracy scores to specific and general tasks. There was a negative and significant correlation between age and extraversion and between age and percentage correct task specific. Older participants were found to be less extrovert $r = -0.27$, $p < 0.001$. There was also a significant and negative correlation between age and percentage correct to task specific with older participants having lower percentage correct with $r = -0.21$, $p < .012$.

Furthermore, it was decided to conduct a series of 3 by 2 Factorial ANOVA using participant category (i.e. drag racers, archers and university sport science students) and gender as the two independent variables on one occasion and participant and level of performance as the two independent variables on a separate occasion instead of a 3 way factorial ANOVA (participant by gender by level of performance) this was in view of having much smaller cells for some of categories e.g. only 3 male elite students!

Participant category and gender

A series of 3 participant (drag racer, archer and student) by 2 gender (male, female) Factorial ANOVAs were conducted with personality, sensation seeking, reaction time and accuracy as the dependent variables. With regards to the extraversion and accuracy data for task specific stimuli, age of participants was used as a covariate to avoid any confounding outcomes due to the significant age differences amongst participants.

Extraversion

Descriptive statistics including mean and standard deviations for extraversion, by participant category and gender, are shown in Table 7.2. The higher the score indicated, the higher the level of extraversion.

Table 7.2 - Mean extraversion scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=29	13.41	4.84
	Female N=11	11.81	4.3
Archers	Male N=26	12.03	4.28
	Female N=13	12.23	3.81
Students	Male N=34	15.05	4.36
	Female N=25	14.40	4.98
Overall mean	N=138	13.50	4.61

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender Factorial ANOVA was conducted on the data which showed a significant main effect for participants with $F(2, 132) = 4.311, p = 0.015$. The mathematical mean for the participant groups was: students=14.78, drag racers=12.98, and archers=12.10. There was no significance for gender with $F(1, 132) = 0.670, p = 0.415$ and no significant interaction effect with $F(2, 132) = 0.324, p = 0.724$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD showed a significant difference between archers and students $SE = 0.934$, $p = 0.005$, and a significant difference between students and drag racers $SE = 0.927$, $p = 0.054$. There was however no significant difference between drag racers and archers $SE = 1.02$, $p = 0.393$.

Neuroticism

The descriptive statistics mean and standard deviations for neuroticism as by participant category and gender are shown in Table 7.3. The higher the score indicated, the higher the level of neuroticism.

Table 7.3 - Mean neuroticism scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=29	10.03	5.73
	Female N=11	11.63	7.86
Archers	Male N=26	9.65	5.52
	Female N=13	13.23	4.81
Students	Male N=34	11.47	3.59
	Female N=25	12.92	3.92
Overall mean	N=138	11.27	5.13

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 0.778, p = 0.461$, but a significant main effect for gender with $F(1, 132) = 5.544, p = 0.020$. The mathematical mean for females=12.71 which was greater than males=10.47. There was no significant interaction effect with $F(2, 132) = 0.528, p = 0.591$.

Sensation Seeking

The descriptive statistics mean and standard deviations for sensation seeking as by participant category and gender are shown in Table 7.4. The higher the score indicated the higher the level of sensation seeking.

Table 7.4 - Mean sensation seeking scores and corresponding standard deviations as by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=29	22.00	6.02
	Female N=11	21.27	5.47
Archers	Male N=26	19.23	8.23
	Female N=13	17.15	5.99
Students	Male N=34	21.73	7.10
	Female N=25	20.72	5.60
Overall mean	N=138	20.67	6.71

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed a significant main effect for participants with $F(2, 132) = 2.886, p = 0.059$. The mathematical mean for drag racers = 21.80, students = 21.31, and archers = 18.54. There was no significant main affect for gender with $F(1, 132) = 1.059, p = 0.305$ and no significant interaction effect with $F(2, 132) = 0.100, p = 0.905$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = 1.58$, $p = 0.04$ and for university sport science students and archers $SE = 1.39$, $p = 0.04$. There were no significant differences between university sport science students and drag racers.

Reaction Time General (RTG)

The descriptive statistics mean and standard deviations for RTG as by participant category and gender are shown in Table 7.5. The lower the time as measured in milliseconds the faster the performance on this general reaction time task.

Table 7.5 - Mean RTG scores measured in milliseconds and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean in milliseconds (msec)	SD
Drag racers	Male N=29	518.79	75.45
	Female N=11	530.33	86.25
Archers	Male N=26	523.81	121.04
	Female N=13	498.86	61.08
Students	Male N=34	507.68	71.08
	Female N=25	528.20	90.68
Overall mean	N=138	517.95	84.26

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 genders (male, female) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 0.197$, $p = 0.821$, no significant main effect for gender with $F(1, 132) = 0.022$, $p = 0.882$ and no significant interaction effect with $F(2, 132) = 0.766$, $p = 0.467$.

Reaction Time Specific (RTS)

The descriptive statistics mean and standard deviations for RTS as by participant category and gender are shown in Table 7.6. The lower the time as measured in milliseconds the faster the performance on this specific reaction time task.

Table 7.6 - Mean RTS scores measured in milliseconds and corresponding standard deviations as by participant and gender

Participants	Gender N=Number of participants	Mean in milliseconds (msec)	SD
Drag racers	Male N=29	539.66	88.48
	Female N=11	537.17	93.69
Archers	Male N=26	549.30	146.84
	Female N=13	522.28	38.57
Students	Male N=34	549.83	163.61
	Female N=25	540.13	74.46
Overall mean	N=138	542.24	100.94

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2,132) = 0.072$, $p = 0.930$, no significant main effect for gender with $F(1, 132) = 0.348$, $p = 0.556$ and no significant interaction effect with $F(2, 132) = 0.096$, $p = 0.908$.

Percentages Correct General (PCG)

The descriptive statistics mean and standard deviations for PCG as by participant category and gender are shown in Table 7.7. The higher the score indicated, the higher the percentage correct or accurate on a general reaction time task.

Table 7.7 - Mean PCG scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=29	89.38	11.63
	Female N=11	92.94	11.61
Archers	Male N=26	93.08	8.61
	Female N=13	94.62	5.93
Students	Male N=34	93.32	8.15
	Female N=25	95.20	6.99
Overall mean	N=138	93.09	8.82

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 1.284$, $p = 0.280$, no significant main effect for gender with $F(1, 132) = 1.919$, $p = 0.168$ and no significant interaction effect with $F(2, 132) = 0.122$, $p = 0.885$.

Percentages Correct Specific (PCS)

The descriptive statistics mean and standard deviations for PCS as by participant category and gender are shown in Table 7.8. The higher the score indicated, the higher the percentage correct or accurate on a sport specific reaction time task.

Table 7.8 - Mean PCS scores and corresponding standard deviations by participant and gender

Participants	Gender N=Number of participants	Mean	SD
Drag racers	Male N=29	88.97	12.42
	Female N=11	93.18	10.31
Archers	Male N=26	92.69	6.81
	Female N=13	93.46	8.26
Students	Male N=34	96.33	5.71
	Female N=25	95.20	6.69
Overall mean	N=138	93.37	8.74

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 gender (male, female) Factorial ANOVA was conducted on the data which showed a significant main effect for participants with $F(2, 132) = 3.313, p = 0.039$. The mathematical mean for the participant groups was: students=95.85, archers=92.95 and drag racers= 90.13. There was no significant main effect for gender with $F(1, 132) = 0.665, p = 0.416$ and no significant interaction effect with $F(2, 132) = 1.018, p = 0.364$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD showed a significant difference between drag racers and students with $SE=1.74, p=0.001$. There was however, no significant difference between drag racers and archers $SE=1.91, p=0.14$ and students and archers $SE=1.75, p=0.1$.

Participant category and level of performance

Extraversion

The descriptive statistics mean and standard deviations for extraversion by participant category and level of performance are shown in Table 7.9. The higher the score indicated, the higher the level of extraversion.

Table 7.9 - Mean extraversion scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=16	12.25	4.29
	Elite N=24	13.45	4.98
Archers	Amateur N=25	11.84	3.94
	Elite N=14	12.57	4.43
Students	Amateur N=50	14.96	4.61
	Elite N=9	13.77	4.71
Overall mean	N= 138	13.14	4.49

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data using age as the covariate which showed no significant main effects for participants with $F(2, 132) = 1.958, p = 0.145$, no significant effect with level of performance with $F(1, 132) = 0.081, p = 0.776$ and no significant interaction effect with $F(2, 132) = 0.643, p = 0.528$.

Neuroticism

The descriptive statistics mean and standard deviations for neuroticism as by participant category and level of performance are shown in Table 7.10. The higher the score for neuroticism indicated, the higher the level of neuroticism.

Table 7.10 - Mean neuroticism scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=16	12.31	7.25
	Elite N=24	9.25	5.43
Archers	Amateur N=25	12.20	5.65
	Elite N=14	8.42	4.44
Students	Amateur N=50	11.90	3.68
	Elite N=9	13.11	4.25
Overall mean	N=138	11.20	5.12

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 1.723, p = 0.183$, a significant main affect for level of performance with $F(1, 132) = 3.642, p = 0.058$. The overall mathematical mean for amateurs=12.14 and elites=10.26. There was no significant interaction effect with $F(2, 132) = 2.348, p = 0.100$.

Sensation Seeking

The descriptive statistics mean and standard deviations for sensation seeking by participant category and level of performance are shown in Table 7.11. The higher the scored indicated the higher the level of sensation seeking.

