AN EXAMINATION OF THE PSYCHOLOGICAL SKILLS PROFILES OF OVAL RACERS AND ROAD RACERS

by

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ABSTRACT
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Introduction: Given the global popularity and far-reaching economics of auto racing, it is surprising how few studies have examined the sport generally and the psychological aspects of the sport specifically. Consistent with this general lack of research is the specific absence of studies examining the psychological skills needed to participate in the two main disciplines of auto racing, specifically oval and road racing. The purpose of the current study was to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers. **Methods:** A total of 106 amateur oval racers (n = 51) and road racers (n = 55) completed the Test of Performance Strategies – 2 (TOPS-2). **Results:** Road racers scored significantly higher than oval racers on emotional control ($p < .001$) and significantly lower than oval racers on negative thinking ($p < .004$), on the competition subscale of the TOPS-2. No significant differences were observed between the two groups on any of the practice subscales of the TOPS-2. Road racers participated in significantly fewer races than oval racers in the past two seasons ($M_{road} = 14.00$, $M_{oval} = 37.59$, $p < .0001$). Compared to a general population of athletes, oval racers and road racers scored significantly higher on imagery in practice ($p < .004$)

and significantly lower on self-talk strategies in both practice and competition ($p < .004$).

Discussion: The differences observed between oval and road racers may be due to their opportunities for competition. Road racers may use psychological skills to a different extent than oval racers in order to effectively cope with the challenges associated with fewer opportunities for competition. Compared to other athletes, both oval and road racers reported more frequent use of imagery in practice settings, which may be due to their practice habits. Due to the financial and logistical constraints of practice, racing drivers may rely on imagery (e.g., cognitive-general imagery) to facilitate strategy acquisition and execution. The specific type of imagery used by racing drivers, along with an examination of the psychological skills used by professional drivers for improved performance, are topics for future study. In line with the results of the current study, practitioners are encouraged to work with drivers to develop their imagery skills. Overall, those interested in studying or working with racing drivers should look for opportunities to collaborate with other professionals (e.g., strength and conditioning coach, mental training coach, driver coach, crew chief) so that they can focus on driver development by utilizing an integrated approach to performance enhancement.

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Chapter I: Introduction

Background

Auto racing is one of the most popular sports in the United States (Corso, 2013). An estimated 75 million people follow NASCAR alone, which helps to explain why sponsors invest so much money to support the top ranked teams in the various American racing series' (e.g., NASCAR Sprint Cup, IZOD Indycar Series). Given that the yearly sponsorship investment to a single racing car is upwards of $15 million and the average salary paid to a top driver is $7.5 million ("NASCAR Racing Statistics," 2012), it makes sense that team owners seek to recruit drivers who have the ability to succeed at each of the different venues that the series' may visit. Two of the most common venues for auto racing in the United States are oval tracks and road courses.

These two venues differ in that oval races are typically hosted on racetracks that are shaped as ovals, with each corner traditionally being a left turn. On the other hand, road races are typically hosted on tracks that range from natural terrain courses, consisting of both left and right turns (i.e., a circuit), to temporary street courses taking place in, and supported by, major cities (e.g., Houston, Baltimore). Stemming from the contrasting track layouts of oval races and road races, the technical and physical demands placed on the drivers in the two disciplines may differ. Oval tracks are typically four turns per lap, whereas road courses have upwards of 20 turns per lap. Road racers are seemingly *busy* behind the wheel as they must perform countless gear shifts as well as precise acceleration and deceleration during each corner in order to properly execute an entire lap. While both types of racing were established early in the 20th century, they became more widely recognized in the 1950s with the growing popularity of Formula

One racing, an exclusive road racing series, and the concurrent inception of another exclusive form of road racing known as sports car racing. Over the years, these two different racing disciplines have become more segregated at the amateur levels, leading to young drivers being exposed to only one of the two disciplines. By the time drivers reach the professional level, the drivers have essentially become *specialists* in their respective discipline, as opposed to being proficient in both disciplines. Such can be problematic, as when entering the higher level of competition (i.e., professional), the drivers are still expected to be successful at both venues the series' visit and may not have the required psychological mindset to be prepared to race on both circuits.