Table 7.11- Mean sensation seeking (SS) scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=16	21.43	5.37
	Elite N=24	22.04	6.19
Archers	Amateur N=25	17.16	6.23
	Elite N=14	21.00	9.19
Students	Amateur N=50	20.06	6.72
	Elite N=9	25.22	2.68
Overall mean	N=138	21.15	6.06

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed a significant main effect for participants with $F(2, 132) = 3.074, p = 0.050$. The overall mathematical mean for the participants was: students=22.64, drag racers=21.74, and archers=19.08. There was a significant main affect for level of performance with $F(1, 132) = 5.569, p=0.020$. The overall mathematical mean for elite =22.75 and amateurs=19.55. There was no significant interaction effect with $F(2, 132) = 0.953, p = 0.388$.

Fisher's Least Significance Difference (LSD) was chosen for the post hoc analysis in order to examine the difference between the participant groups. Post hoc comparisons of the means using LSD found significant differences for drag racers and archers $SE = 1.46, p = 0.02$ and for university sport science students and archers $SE = 1.34, p = 0.04$. There were no significant differences between university sport science students and drag racers.

Reaction Time General (RTG)

The descriptive statistics mean and standard deviations for RTG as by participant category and level of performance are shown in Table 7.12. The lower the time as measured in milliseconds the faster the performance on this general reaction time task.

Table 7.12 - Mean RTG scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean in milliseconds (msec)	SD
Drag racers	Amateur N=16	509.00	61.53
	Elite N=24	530.6	88.87
Archers	Amateur N=25	528.94	109.84
	Elite N=14	491.76	92.84
Students	Amateur N=50	511.76	71.59
	Elite N=9	541.99	118.38
Overall mean	N=138	517.69	86.8

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 0.316$, $p = 0.730$, no significant main affect for level of performance with $F(1, 132) = 0.087$, $p = 0.768$ and no significant interaction effect with $F(2, 132) = 1.555$, $p = 0.215$.

Reaction Time Specific (RTS)

The descriptive statistics mean and standard deviations for RTS as by participant category and level of performance are shown in Table 7.13. The lower the time as measured in milliseconds the faster the performance on this sport specific reaction time task.

Table 7.13 - Mean RTS scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean in milliseconds (msec)	SD
Drag racers	Amateur N=16	524.29	78.46
	Elite N=24	548.76	95.31
Archers	Amateur N=25	544.55	113.69
	Elite N=14	532.69	139.16
Students	Amateur N=50	553.46	140.62
	Elite N=9	502.73	60.34
Overall mean	N=138	542.24	117.47

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 0.071, p = 0.931$, no significant main affect for level of performance with $F(1, 132) = 0.297, p = 0.586$ and no significant interaction effect with $F(2, 132) = 0.854, p = 0.428$.

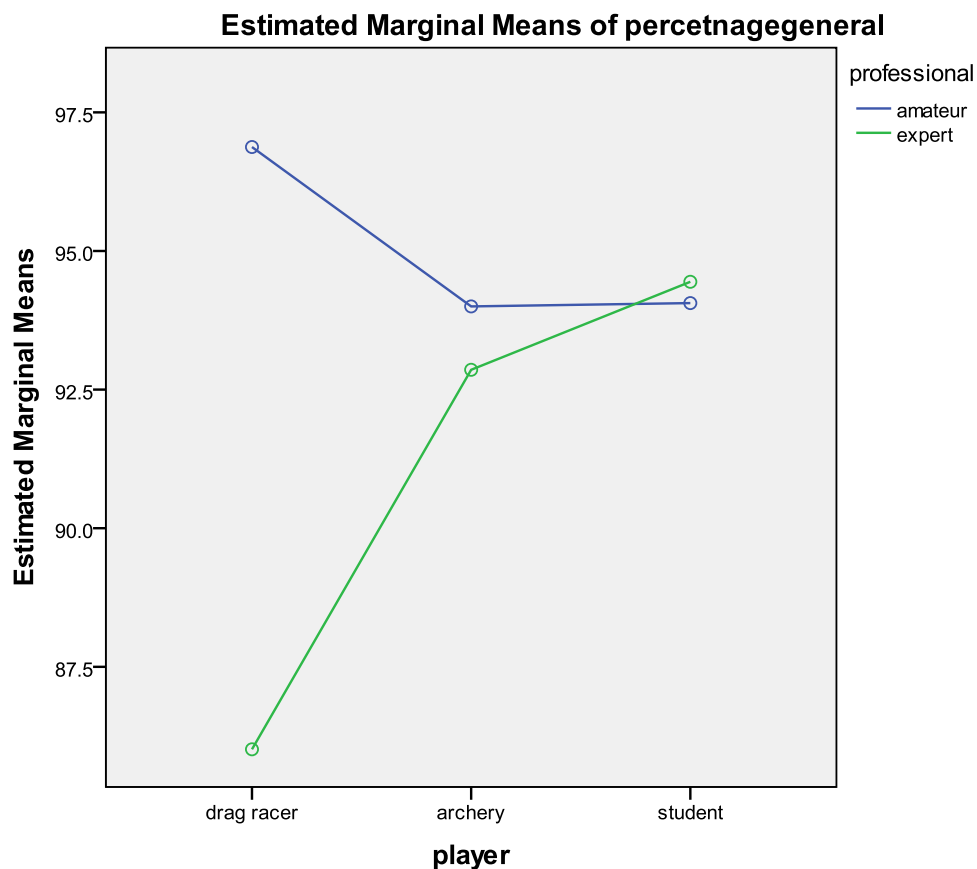
Percentages Correct General (PCG)

Table 7.14 - Mean PCG scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=16	96.87	4.79
	Elite N=24	86.01	12.79
Archers	Amateur N=25	94.00	7.50
	Elite N=14	92.86	8.48
Students	Amateur N=50	94.06	7.55
	Elite N=9	94.44	8.82
Overall mean	N=138	92.88	9.09

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 0.99, p = 0.374$. There was a significant main effect for level of performance with $F(1, 132) = 5.243, p = 0.024$. The mathematical mean for amateurs=95.54 and elite=89.67. There was a significant interaction effect with $F(2, 132) = 4.511, p = 0.013$ (see figure 5 for interaction effect).

Figure 5- A graphic display of the interaction effects (PCG and level of performance)



Analysis of simple effects showed a significant level of performance difference for drag racers with $t(38) = 3.2, p = 0.002$ but no significant difference for archers $t(37) = 0.43, p = 0.66$ or for students $t(57) = .13, p = 0.89$.

Percentage Correct Specific (PCS)

The descriptive statistics mean and standard deviations for PCS by participant category and level of performance are shown in Table 7.15. The higher the score indicated, the higher the percentage correct or accurate on a sport specific reaction time task.

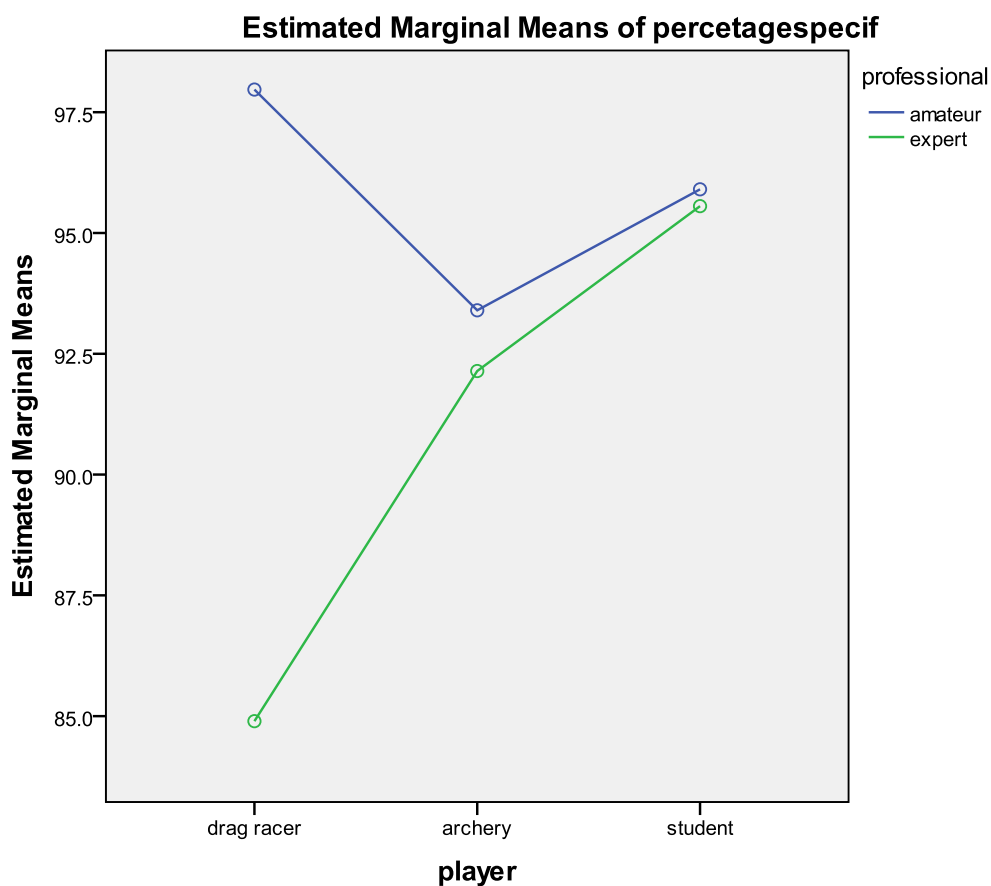
Table 7.15 - Mean PCS scores and corresponding standard deviations by participant and level of performance

Participants	Level of performance N=Number of participants	Mean	SD
Drag racers	Amateur N=16	97.97	4.00
	Elite N=24	84.90	12.59
Archers	Amateur N=25	93.40	8.26
	Elite N=14	92.14	5.08
Students	Amateur N=50	95.90	5.53
	Elite N=9	95.56	9.17
Overall mean	N=138	93.37	8.74

Formal analysis of the data using a 3 participant (drag racer, archer, student) by 2 level of performance (elite, amateur) Factorial ANOVA was conducted on the data which showed no significant main effect for participants with $F(2, 132) = 2.644, p = 0.075$, a significant main affect for level of performance with $F(1, 132) = 10.223, p = 0.002$.

The overall mathematical mean for amateurs=95.58 and elite=89.10. There was a significant interaction effect with $F(2, 132) = 7.515, p = 0.001$ (see figure 6 for interaction effect).

Figure 6 - A graphic display of the interaction effects (PCS and level of performance)



Analysis of simple effects showed a highly significant level of performance difference for drag racers with $t(38) = 4, p = 0.0001$ but no significant difference for archers $t(37) = 0.51, p = 0.609$ or for students $t(57) = .156, p = 0.87$.

Correlations

These are the following significant correlations.

Overall with participants

1. E and SS, $r=.292$, $p=.000$ (highly significant)
2. E and TAS, $r=.198$, $p=.020$
3. E and DIS, $r=.269$, $p=.001$ (highly significant)
4. E and PCS, $r=.191$ $p=.025$

Drag racers—no significant correlations

Archers

- E and TAS $r=.356$, $p=.026$
 E and ES $r=.457$, $p=.003$ (highly significant)
 E and BS $r=.402$, $p=.011$
 E and SS, $r=.496$, $p=.001$ (highly significant)
 E and PCS, $r=.431$, $p=.006$ (highly significant)
 RTG and PCG $r=.350$ and $p=.029$

Students

- E and N, $r=-.461$, $p=.000$ (highly significant)
 E and DIS, $r=.424$, $p=.001$ (highly significant)
 E and SS, $r=.365$, $p=.004$ (highly significant)
 E and RTG, $r=.263$, $p=.044$
 RTG and PCG $r=-.274$, $p=.035$
 RTS and PCS, $r=-.284$, $p=.029$

Drag racers and gender (male)

RTG and N $r=.464$ $p=.011$

Drag racers and gender (female)

No significant relationships

Archers and gender (male)

- E and ES, $r=.444$, $p=.023$
 E and DIS, $r=.418$, $p=.034$
 E and BS, $r=.506$, $p=.008$ (highly significant)
 E and SS, $r=.586$, $p=.002$ (highly significant)

Archers and gender (females)

- E and RTS, $r=.647$, $p=.017$
 E and PCS, $r=.713$, $p=.006$ (highly significant)
 RTG and PCG, $r=.586$, $p=.035$

Students and gender (male)

- E and ES, $r=.469$, $p=.005$ (highly significant)
 E and DIS, $r=.487$, $p=.004$ (highly significant)
 E and SS, $r=.509$, $p=.002$ (highly significant)
 RTS and PCS, $r=-.440$, $p=.009$ (highly significant)

Students and gender (female)

- E and N, $r=-.727$ and $p=.000$ (highly significant)
 E and RTG, $r=.447$ and $p=.025$
 E and RTS, $r=.419$, $p=.037$

Drag racers and level of performance (amateur)

- TAS and PCS, $r=-.743$, $p=.001$ (highly significant)
 TAS and PCG, $r=-.682$, $p=.004$ (highly significant)
 SS and PCS, $r=-.637$, $p=.032$

Drag racers and level of skill (elite)

PCS and N, $r=-.412$, $p=.045$

Archers and level of performance (amateur)

- E and PCS $r=.408$, $p=.043$
 PCG and RTG, $r=.430$, $p=.032$

Archers and level of performance (elite)

- E and TAS, $r=.673$.008 (highly significant)
 E and ES, $r=.618$ $p=.018$
 E and DIS, $r=.538$ $p=.047$
 E and SS, $r=.695$, $p=.006$ (highly significant)
 PCS and E, $r=.590$, $p=.026$
 PCS and ES, $r=.594$, $p=.025$

Students and level of performance (amateur)

- E and N, $r=-.454$ $p=.001$ (highly significant)
 E and DIS, $r=.409$, $p=.003$ (highly significant)
 E and SS, $r=.39$, $p=.004$ (highly significant)
 PCS and RTS, $r=-.347$, $p=.014$

Students and level of performance (elite)

- E and DIS, $r=.837$, $p=.005$ (highly significant)
 E and SS, $r=.697$, $p=.037$
 N and RTS $r=-.718$, $p=.029$
 N and RTG, $r=-.669$, $p=.049$
 PCS and ES, $r=.695$, $p=.038$

7.2.5 Discussion

The aim of this study was to examine the relationship between personality and reaction time between drag racers, archers and university sport science students. The overall results demonstrated that there was a significant difference in extraversion between the participants though not significant between drag racers and students. This shows the importance for the inclusion of another specific sport group in study 4. There were significant differences in neuroticism when level of performance and gender was controlled for. Amateurs were higher scores on neuroticism than the elite with drag racers and with archers. Interestingly enough, this was in reverse with students where the elite were higher on neuroticism than the amateur. In sensation seeking there were significant differences between the groups, though not between drag racers and students, and level of performance was shown to be an important moderating variable.

On reaction time measures, there was a significant difference between participants. There were significant differences where amateur drag racers were significantly higher than elites drag racers on these measures, i.e. PCS and PCG. There was a difference between the participant groups in terms of sensation seeking though not between drag racers and students.

There were no significant differences on speed of reaction, which according to the majority of research should show that those in sport are high in extraversion and high in speed (as measured in study 4 by RTG and RTS). In examining the descriptive statistics on the sport specific reaction time measure, male and female drag were very close together in their scores. Male and females compete side by side in this sport and therefore this may account for why there was little difference. However, male and female archers, who also compete together, demonstrated a larger difference in speed (approximately 25- 27 msec) between their scores on both sport general and sport specific tasks. Female archers were faster than male archers, which was contrary to a study into shooting sports (Barral and Debu, 2004).

In comparing the averages from the reaction time general to the reaction time specific measures, participants were generally slower on the specific sport tasks. On the measures of accuracy, both for percentage correct general (PCG) and sport specific (PCS), scores were quite similar for all the participant groups. The biggest difference was between elite and amateur drag racers. Amateur drag racers were more accurate (approx. 12%) than amateur racers on both reaction time measures.

Correlations

Correlations with extraversion

Eysenck et al., (1982) maintained that reaction time measures would correlate with extraversion and neuroticism. Those scoring high on extraversion and low on neuroticism would be quicker in reaction time (Brebner, 1980; Welford, 1980) and would be less accurate (Eysenck et al., 1982). Eysenck's premise has been accepted and supported by a recent study (Canli, 2004).

However, study 4, found that there was a positive correlation between (high) extraversion and (high) reaction time scores on general measures (note-the higher the score the slower the participant) for students and a positive correlation of extraversion and reaction time on sport specific measures with male archers. This means that the higher the extraversion the higher the time – i.e. the slower the participants. This was contrary to Eysenck's premise. However, there was also an overall significant correlation for all participants in study 4, between extraversion and the percentage correct on specific sport tasks. So, the higher the extraversion demonstrated, the higher the accuracy, which is contrary to Eysenck's theory. Amateur and elite drag racers did not show a correlation between extraversion and reaction time.

With archers, as a group, as well as female archers and amateur archers- the higher the extraversion score, the higher the accuracy as measured on a reaction time test. This contradicts, Eysenck's theory that high extraversion is negatively correlated with

accuracy. So overall all, there is a new picture emerging that extraversion may not be a detrimental to sport as in some sports it is related to being accurate and therefore proficient.

Overall archers demonstrated a positive correlation between extraversion and the percentage correct on specific reaction time task. The more extravert the archers were the more accurate they were. This contradicts Eysenck that high extraversion means low accuracy. Female archers showed several relationships between extraversion and reaction time measures. They demonstrated a positive relationship between extraversion and both reaction time (measured in seconds) as measured on sport specific tests. So female archers who were extravert were slow in reaction time. They also showed a highly significant relationship between high extraversion and being high accurate on a sport specific task. So female archers who are high in extraversion are slower and more accurate. This does not support Eysenck's research.

Amateur and elite archers showed a positive relationship between extraversion and percentage correct on general specific sports tasks. The higher their extraversion the more accurate they were on the task. This contradicts Eysenck's premise.

With university sport science students, there was an overall relationship between extraversion and reaction time on general tasks, i.e. the greater the extraversion, the greater the time (i.e. slower the speed). Female university sport science students demonstrated a positive relationship between extraversion and reaction time on both specific and general task.

The 'extraversion-reaction time relationship' assumes the premise of a 'speed-accuracy trade off'. The speed accuracy trade-off is that 'the faster you are, the less accurate you are'. Therefore, if an athlete is high on extraversion, then they are fast in reaction time, and therefore prone to be less accurate.

The result of study 4 contradicted the accepted relationship that those 'high in extraversion are low in accuracy'. There was a positive correlation between extraversion and accuracy on the sport specific measure for all the participant groups. In particular, this extraversion-accuracy link was demonstrated on a specific reaction time task with archers (female, amateur and elite). The higher these archers were on accuracy (measured by % accurate on specific tests) the higher they were on extraversion.

Correlations with neuroticism

Male drag racers demonstrate a positive correlation between neuroticism and general reaction time (note: the higher the RTG score in seconds the slower the participant). Therefore higher male drag racers were in neuroticism, the slower they were on a reaction task. This is consistent with research, which suggests that sports persons who are low in neuroticism - react quickly (Eysenck et al., 1982). It would seem that in an extreme sport such as drag racing, to be relaxed and less anxious is important in being a fast and effective racer.