In addition to racing drivers competing in multiple disciplines within a sport, the popular press has alluded to the challenges and unique accomplishments of athletes who can succeed in various disciplines within a sport, such as Bradley Wiggins and Jenny Owens. Bradley Wiggins, a Tour de France champion and 2012 Olympic gold medalist, has roots beginning in a different discipline of cycling known as track cycling, where he is a three-time Olympic champion. Various sources have labeled him as one of the sport's greats, stemming from his ability to make a successful, yet difficult transition from track specialist to road champion (Adams, 2012; "Bradley Wiggins," 2012; Keaten, 2012). Similarly, Jenny Owens made a transition from Alpine skiing to the Ski Cross discipline. Owens competed in Alpine skiing at two World Championships and the 2002 Winter Olympic Games. Since her switch to Ski Cross, Owens competed in the 2010 Winter Olympic Games and has maintained a world ranking near the top ten. Her record would suggest that she too has made a successful transition between disciplines within the same *sport* (Owens, 2011).

In addition to the transition between various disciplines within cycling and skiing, the transition between oval racing and road racing, and vice versa, has been widely discussed among auto racing commentators. Most recently, the 2012 IZOD Indycar Championship was decided at the final race, which was held at a two-mile oval. The first and second place drivers in the Championship were drivers who excelled in different disciplines. Not surprisingly, the road racing specialist did not have success during the oval finale and subsequently lost the Championship to the driver who was accomplished on the ovals, in addition to the road courses. Post-race interviews with competitors provided support for the notion that these so-called road course *specialists* struggle to be successful on the oval tracks. However, the aforementioned evidence is purely anecdotal and thus needs to be interpreted cautiously.

Given the popularity of auto racing, the resources put into the sport, and the documented relationship between psychological variables and performance in other sports, it is surprising that the psychological aspects of this sport have been largely ignored in scholarly work. While the personality of road racing drivers was investigated throughout the 1960s and 1970s (Benton, Mills Jr., Hartman, & Crow, 1961; Johnsgard & Ogilvie, 1968; Johnsgard, Ogilvie, & Merritt, 1975; Johnsgard, 1977; Krikler, 1965), and has again gained some popularity, only a handful of scholarly (Arguelles, 2008; Ebben & Gagnon, 2012) and popular-press (Anderson, 2008; Miller, 1989; Spencer, 2001) sources have explored the psychological skills of racing drivers. The lack of research in racing is in direct contrast to the general sport literature which suggests that athletes competing in different types of sport (i.e., team, individual) (Eysenck, Nias, & Cox, 1982; Jonker, Elferink-Gemser, & Visscher, 2010; Mahoney, Gabriel, & Perkins, 1987), or positions

within a sport (Cameron, Cameron, Dithurbide, & Lalonde, 2012; Eloff, Monyeki, & Grobbelaar, 2011; Eysenck et al., 1982; Grobbelaar & Eloff, 2011), demonstrate different psychological profiles. The latter body of literature suggests that there may in fact be differences in the psychology of athletes competing in two different disciplines within a sport.

Statement of Purpose

As indicated above, the literature is scarce in terms of examining the psychological characteristics of athletes who participate in distinct sub-disciplines within a sport. The purpose of the current study, therefore, is to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers.

Delimitations

In order to control for level of participation (i.e., professional, amateur), professional racing drivers were excluded from the study. Drivers without at least two years of experience in their respective discipline (i.e., oval, road) were excluded from the study. Drivers currently racing in a series which includes both oval and road races were also excluded from the study. The above exclusions ensured that pure samples of *exclusively* oval racers and *exclusively* road racers were obtained.

Assumptions

Due to the self-report nature of the study, an assumption will be made that participants will answer honestly and to the best of their ability on items comprising the Demographic Questionnaire and Test of Performance Strategies-2 (TOPS-2; Hardy, Roberts, Thomas, & Murphy, 2010).

Significance

Scientific significance. The current study is the first of its kind to examine the psychological skills of racing drivers in both practice and competition settings. Furthermore, the current study adds to a limited body of literature concerning the psychological differences of participants in sub-disciplines within a sport.

Practical significance. Results of the current study add to the understanding of drivers' psychological strengths and areas for development in the two different disciplines of auto racing. As stated previously, anecdotal evidence suggests that elite drivers are those who excel in both disciplines. Thus, an identification of the psychological skills used by oval racers and road racers, respectively, may lend to an understanding of what one disciplines requires over the other. Sport psychology professionals can then work with drivers in order to improve their psychological skills in accordance with the needs of the discipline in which s/he is unfamiliar.