Study 4 found that elite university sport science students demonstrated a negative correlation between neuroticism and general reaction time and specific. So the more neurotic, the faster they were on reaction measures. This supports a recent study, which also found a negative correlation between neuroticism and the performance of simple reaction (Cui et al., 2009). Recently research appears to be mixed on this relationship. According to Robinson and Tamir, (2005) when neuroticism is high, reaction times are less consistent, though they did not find them to be not inversely related.

Correlations with level of performance

In a study on American footballers (Werner and Thies, 2000) expert players were more efficient at detecting changes in their visual domain. However, experienced players made quick decisions at the expense of accuracy, which is in essence the 'speed-accuracy' trade-off. Study 4 demonstrated the importance of controlling for level of performance in studying the relationship between personality, reaction time and accuracy.

Amateur drag racers demonstrated a negative correlation between both TAS and SS with accuracy on both general and speed reaction time measures. So the higher they were in sensation seeking as well as in thrill and adventure seeking, the less accurate they were. This shows that in extreme sport, a participant cannot be a thrill seeker as this could place them in a dangerous position. It also is interesting that amateurs are in this position. This would somewhat support Zuckerman's premise that those high in sensation seeking are fast and therefore not accurate. It may also be that those who participate in high-risk sport need to control their speed if they are aware of being a sensation or thrill seeker. As a coping mechanism this would keep you safe.

Elite and amateur archers who were high in extraversion were also high in accuracy. This is contrary to the research as already mentioned (e.g. Eysenck et al., 1982) that the more extravert you are the faster you are and therefore the less accuracy you demonstrate. In a sport that doesn't have a high-risk factor, this is not a problem.

Elite university sport science students who were high in neuroticism were lower in reaction time. Amateur university sport science students on the other hand, who were high in thrill and adventure seeking, were slower in reaction time. This is also contrary to Zuckerman (1994) who said that those high in sensation seeking and thrill and adventure seeking were also quick in reaction time.

Eysenck et al., in their study of 1982, suggested, that certain variables, need to be controlled, especially in sport, in order to see if personality relationships are accurate. Without controlling for these factors false assumptions can be made. For example those high in extraversion and low in neuroticism are the best combination in sport in terms of accuracy. Being able to use personality tests to predict performance or even for the use in selection is vital in this area as there is an increase in number of competition, there is money and sponsorship and there is psychological help available. However, this relationship is not correct for all sports. Using sport science university sport science students did show similar results to Eysenck et al., (1982) and to what is in all the

psychology textbooks. However, this has not enabled the sport psychology literature to move and will not empower sport psychologists.

Correlation with gender

The only significant finding between genders in drag racers was with neuroticism and the relationship with speed for males. The higher they were on N the slower they were. The positive relationship between extraversion and accuracy was highly significant with female archers and was not demonstrated at all with male archers. The differences between male and female archers were apparent with sensation seeking measures. With male archers the more extravert they were the higher their scores on all measures of sensation seeking except for thrill and adventure seeking. With students, males were similar to archers in that extraversion was positive related to measures of sensation seeking. Also the slower they were the more accurate they were which support the speed accuracy trade off. With female students, extraversion was related to speed (similar to female archers). The higher their extraversion the slower they were which is contrary to research. These are mixed results on gender though they do show the importance of controlling for gender.

Correlations with sensation seeking

The only relationship demonstrated was with amateur drag racers and this was a negative correlation between overall sensation seeking (SS) and accuracy. The more of a thrill seeker they were, the less accurate they were. This does not contravene research, which relates that those high in SS are therefore fast and less accurate. However, this is an important finding for the psychology of extreme sport. Reaction time measures were useful in demonstrating this relationship along with personality testing. Accuracy is the key to being successful in an extreme sport not being a sensation seeking. Being a sensation seeker who takes a high risk along with a less accurate decision could become severely injured or even die.

Elite archers who were high in the subscale of experience seeking were also high in percentage accuracy. Perhaps ES is a marker for elite archers. With students,

extraversion was related to measures of sensation seeking. With female students, extraversion was related to speed. Using sport science students in sport research provided a sample who were students and were heterogeneous in sport. The results are typical to sport studies findings where those in sports are high in E, high in SS and high in speed.

Sensation seeking was not significantly different between the three groups, i.e. drag racers, archers and university sport science students. It appears to be important with amateur drag racers and perhaps with elite archers.

How useful is the sensation seeking scale as a way of identifying sensation seekers in sport? Are we looking for university sport science students who risk all and are faster? This study raises two issues. First, that sensation seeking does not correlate with those who are already engaged in extreme sport (specifically overall drag racers, males and females) and secondly, that the sensation seeking test either needs revising or abandoning if it is to be relevant to those in extreme sport. Sensation seeking has positively correlated with 'reaction time' (Zuckerman 1994; Miller, 2007) however this was not demonstrated in study 4. In fact, extreme sport enthusiasts may be relatively high-risk takers in much of the literature as measured by sensation seeking or thrill and adventure seeking, though this was negatively correlated with accuracy.

Overall the studies on personality and reaction time confirmed the research that 'reaction time' correlates with personality traits (see: Kashihara and Nakahara, 2005; Robinson and Tamir, 2005). However, it is clear that the use of different sample groups does affect these results and distinguishing between level of performance and gender was also important.

Sport specific tests

This study also highlights the need to research into extreme sport by developing task specific measures. This research developed a SuperLab programme based around the reaction to green lights and the Christmas tree lighting found at the start line in drag

racing. Studies have indicated that task specificity tests can identify differences in reaction time and accuracy in specific sports. For example, volleyball players react faster than basketball players demonstrating the highest number of correct responses in choice reaction times (Kioumourtzoglou et al., 1998). Tennis players had quicker discrimination skills than triathletes (Overney et al., 2008). Thompson et al., (2009) examined speed discrimination in sport, i.e. basketball, volleyball and soccer, through non-sport related tasks.

In examining the RTS and PCS in study 4 as compared to RTG and PCG there appears to be some differences. The general reaction time measures were mostly useful in distinguishing relationships between personality and reaction time with the heterogeneous sport science students. However, there were significant relationship between personality and the sport specific test designed for drag racers only when controlling for level of performance. Therefore, designing a sport specific test appears to be useful in measuring reaction time and accuracy.

Limitations

There are limitations in these findings. Firstly, there was a need for participants to use a computer in order to measure reaction time. All the participants were IT proficient and therefore, no participant was disqualified for being unable to under this test. There is of course the issue of whether results from a computerized test can be transferred to a 'real' sport situation. How did this sport specific task replicate what the drag racers do? Many of the drag racers admitted doing practice 'reaction time' tests on computers or through racing game programs. The SuperLab sport specific task developed for drag racers did not demonstrate that drag racers were faster and more accurate on this measure than other groups. A variation on study 4 could be to wire up a car to a practice Christmas tree for the drivers. This was something this researcher did in working with a particular racing team.

Lifestyle factors can have an effect on the results in research. In study 4, the drag racers were approached in person and the researcher did assess their state of well-being.

However, specific information as to their health or lifestyle was not taken. Drivers may have been tired or even in some case under the influence of alcohol though drivers tend not to drink during a competition weekend. Many factors can have an affect on 'reaction time' such as caffeine (Durlach, et al., 2002) smoking (Froeliger et al., 2009) and sleep deprivation (McLellan et al., 2005). Difficulty in language was less of an issue as this was a non-verbal task and once the European drivers understood what they needed to do for the task, and then language issues were not a barrier. Another factor, which may have affected the test, was distraction as drag racers did take this test in a noisy track environment. Distractions increase reaction time (reviews by Welford, 1980; Broadbent, 1971). This may be because environmental sounds increase reaction time by impeding parts of the cerebral cortex (Trimmel and Poelzl, 2006). When auditory and visual stimuli are presented simultaneously, for example in a simulated driving task, reaction times are longer (Lee, Caven, Haake, and Brown, 2001). The effect of distraction may be incumbent on emotional state as well as based on previous experience. Participants who are frustrated by a task and then tested on the reaction measures were slower and more distracted than subjects who had not been frustrated prior to the reaction time test (Reed and Antonova, 2007). However, this was carried out in either a quiet area or in the cabins of the drivers, which are soundproofed, and there was little noise experienced. It is in my experience, that drag racers become habituated to the track noise.

Sample size is always a problem when working with very specific groups such as drag racers who are an elite FIA sport. Female elite drag racers in particular were difficult to find. Finally, students who could be classified as elite athletes were also somewhat rare though in the run up to the Olympics their public profiles were more visible which helped in finding them.

Conclusion

Personality has been shown to be an important area of study in relation to reaction time. There were significant differences between drag racers, archers and sport science university sport science students on measures of personality measures of extraversion/neuroticism, sensation seeking, and measures of speed and accuracy.

An important finding was the role of level of performance in analysing difference between sporting groups. When controlling for level of performance, there were significant differences on measures of sensation seeking, neuroticism and accuracy. When controlling for gender, there was a significant differences only for neuroticism.

In examining correlational relationships, there were significant relationships between participants on extraversion, sensations seeking measures as well as accuracy on a sport specific task. There were significant relationships for male drag racers on reaction time general and neuroticism. With amateur drag racers there were significant relationships between sensation seeking measures and percentage correct on sport specific and general measures. There were significant relationships between personality and reaction time accuracy for archers: elite, amateur and female. For students there was a significant relationship between personality and speed.

Students demonstrated the same relationship as evident in research, that high extraversion is related to high speed. As a heterogeneous group this is quite typical a result found in the literature. Archery players on the other hand, require high levels of accuracy to be successful in their sport. Having an extravert personality and being female, elite or amateur would be a positive advantage as there is a positive correlation being these variables and being accurate. Extreme sport participants, such as drag racers, have shown that neuroticism slows them down, and that sensation seeking measures are related to their accuracy. Drag racers require great accuracy as they participate in a dangerous 'extreme sport'. Such a finding is of great interest in understanding the impact of a sensation seeking personality to a perceptual motor skill in sport. An

accurate identification of the relationship between sport personality and sport specific reaction time would enable the field of talent identification to grow substantially. It would also lead to the development of appropriate interventions designed to improve reaction time in 'extreme sports'.

Finally, this study 4 concludes that the speed accuracy trade-off in the extreme sport does not exist. Study 4 did not demonstrate that participants of sport have high speed and low accuracy except with amateur students. The speed accuracy trade-off is not prevalent in drag racing and may not be relevant on sports where a risk has to be taken in order to win. Extreme sport is about 'extreme accuracy', which is defined by this author "the ability to undertake a task successfully, whilst facing the highest possible level of risk even if reaction time is sacrificed".

8.0 Chapter 8: General Discussion

8.1 Preface

The main aims of this thesis were to examine the relationship between the personality traits of extraversion/neuroticism and sensation seeking in ‘extreme sport’ (high-risk sport) compared to a traditional sport. This thesis also investigated the use of reaction time as an additional measure in understanding the profile of participants in ‘extreme sport’. For this reason, drag racing and archery were selected as representative of two ends of the continuum in relation to risk-taking in sport. A sample of university sport science students also acted as a comparison group during the investigations. University sport students not only represent a typical student body but also represent those who participate in traditional sport or physical activity. They are a strong heterogeneous group to compare to the homogenous and extreme sport of drag racing as well as to the homogeneous traditional sport such as archery. The main drivers for this line of investigation are outlined below.

Whilst a considerable body of research is devoted to the relationship between personality and sport (as explained in chapters 2 and 3) much of this previous work lacks adequate controls, (i.e. gender, level of performance, age and use of students as participants). Furthermore, as discussed in chapter 4 there is still no clear consensus as to which personality traits correlate with a particular type of sport. This could be partly due to inadequate definitions of what is ‘extreme sport’ or high-risk sport (as discussed in chapter 5).

Taking on board the above gaps in the scientific literature, the aim of the present thesis was to:

- i) Introduce for the first time an investigation on the personality traits of extraversion/neuroticism and sensation seeking measures of drag racers, a sporting population engaged in an high-risk, ‘extreme sporting’ activity (chapter 6).

ii) Resolve the issue of adequate control variables in this line of investigation by not only including a sample of university sport science students but also by including archers from a low-risk 'non-extreme' or traditional sport - as a sporting population representing an ideal opposite end of a continuum of high-to low-risk activity (chapter 7).

Finally, as discussed in chapters 6 and 7, the present study was also designed to follow up Eysenck et al's. (1982) work outlining the possible relationship between personality traits and reaction time latencies within sporting behaviour. The sport of drag racing is particularly relevant in this regard, as reaction times are a measured and important variable with the sport. The discussion will continue with a summary of findings from studies 1-4, followed by detailed discussions regarding the findings, implications for future research and the contribution this thesis will make to scientific literature.

8.2 Summary of the studies

Study 1: The aim of this study was to examine personality and its relationship with sport in a scientifically controlled way, by incorporating variables that have been shown to affect previous research such as gender and levels of performance. The study involved comparing personality traits against a more typical comparison group of university sport science students with those of 'extreme sport' participants, i.e. drag racers as measured by extraversion and neuroticism. Personality theory has consistently identified individuals in sport as high in extraversion and low in neuroticism. Though both groups were higher than the population norms in extraversion, which is consistent with research, there was no significant difference in the two groups with regard to this factor (i.e. extraversion). This is contrary to literature (which is limited) though predominantly that shows that 'extreme sport' participants are higher in extraversion than those in other sports. Perhaps those low in extraversion tend to find that too high a level of extraversion combined with the thrill of an 'extreme sport' interferes with their ability to perform cognitive tasks successfully. The results also indicated there was no significant

difference when controlling for level of performance or for gender. The validity of using measurements of extraversion in 'extreme sport' was shown to be unreliable for profiling and for predicting relationships in personality. Elite drag racers were not higher in extraversion, in this study, in relation to the comparison group.

A significant difference between participants was demonstrated for neuroticism (students were higher than drag racers) though there were no significant differences in either gender or level of performance. According to the descriptive statistics on average, female sport students had higher scores in neuroticism compared to the other participants. Females are generally regarded in research as being higher in neuroticism than males. Female drag racers were slightly higher in neuroticism than their male counterparts this was not a significant factor in 'extreme sport'.

Study 2: The aim of this study was to manage gender and levels of performance, and to compare personality traits as measured by Zuckerman's (1994) Sensation Seeking Scale (SSS-V), and its subscales of thrill and adventure seeking, experience seeking, disinhibition and boredom susceptibility. The novel group of drag racers was again compared with university sport science students. Results did not show significance in controlling for level of performance or gender in sensation seeking. Gender and level of performance were also not significant on the majority of subscales. There was only a significant gender difference on the subscale of disinhibition.

The results showed that drag racers have a different profile to the current sport psychology research. Studies show that participants in sport are consistently high in sensation seeking as well as in thrill and adventure seeking. Those competing in extreme sport may have a different profile, which distinguishes them from those who compete in more traditional sport. There may also be unique differences between extreme sports. Lack of significance, however, could also be due to the high level of sensation seeking found in university sport science students, used as the comparison group.

Though significance was only found in study 2 for Disinhibition, the descriptive statistics are rather interesting. In examining the descriptive statistics, students were higher than drag racers on sensation seeking and all subscales except experience seeking. In controlling for level of performance, elites had higher averages than amateurs on sensation seeking, thrill and adventure seeking and disinhibition. Amateurs were slightly higher on experience seeking as well as boredom susceptibility. Females had the highest average on thrill and adventure seeking and males had the highest average on experience seeking and disinhibition. Results were comparable on boredom susceptibility, which is similar to other research findings on this subscale. In examining the statistics within a group, the larger differential in drag racing was found between male and female drag racers on the subscale of disinhibition, where males were higher. With students, the largest differential between the average scores was in sensation seeking and was between elite and amateur students, where elites showed higher scores.

Studies 1 and 2: In conclusion, the first two studies present an insight into a novel group of 'extreme sport' participants providing psychological literature with a unique personality profile. Contrary to literature, drag racers were low on extraversion (i.e. in comparison to university sport science students) and low on sensation seeking (i.e. in comparison to university sport students). They were not significantly distinguishable in terms of level of performance. There was a significant difference in neuroticism between the participant groups and with gender on the subscale of disinhibition. Drag racers did demonstrate lower scores on neuroticism in comparison to university sport science students.

Psychological research into personality has been criticized in major review studies (Eysenck et al., 1982; Kolega, 1992, Goma-i-Freixanet, 2004; Silverman, 2006) for its inconsistencies and lack of scientific rigour. Study 1 and Study 2 have addressed these issues through statistical means, i.e. by using age as a covariate, and by controlling moderating factors of gender and level of performance. However, the studies in this thesis have identified weaknesses in the use of sport students as a comparison group and

in addition, highlighted the need for further research using a contrasting comparison group, i.e. a 'traditional' 'non-extreme sport'. It was intended that such a course of action would ensure that the research was scientific and would enable accurate generalizations to be made.

Study 3: The aim of this study was to further contribute to research on the relationship between personality traits and sporting activity by introducing the contrasting sporting comparison group of archers. Drag racing and archery are 'opposites' ends of the sporting continuum with regards to being extreme or high-risk in nature. There is also limited psychological research on archers, which makes them an interesting group to study. This study compared drag racers, archers and sport students while maintaining the rigorous scientific controls for age, gender and level of performance.

The results indicated that there were significant differences between the 3 groups in sensation seeking, thrill and adventure seeking and disinhibition. The post hoc results do demonstrate that there were significant differences between the groups (drag racers/archers; students and archers)). Gender was shown to be a significant variable in measuring neuroticism (females>males), whilst level of performance was significant for measures of sensation seeking as well as for thrill and adventure seeking.

Drag racers were not as high as university sport science students on measures of extraversion. Drag racers were higher in extraversion than archers, which is consistent with established research. Females were slightly similar to males on measures of extraversion. Female university sport science students scored the highest on extraversion compared to all females whilst male university sport science students were the highest of all the participants. Female sports participants are typically higher in extraversion than the population norm. On measures of neuroticism, male archers had the lowest mean and female archers the highest. Females are usually high in neuroticism. It is interesting that female archers were particularly high in neuroticism.

There were no significant differences in level of performance for extraversion, though elite participants were higher on extraversion. Elites were lower on neuroticism than amateurs, which, also does support established research.

On sensation seeking, results were highly significant between participants and for level of performance. Amateur archers scores were the lowest on sensation seeking while elite drag racers had the highest. This is clearly illustrated when university sport science students are taken out the picture and is an expected result. However, when university sport science students are included these students rank higher in sensation than the other two groups. By gender, female archers had the lowest mean on sensation seeking. Results were consistent with literature where archery, as a non-moving target sport, would attract athletes low in sensation seeking. Females are also consistently lower in sensation seeking than males.

As sensation seeking is linked with extraversion, it would be expected that those high in extraversion are also high in sensation seeking. University sport science students who were the highest in extraversion are also the highest in sensation seeking. Archers who were the lowest in extraversion were also the lowest in sensation seeking.