Chapter II: Literature Review

Introduction

Sport is defined by the Oxford Dictionary (2013) as "an activity involving physical exertion and skill in which an individual or team competes against another or others for entertainment." Therefore, auto racing is considered a sport and thus we should consider racing drivers as athletes. As athletes, racing drivers endure substantial physical demands and have been shown to have maximal oxygen consumption rates close to those of boxers, basketball and soccer players, runners and cyclists (Jacobs & Olvey, 2000; Jacobs, Olvey, Johnson, & Cohn, 2002). Racing drivers also endure psychological demands, although this domain has been scarcely examined.

An athlete-centered performance model, the Meyer Athlete Performance Management Model (MAPM; Meyer, Merkur, Ebersole, & Massey, in press) can provide a theoretical basis for understanding the psychological characteristics needed for successful racing performance. The MAPM suggests that physical, technical, and psychological aspects characterize an individual's sport performance, and highlights the need to understand these various aspects in order to optimize an athlete's performance. A large body of literature exists which describes the physical demands of racing (Backman, Häkkinen, Ylinen, Häkkinen, & Kyröläinen, 2005; Baur, Müller, Hirschmüller, Huber, & Mayer, 2006; Jacobs & Olvey, 2000; Jacobs et al., 2002), but far less research has been conducted to examine the psychological aspects of racing despite the importance that racing drivers themselves place on their psychological skills (Anderson, 2008; Miller, 1989; Spencer, 2001).

The sport of auto racing encompasses many different disciplines, including but not limited to oval racing, road racing, rally racing, and drag racing. Some of the most popular auto racing series' have a championship which comprises races at different types of tracks (i.e., oval tracks, road courses). Road racing takes place on *road courses* which are designed to be as similar as possible to every day roads (Benton, Mills Jr., Hartman, & Crow, 1961), and is very popular worldwide (i.e., Formula One racing, Indycar racing, sportscar racing, select NASCAR events). Oval racing takes place on tracks shaped like *ovals,* and is popular predominantly in the United States (i.e., NASCAR racing, select Indycar events). Select racing series' such as NASCAR and Indycar incorporate both oval races and road races into their respective season schedules, while other series' (i.e., Formula One, sportscar) race only on road courses. The top drivers in both NASCAR and Indycar excel on both types of tracks, making them the most elite drivers in the sport. Researchers have examined the psychological characteristics of road racers (Arguelles, 2008; Johnsgard & Ogilvie, 1968; Johnsgard, Ogilvie, & Merritt, 1975; Johnsgard, 1977) and the psychological characteristics of oval racers (Ebben & Gagnon, 2012; Ebben & Suchomel, 2012; Ferguson, Bowen, & Lightfoot, 2011), but have yet to examine whether differences exist between the two populations of drivers. Because the road and oval disciplines are so different, it is reasonable to consider that the psychological skills necessary for success in each may be different. As such, the purpose of the current study is to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers.