On the subscale of thrill and adventure seeking, there was a significant difference between the participants in level of performance between archers and drag racers. Elites were higher than amateurs on this measure. Drag racers, once again, scored the higher than archers unless student results were also compared. In an interaction effect, female archers scored significantly lower than male archers.

According to the descriptive statistics, female drag racers were higher on thrill and adventure seeking compared to female archers who were the lowest. When all 3 cohorts are taken into account, female university sport science students were the highest on thrill and adventure seeking averages and university sport science students collectively were also the highest of the 3 cohorts. University sport students represent a general picture of sport that is similar to established research. Testing for archers and drag racers enables this research to examine sport specific profiles and personality.

On experience seeking, there were no significance differences between participants on gender or for level of performance. On the descriptive statistics, male archers were the highest on experience seeking and female university sport science students the lowest according to the means. This is an interesting result demonstrating that male archers take up experiences that satisfy themselves in ways other than through thrill seeking. In particular, the results of the descriptive statistics indicated that in controlling for level of performance, elite archers were the highest on average for experience seeking and elite drag racers the lowest. So whereas level of performance is not significant between these groups of participants it may be that level of performance is unique for each of these sports.

On disinhibition, there was significance difference between the participants. University sport science students demonstrated overall the highest scores and archers the lowest. Male university sport science students reveal that they look for ways to get their kicks through binge drinking /illegal drugs compared to female archers who were the lowest when it comes to engaging in antisocial behavior. Elites were higher than amateurs, which one can only speculate may have to do with the pressure of competitive on an elite level. On boredom susceptibility, no significance was found between levels of performance, gender or between groups. In examining the descriptive statistics, male drag racers had the highest average means whilst female archers the lowest.

The overall results of this study show that there were significant differences between groups in level of performance for: sensation seeking and thrill and adventure seeking. There were significant differences as a result of gender on neuroticism with females scoring higher on this measure. There were significant differences between the participants on sensation seeking, thrill and adventure seeking and disinhibition. There were not any significant findings with the subscale measure of boredom susceptibility.

Female drag racers are very high thrill seekers whilst female archers are highly neurotic and subsequently thrill-aversive. Male drag racers are sensation seekers who also enjoy engaging in activities, such as drugs and binge drinking as measured on the disinhibition

subscale of the SSS-V. On the other hand, male archers who are low in neuroticism look for stimulating experiences through intellectual or artistic pursuits. None of the participants engage in 'extreme sport' due to boredom. Finally, neither archers nor drag racers engage in sport due to boredom. Male university sport students are: highly extravert, sensation seekers who are high in disinhibition. Female university students are extraverts who are thrill seekers though they are also high in neuroticism.

Study 4: The aim of this study was to examine the relationship between personality and reaction time to sport-specific and neutral stimuli between drag racers, archers and sport students. There were significant differences demonstrated between the participants on extraversion, sensation seeking and sport specific accuracy. There was significance in level of performance on neuroticism, sensation seeking and measures of both general and specific accuracy. There was also a gender difference on neuroticism.

In the correlational analyses, there were a variety of significant relationships though overall there was a positive correlation between extraversion and percentage accuracy as measured on a sport specific test. Only sport students, demonstrated the relationship of high in extraversion and high in reaction time.

In examining the relationships between accuracy and personality, amateur drag racers demonstrated that the higher their sensation seeking, the lower their accuracy. Drag racers need a high level of speed yet a high level of accuracy to avoid a dangerous situation. Being a thrill seeker cannot be advantageous. The research does suggest that those high in sensation seeking are less accurate (Eysenck et al., 1982; Zuckerman, 1994). These relationship between sensation seeking and accuracy was not show in other participant groups.

For elite drag racers, the higher the neuroticism, the less accurate they were as measured on sport specific tasks. Male drag racers also demonstrated, that the higher they were on neuroticism, the slower they were on a measure of reaction time. Therefore, having a high level of neuroticism is not beneficial for the sport. This supports the research

premise that outstanding athletes need to be low on neuroticism (Eysenck et al., 1982 ; Zuckerman, 1994 ; O'Sullivan et al., 1998).

With archers however, different results were demonstrated. There were significant positive correlations between extraversion and accuracy for females, amateurs and elites. So high extraversion as a personality trait would benefit the archer and enhance performance. Once again, these results do not support the sport psychology literature, which, is that there is an inverse relationship between extraversion and accuracy.

The only groups to demonstrate a relationship between extraversion and speed were the female university students and the female archers. Neither group's results supported Eysenck's positive correlation of extraversion with speed. The results in study 4 showed that the higher the extraversion the slower the speed. Elite students, on the other hand dispelling Eysenck's premise that by showing that the more neurotic the faster they were on measures of reaction time. Sport Science students also showed a significant relationship between extraversion and accuracy. The higher they were in extraversion the more accurate they were.

The aim of investigating personality tests and sensation seeking tests on the one hand, with reaction time latency on the other, was to contribute to the literature by substantiating or dispelling Zuckerman's and Eysenck's original personality theories that those high in extraversion and sensation seeking also have fast reaction times. Specifically, the contrasting sports of drag racing and archery from a risk perspective provided useful cohorts. Furthermore, this analysis goes further than previous research by controlling for level of performance and gender.

Eysenck's and Zuckerman's research has been accepted since 1982 and was even supported by a recent study (Canli, 2004). This is that: extraversion correlates positively with faster reaction time; extraversion is inversely related to accuracy; neuroticism negatively correlates with accuracy; and sensation seeking correlated with speed. However, these studies may be significant when general sport participants are used, as

with sport science students, however a different set of results emerges when sports are studies by type and variables such as gender and level of performance are taken into account.

It was demonstrated, in study 4, that the speed and accuracy trade-off is not prevalent in drag racing, especially in the elite classes where there is an extreme risk to commit to the task and to win an event. Drag racing is characterized by extreme danger, and for this reason may be linked to ‘extreme accuracy’, which is defined by this author as, “the ability to undertake a task successfully, whilst facing the highest possible level of risk even if reaction time is sacrificed” may be something that is key to extreme sport.

Overall, there were significant differences between the groups for gender and level of performance related to accuracy on both the sport specific task and general task. There was a significant relationship between personality, sensation seeking measures and reaction time.

8.3 Contributions

The main aim and contribution of this thesis was to introduce to the scientific literature the relationship between personality traits and sporting behavior in new sports, namely drag racing and archery, which has never been researched in this way before. Examining the personality of drag racers in terms of extraversion, neuroticism and sensation seeking was a novel contribution to the literature. Furthermore the reaction time paradigm used in this thesis was measured on both a general and a sport specific test, which was designed specifically for drag racing.

Another aim of this thesis was to scientifically control for moderating factors. Research into this area has been flawed, methodologically weak with an absence of a disciplined approach (Eysenck et al., 1982). According to Eysenck et al., (1982), there is a close relationship between sport and personality however researchers are enticed to administer personality questionnaires to large heterogeneous groups of sports participants and then

compare results with standardized data ignoring vital moderating factors such as age, level of activity, and type of sport. Psychological studies are therefore difficult to replicate as well as difficult to generalize from. In order to contribute to the overall success of athlete's research is required to have an enhanced understanding of the personality sport relationship supported by appropriate evidence (Eysenck et al.,1982). Eysenck criticized psychological research for being quick to get involved with the latest craze and then lose focus when an investigation gets difficult. Anomalies and replication, he wrote, meant that research is not always easy. He cites the absence of a disciplined approach as a primary reason why psychology has not, despite a strong historic profile, achieved scientific respectability and called for a more systematic approach. Koelega (1992) echoes these concerns that psychology has not achieved respectability despite its long history. In his review on extraversion and vigilance, he acknowledges that there are 30 years of inconsistencies. Raglin (2001) wrote that reviews of personality and sport literature have consistently only revealed extraversion and emotional stability to be moderately associated with sport participation or performance.

More recently, Rhodes and Smith (2006) conducted a review on personality and physical activity. The authors felt that it was too difficult to draw conclusions from the research, as there was still a lack of control related to variables. The variables identified as most inconsistent and yet most relevant to this thesis, were age, gender and levels of performance. In addition, it was felt necessary to control for the comparison groups. A comparison group of university sport science students represented a heterogeneous group of sporting participants as well as students. The other group chosen was a heterogeneous group, i.e. archery, which is quite 'opposite' on a sporting continuum to 'extreme sport' such as drag racing.

A further issue raised during the course of this research was the suitability of students and or sport students as a comparison group. Undergraduate university sport science students used in a recent study were high in both extraversion and neuroticism (Xiangle, 2009). In fact, the university sport science students in this thesis were significantly

higher in extraversion than even the drag racers. This was a useful group to compare as they represented the typical generic group of sports participants often used in sport research. However, Peterson (2001) suggests that researchers utilizing college or university students also employ non-student participants before attempting any generalizations. Using a student sample, which differs significantly from the general population of, in this case, non-sport participants raises questions about how valid sport research really is. The greater the differences between sports students and non-participants the more problematic for research credibility. Sears (1986) criticized the use of a comparison group with a 'narrow data base'. Other studies have compared student samples to non-student samples and some have found differences (e.g. Peterson, 2001; Mintz et al. 2006).

Research suggests that personality has an effect on sporting performance. So traditional tests of personality, Eysenck and Eysenck's EPI (1982) and Zuckerman's SSS-V (1994) were chosen. Eysenck's extraversion/neuroticism paradigm was the basis for the research as extraversion is the only consistent finding. Other factors could have confused the purity of the issues and so it was decided to go back to the basics in order to test out the issues scientifically. Research using the EPI (Eysenck and Eysenck, 1982) demonstrated that it was the most commonly used test in sport studies and was also accepted as a valid and reliable measure of personality (e.g. review paper by Kolega, 1992). Sport participants had also consistently demonstrated that they tend to be high on scales of extraversion and low in neuroticism.

Sensation seeking is associated with thrill seeking (Zuckerman, 1994) and is a trait that is correlated with extraversion (Eysenck et al., 1982). It is the focus on the majority of personality research on high-risk sport. Sensation seeking is a trait theory based on the idea that there are stable individual differences associated with ideal amounts of stimulation and arousal. One of the implications is that individuals with a high sensation seeking trait are more likely to engage in high-risk sport (Goma-i-Freixanet, 1991). In a review of 40 papers on high-risk and sport, Goma-i-Freixanet (2004), concluded that the subscales also relate to whether an individual actually engages in high-risk sport. The

thrill and adventure seeking subscale represents those who undertake high or medium risk sport and even to some extent, low-risk sport. Differences on boredom susceptibility vary only when comparing extremes such as high to low-risk sport. The disinhibition is characteristic of individuals in sport at any level. It is clear from past empirical studies that 'extreme sport' was associated with high-risk. Zuckerman's SSS-V measuring sensation seeking seemed extremely pertinent to this thesis. The SSS-V test can provide important information about different preferences for risk or non-risk. Recently, Roberti (2004) commented that the relationship of sensation seeking to behavioral as well as biological correlates was an important key to personality and worthy of empirical study. Gender differences also appear to be evident. Studies have demonstrated that personality is likely to influence women's risk taking behavior (Cooper et al., 2003).

The various definitions for 'extreme sport' and classifications of sport with high-risk sport presented major problems. A definition on what is 'extreme sport' did not exist. There was not any kind of consistency as to what constitutes 'extreme sport' which raised conceptual difficulties. Personality and cognitive variables may differ according to various sports and therefore designing a study and considering interventions was hard. Chapter 5 in the thesis has researched and was devoted solely on exploring the meaning of 'extreme sport'. The outcome of the chapter was a workable academic definition on 'extreme sport,' which can be used in future studies. Just as a note, in England, approximately 5% of the population regularly participates in alternative sports (Campbell and Johnson, 2005) so this is an area that is growing and a definition for future research into this area is beneficial.

Personality tests are useful to enhance ability and achievement (Robertson, Baron, Gibbons, MacIvor, and Nyfield, 2000) or to optimize success through their predictability (Aidman, 2007; Raymark and Schmit, 1997). Twenty years on there is a study by Aidman (2007) which claims that personality makes the difference between "the best and the rest" in athletes (p.1). The results of this study resurrect the study of

personality in a mediating role of converting ability to achievement and integrating it with the probability of success in transition of athletes from juniors to elite standard.

Personality studies rely on questionnaires and as methodological inconsistencies in research have been noted, a third measure was chosen for this thesis. Reaction time has been shown to relate to personality and those high in extraversion tend also to have fast reaction times. The sensation seeking scale was significantly related to a number of personality types. Adding reaction time brings another dimension to this thesis in being able to understand and predict sporting success.

The suitability of reaction time as a measure in 'extreme sport' was unknown. Participants' accuracy in responding to complex stimuli was taken as a measure of performance effectiveness and could combining this with personality be effective for 'extreme sport' participants. Simple reaction time in conjunction with a type of personality was recorded as the most effective measure of efficiency. Efforts to understand factors that influence how quickly sensations seekers make decisions as measured by reaction time and how these impacts on performance (in terms of benefits, i.e. winning and costs, i.e. injuries) are essential. Extreme accuracy is required in 'extreme sport' and is defined by the author of this thesis as the ability to undertake a task successfully, whilst facing the highest possible level of risk even if reaction time is sacrificed. This fits within the definition of 'extreme sport' as "extreme sport is a competitive activity within which the participant is subjected to unnatural or unusual physical and mental challenges such as speed, height, depth or natural forces and where fast and accurate cognitive perceptual processing maybe required for a successful outcome. An unsuccessful outcome is more likely to result in the injury or even fatality of the participant more so than in a 'non-extreme sport'.

8.4 Implications and Future Research

The implications for this research is that there are some relationships between personality and the sensation seeking trait that may be beneficial to those in drag racing

and 'extreme sport'. Use of personality tests in combination with a reaction time test (that also examines accuracy) may provide drag racers with what is required to be successful in their sport. The development of interventions and tests for talent identification could be developed next and this may be useful for drag racers that are in the elite FIA classes, as well as sport psychologists. The implication of the need for accuracy in conjunction with a fast reaction time may also prove to be very useful in other 'extreme sports' as a predictor of success, rather than a tendency of merely scoring high in extraversion. Also, use of sensation seeking on its own is not enough of an identifier for all drag racers though this could be a good marker for amateur drag racing competitors. As severe and even debilitating injuries may not be unusual, a sport psychologist could monitor and interpret sensation seeking scores as a tool to highlight the importance of potential dangers that participants of these activities face. This study also included sports where participants, male and female, compete side by side in competition and this may also have highlighted differences, which need further examination. Differences were demonstrated between gender so psychological research and applied psychology needs to consider these differences. There are also implications for elite drag racers that score higher in extraversion and therefore low in accuracy as they may run more of a risk of injury or accident. Taking that into account would be useful for those that train drag racers, and before they awarded are a license in the elite classes. Female archers who are high in extraversion may be fast but they are also accurate as this knowledge would benefit competitive archery teams. Elite drag racers who are high in neuroticism may benefit from sport psychology interventions that include stress management, as a negative correlation between neuroticism and accuracy was demonstrated.

Variation in sports and 'extreme sport' does exist and this research stresses the importance of examining different sports homogeneously rather than including several extreme or high-risk sports together in one study comparing them against other sports or students. Review papers are still raising this as an issue and the lack of control in the psychological research community does not help the field progress. This research recommended that psychology research moves towards a more scientific approach and

that variables such as age, gender and level of performance always be taken into account so that accurate comparisons can be made. As a researcher into this area it would be interesting to create a continuum of risk, which positions sports from 'low-risk' to 'high-risk'. This could assist other researchers in clearly defining which sports are extreme so that sports could be studied separately and compared. The implications of this research stressed the importance in scientifically controlling variables. So the development of a continuum of sports in conjunction with scientific controls would enhance sport psychology research.

A package of revised and even newly developed tests for those who are considering certain sports in order to identify those who would not be at risk of extreme sport. Though the test could be nomothetic the results have to vary for sports. The SSS needs revising as it has many questions, which revolve around asking participants if they would like to fly a plane, or jump out of a plane or go skiing are now out of date. This may not measure intention according to the authors who built intention more into SSS-VI however it is still about whether someone would like to try these 'extreme sports' out and that crosses into 'intention'. What is interesting is how it demonstrated that those in 'extreme sport' do not worry so much about being quick which does provide insight into why these participants feel safe in what they are doing. Practice in reaction time and in pushing the limits through electronic online games would help participants. The relationship and transferable skills between electronic games and sensation seeking could also be examined. The development of sport specific training aids such as a Christmas tree linked in with reaction time pedal to practice on would simulate the start of a race and would aid racers.

There should be debate by the academic psychological community as to whether students should be used as comparison groups so that generalizing results from students does not show inaccurate results. More specific studies examining homogenous sports would facilitate the development of an extensive psychological profile on sports used to

develop interventions to enhance success and to assist in identifying talent. University sports students are useful as a cohort when looking at sport characteristics in general as they represent a lot of sporting activity involvement and usually fitness participation as well.

In summation, accepting that personality factors of extraversion and neuroticism can be significant factors in facilitating success with drag racers archers, and university sport students in sports where accuracy is vital. Neuroticism is still important in some sports and anxiety and stress management may be important for sport psychologist in enhancing performance. Zuckerman's (1994) Sensation Seeking Scale appears to be outdated and not linked with personality except for its negative effect on accuracy with drag racers. Stressing the importance of research to scientifically control important factors. Open up personality debates as a viable area to study and examine ways in which it is linked in with other psychological measures or behavioral measures such as with reaction time. The conclusion from this thesis proposed further study from researchers into 'extreme accuracy' as a concept in 'extreme sport' as opposed to the 'speed-accuracy trade off'. The present research stresses the importance in using of homogeneous 'extreme sports' groups and juxtaposing them against extreme opposite groups. This thesis has providing results that hopefully can be useful in providing insight for psychologists, trainers, athletes, recreational participants and coaches to consider the manner in which 'extreme sport' participants learn to respond to requirements of their sport.

8.5 Conclusion

Now should be the time for systematic investigations once criticized in the past for their lack of scientific methodology and replicability. Controlling moderating factors such as gender and level of performance was shown to be invaluable. Age was important to control as a covariate due the vast differences in age of the three cohorts. Extraversion scores decline continually after adolescence - much more for males than for females (Feingold, 1994) and arousal also changes with age (Giambra et al.,1988). The link between extraversion and 'extreme sport' is not the same as it is with general sport. The use of university sport science students in previous research may also have affected those generalizations. Sensation seeking is not as prevalent in 'extreme sports' today as 'everyone' is doing it and the test needs revising unless a new test is developed. Reaction time is a necessity in 'extreme sport' and this could be developed further as 'extreme sport' is about 'extreme accuracy'. 'Extreme sport' does vary and scientific of comparison groups within research is essential if the psychological sport research is to advance.

Eysenck et al.'s (1982) classic review cited on many occasions in this thesis was a prime motivating source behind completing this work. In their paper, Eysenck et al. (1982) concluded by stating that "the whole field is ready and open for research of an altogether higher quality than has been characterized of the past two or three decades" (p49). It's hoped that this has been achieved in the present thesis!