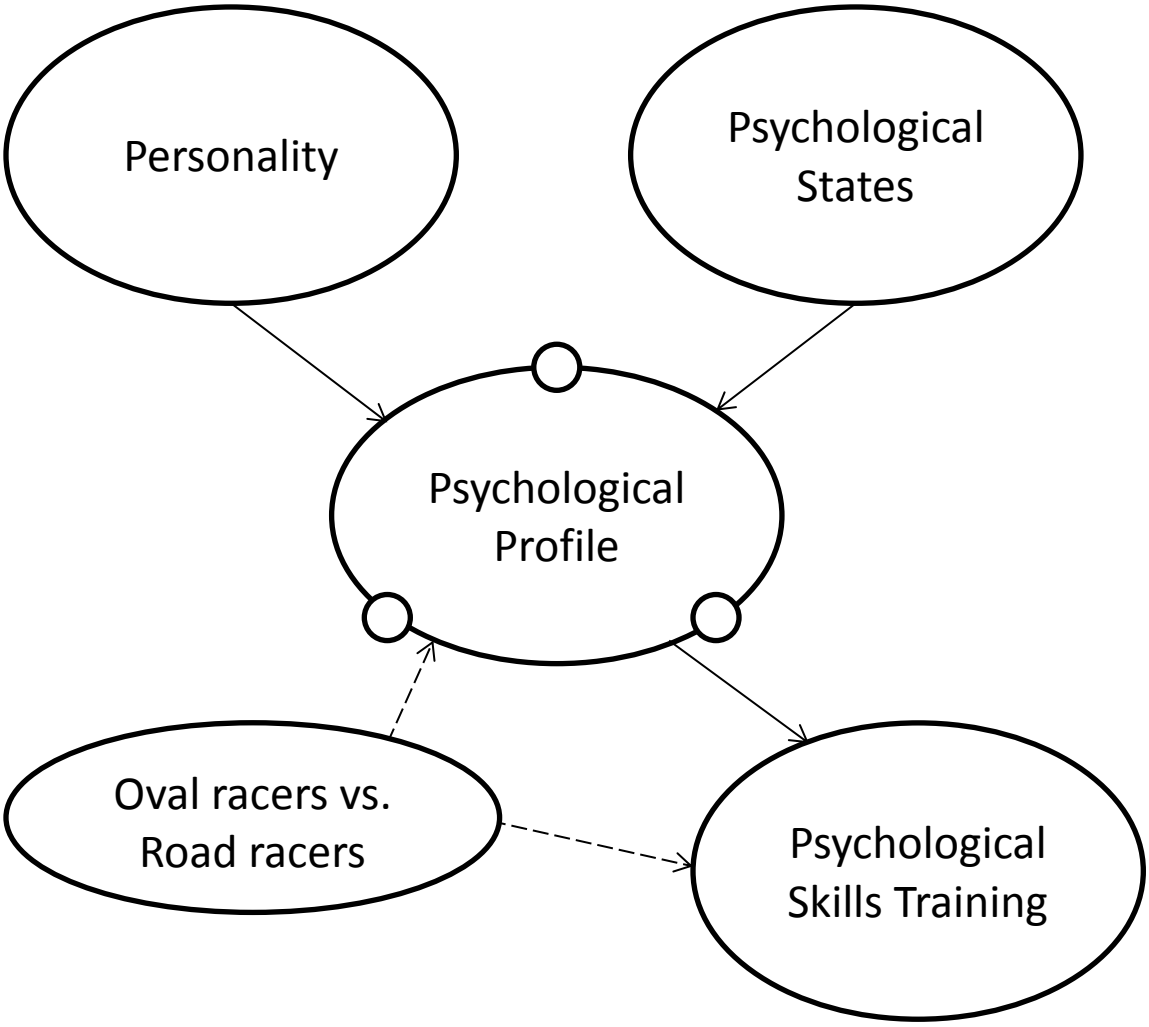
When examining various psychological aspects of performance, the term *psychological profile* is frequently used, which typically consists of several factors. The

model below (i.e., Figure 1) represents the basic framework around which the following literature review is structured. At the center of the model is an athlete's psychological profile (i.e., make-up), which consists of his or her stable personality traits (i.e., personality) and dynamic psychological states (i.e., psychological skills). An athlete's psychological profile is also influenced by various situational factors such as level of competition, type of sport played, and position played within the sport. This psychological profile represents an athlete's psychological strengths and areas for development, some of which can be enhanced through psychological skills training interventions. Just as the physical and technical requirements for performance success may differ across sport or position within a sport, so too may the psychological requirements for performance success (Cameron, Cameron, Dithurbide, & Lalonde, 2012; Eloff, Monyeki, & Grobbelaar, 2011; Jonker, Elferink-Gemser, & Visscher, 2010). Theoretically, athletes with deficiencies in their psychological states could be remediated through appropriately individualized psychological skills training programs (Gould, 2009; Horn, Gilbert, Gilbert, & Lewis, 2011).

Compared with other sports such as hockey and football, very little research has been conducted in auto racing, which is somewhat surprising given the mass appeal and high dollar investments into the sport (Corso, 2013, "NASCAR Racing Statistics," 2012). Additionally, there is a lack of research examining the psychological profiles of athletes competing in different disciplines within the same sport, which in an auto racing context refers to oval racers and road racers. Understanding the psychological skills profiles of oval racers and road racers can inform their psychological skills training programs. Once researchers suggest what it takes to compete in both disciplines, sport psychology

practitioners can train the athletes appropriately. Researchers have not yet examined what it takes to compete in these disciplines, thus the purpose of the current study is to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing (i.e., oval racers, road racers).

Figure 1. Literature review framework.



With this purpose in mind, four topics will be addressed in the literature review to follow. Literature examining the role of psychology in sport performance will be examined first, with a focus on how psychological traits (i.e., personality) and

psychological states (e.g., concentration, anxiety) are important to sport performance in general. The literature covering the personality of racing and the psychological skills used by racing drivers will be reviewed next. Literature demonstrating support for individual difference in psychological profiles will be reviewed next, followed by literature exploring how sport performance can be improved through psychological skills training with an athlete or team.