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APPENDIX I**Eysenck Personality Inventory****1.Choose AorB**

A I like “wild” uninhibited parties.

B I prefer quiet parties with good conversation.

2.Choose AorB

A There are some movies I enjoy seeing a second or third time.

B I can't stand watching a movie I've seen before.

3.Choose AorB

A I often wish I could be a mountain climber.

B I can't understand people who risk their necks climbing mountains.

4.Choose AorB

A I dislike all body odors.

B I like some of the earthy body smells.

5.Choose AorB

A I get bored seeing the same old faces.

B I like the comfortable familiarity of everyday friends.

6.Choose AorB

A I like to explore a strange city or section of town by myself, even if it means getting lost.

B I prefer a guide when I am in a place I don't know well.

7.Choose AorB

A I dislike people who do or say things just to shock or upset other people.

B When you can predict almost everything a person will do and say he or she must be a bore.

8.Choose AorB

A I usually don't enjoy a movie or a play where I can predict what will happen in advance.

B I don't mind watching a movie or play where I can predict what will happen in advance.

9.Choose AorB

A I have tried marijuana or would like to.

B I would never smoke marijuana.

10. Choose A or B

A I would not like to try any drug which might produce strange and dangerous effects on me.

B I would like to try some of the new drugs that produce hallucinations.

11. Choose A or B

A A sensible person avoids activities that are dangerous.

B I sometimes like to do things that are a little frightening.

12. Choose A or B

A I dislike people who are uninhibited and free about sex.

B I enjoy the company of people who are uninhibited and free about sex.

13. Choose A or B

A I find that stimulants make me uncomfortable.

B I often like to get high (drinking liquor or smoking marijuana).

14. Choose A or B

A I like to try new foods that I have never tasted before.

B I order the dishes with which I am familiar, so as to avoid disappointment and unpleasantness.

15. Choose A or B

A I enjoy looking at home movies, travel slides, or home videos.

B Looking at someone's home movies, travel slides, or home videos bores me tremendously.

16. Choose A or B

A I would like to take up the sport of water-skiing.

B I would not like to take up water-skiing.

17. Choose A or B

A I would like to try surf-board riding.

B I would not like to try surf-board riding.

18. Choose A or B

A I would like to take off on a trip with no pre-planned or definite routes, or timetable.

B When I go on a trip I like to plan my route and timetable fairly carefully.

19. Choose A or B

A I prefer the "down-to-earth" kinds of people as friends.

B I would like to make friends in some of the "far-out" groups like artists or "punks."

20. Choose A or B

A I would not like to learn to fly an airplane.

B I would like to learn to fly an airplane.

21. Choose A or B

A I prefer the surface of the water to the depths.

B I would like to go scuba diving.

22. Choose A or B

A I would like to meet some persons who are homosexual (men or women).

B I stay away from anyone I suspect of being “gay” or “lesbian.”

23. Choose A or B

A I would like to try parachute jumping.

B I would never want to try jumping out of a plane with or without a parachute.

24. Choose A or B

A I prefer friends who are excitingly unpredictable.

B I prefer friends who are reliable and predictable.

25. Choose A or B

A I am not interested in experience for its own sake.

B I like to have new and exciting experiences and sensations even if they are a little frightening, unconventional, or illegal.

26. Choose A or B

A The essence of good art is in its clarity, symmetry of form and harmony of colors.

B I often find beauty in the “clashing” colors and irregular forms of modern paintings.

27. Choose A or B

A I enjoy spending time in the familiar surroundings of home.

B. I get very restless if I have to stay around home for any length of time.

28. Choose A or B

A I like to dive off the high board.

B I don't like the feeling I get standing on the high board (or I don't go near it at all).

29. Choose A or B

A I like to go out or date people who are physically exciting.

B I like to date people who share my values.

30. Choose A or B

A Heavy drinking usually ruins a party because some people get loud and boisterous.

B Keeping the drinks full is the key to a good party.

31. Choose A or B

A The worst social sin is to be rude.

B The worst social sin is to be a bore.

32. Choose A or B

A A person should have considerable sexual experience before marriage.

B It's better if two married persons begin their sexual experience with each other

33. Choose A or B

A Even if I had the money I would not care to associate with flighty rich persons in the 'jet set.'

B I could conceive of myself seeking pleasures around the world with the "jet set."

34. Choose A or B

A I like people who are sharp and witty even if they do sometimes insult others.

B I dislike people who have their fun at the expense of hurting the feelings of others.

35. Choose A or B

A There is altogether too much portrayal of sex in movies.

B. I enjoy watching many of the "sexy" scenes in the movies.

36. Choose A or B

A I feel best after taking a couple of drinks.

B Something is wrong with people who need liquor to feel good.

37. Choose A or B

A People should dress according to some standards of taste, neatness, and style.

B People should dress in individual ways even if the effects are sometimes strange.

38. Choose A or B

A Sailing long distances in small sailing crafts is foolhardy.

B I would like to sail a long distance in a small but seaworthy sailing craft.

39. Choose A or B

A I have no patience with dull or boring persons.

B I find something interesting in almost every person I talk with.

40. Choose A or B

A Skiing fast down a high mountain slope is a good way to end up on crutches.

B I think I would enjoy the sensations of skiing very fast down a high mountain slope.

APPENDIX II**SENSATION SEEKING SCALE – V**

1. Do you often long for excitement ?

A) Y e s

B) N o

2. Do you often need understanding friends to cheer you up ?

A) Y e s

B) N o

3. Are you usually carefree ?

A) Y e s

B) N o

4. Do you find it very hard to take no for an answer ?

A) Y e s

B) N o

5. Do you stop and think things over before doing anything ?

A) Y e s

B) N o

6. If you say you will do something do you always keep your promise , no matter how inconvenient it might be to do so ?

A) Y e s

B) N o

7. Do your moods go up and down ?

A) Y e s

B) N o

8. Do you generally do and say things quickly without stopping to think ?

A) Y e s

B) N o

9. Do you ever feel 'just miserable' for no good reason ?

A) Y e s

B) N o

10. Would you do almost anything for a dare ?

A) Y e s

B) N o

11. Do you suddenly feel shy when you want to talk to an attractive stranger ?

A) Yes

B) No

12. Once in a while do you lose your temper and get angry ?

A) Yes

B) No

13. Do you often do things on the spur of the moment ?

A) Yes

B) No

14. Do you often worry about things you should have done or said ?

A) Yes

B) No

15. Generally, do you prefer reading to meeting people ?

A) Yes

B) No

16. Are your feeling rather easily hurt ?

A) Yes

B) No

17. Do you like going out a lot ?

A) Yes

B) No

18. Do you occasionally have thoughts and ideas that you would not like other people to know about ?

A) Yes

B) No

19. Are you sometimes bubbling over with energy and sometimes very sluggish ?

A) Yes

B) No

20. Do you prefer to have few but special friends ?

A) Yes

B) No

21. Do you daydream a lot ?

A) Yes

B) No

22. When people shout at you do you shout back ?

A) Yes

B) No

23. Are you often troubled about feelings of guilt ?

A) Yes

B) No

24. Are all your habits good and desirable ones ?

A) Yes

B) No

25. Can you usually let yourself go and enjoy yourself a lot at a lively party ?

A) Yes

B) No

26. Would you call yourself tense or 'highly strung' ?

A) Yes

B) No

27. Do other people think of you as being very lively ?

A) Yes

B) No

28. After you have done something important, do you often come away feeling you could have done better ?

A) Yes

B) No

29. Are you mostly quiet when you are with other people ?

A) Yes

B) No

30. Do you sometimes gossip ?

A) Yes

B) No

31. Do ideas run through your head so that you cannot sleep ?

A) Yes

B) No

32. If there is something you want to know about, would you rather look it up in a book than talk to someone about it ?

A) Yes

B) No

33. Do you get palpitations or thumping in your heart ?

A) Yes

B) No

34. Do you like the kind of work that you need to pay close attention to ?

A) Yes

B) No

35. Do you get attacks of shaking or trembling ?

A) No

B) Yes

36. Would you always declare everything at customs, even if you knew that you could never be found out ?

A) Yes

B) No

37. Do you hate being with a crowd who play jokes on one another ?

A) Yes

B) No

38. Are you an irritable person ?

A) Yes

B) No

39. Do you like doing things in which you have to act quickly ?

A) Yes

B) No

40. Do you worry about awful things that might happen ?

A) Yes

B) No

41. Are you slow and unhurried in the way you move ?

A) Yes

B) No

42. Have you ever been late for an appointment or work ?

A) Yes

B) No

43. Do you have many nightmares ?

A) Yes

B) No

44. Do you like talking to people so much that you never miss a chance or talking to a stranger ?

A) Yes

B) No

45. Are you troubled by aches and pains ?

A) Yes

B) No

46. Would you be very unhappy if could not see lots of people most of the time ?

A) Yes

B) No

47. Would you call yourself a nervous person ?

A) Yes

B) No

48. Of all the people you know, are there some whom you definitely do not like ?

A) Yes

B) No

49. Would you say that your were fairly self confident ?

A) Yes

B) No

50. Are you easily hurt when people find fault with you or your work ?

A) Yes

B) No

51. Do you find it hard to really enjoy yourself at a lively party ?

A) Yes

B) No

52. Are you troubled by feelings of inferiority ?

A) Yes

B) No

53. Can you easily get some life into a dull party ?

A) Yes

B) No

54. Do you sometimes talk about things you know nothing about ?

A) Yes

B) No

55. Do you worry about your health ?

A) Y e s

B) N o

56. Do you like playing pranks on others ?

A) Y e s

B) N o

57. Do you suffer from sleeplessness ?

A) Y e s

B) N o

APPENDIX III