Role of Psychology in Sport Performance

There have been numerous studies providing support for the importance of psychological traits (Cameron, Cameron, Dithurbide, & Lalonde, 2012; Garland & Barry, 1990), as well as psychological states (Mahoney, Gabriel, & Perkins, 1987; Smith & Christensen, 1995; Taylor, Gould, & Rolo, 2008) in sport. Research has shown that the psyche of an athlete is important to his or her sport performance, and is comprised of both traits (i.e., general tendencies or predispositions) and states (i.e., situation-specific characteristics) (Cameron et al., 2012; Garland & Barry, 1990; Mahoney, Gabriel, & Perkins, 1987; Smith & Christensen, 1995; Taylor, Gould, & Rolo, 2008). Overall, research indicates that psychological characteristics needed to be successful may vary by a number of situational factors, including level of competition, type of sport, and position played within a sport.

Personality. Psychological traits, namely personality, are of great interest to sport psychology researchers and practitioners alike. Martens' (1975) schematic representation of the personality structure, illustrates that personality is comprised of three levels: (a) the psychological core; (b) typical responses; and (c) role-related behaviors. The psychological core, the structure most commonly referred to when

discussing personality, is the innermost, stable part of the construct and is unlikely to change, and is the aspect most commonly referred to in this literature review. Typical responses represent how an individual will likely react in a given situation. Role-related behaviors are susceptible to environmental and situational influences and are therefore the most dynamic aspect of the personality structure. The psychological core is not typically targeted for development, but is still considered when designing psychological skills training interventions. Sport psychology training interventions target the two outer layers of the personality structure, while using assessments of the psychological core to identify overall strengths and weaknesses of the athlete. Personality assessment has changed over the years, with recent methods relying on utilization of the Big Five framework which identifies neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness as five main factors of personality (Benet-Martinez & John, 1998; McCrae & Costa, 1987).

Personality in racing. The relationship between personality and sport performance has been under investigation for decades, with numerous studies supporting a link between the two variables. Specifically, researchers have identified links between personality and performance among individual (Johnsgard, 1977) and team (Garland & Barry, 1990) sport athletes, and athletes at different developmental or participation levels (Cameron et al., 2012; Eysenck, Nias, & Cox, 1982).

The first published study (Benton et al., 1961) to investigate the personality (i.e., psychological core) of road racing drivers was undertaken as part of a larger effort to identify factors that would eliminate unsafe drivers from receiving a license to compete. A sample of 331 drivers, including 48 superior drivers and 283 field drivers, was

recruited from an amateur sportscar club. Benton and colleagues examined drivers' physical (i.e., medical history, blood pressure, coordination, balance), ophthalmological, and psychological characteristics (i.e., cultural conformity, adventure vs. security, preference for abstract thinking) as assessed by the Dynamic Factors (DF) Opinion Survey (Guilford, Christensen, & Bond Jr., 1956a; Guilford, Christensen, & Bond Jr., 1956b). An index of driver safety (i.e., the ratio of the number of observable driving errors incurred to the number of races in which the driver competed) was also recorded. While neither physical nor ophthalmological factors were related to the index of driver safety in this study, psychological factors were. Results indicated a significant negative correlation between driver conformity and driver error ($r = -.57$, $p < .01$), which suggests that low scores on this scale (i.e., lack of cultural conformity) are associated with a high index of driving errors. Results also indicated a significant positive correlation between driver adventure versus security and driver error ($r = .41$, $p < .05$), suggesting that drivers who like to take personal risks commit more driving errors. There was also a significant correlation between driver liking for thinking and driver error ($r = .39$, $p < .05$), indicating that drivers who had more desire to think in an abstract manner are more likely to commit driving errors. Taken together, these findings suggest that drivers who commit the greatest number of errors during a race are likely to reject social customs, be deficient in ethical awareness, take personal risks, and be interested in abstract thinking. Given the overarching purpose of the current study and the fact psychological but not physical or ophthalmological factors were related to the index of driver safety, the researchers concluded that psychological factors should be considered when licensing racing drivers, although no follow-up was reported to confirm the implementation of this suggestion.

Several years later, and in an effort to identify psychological characteristics of racing drivers, Krikler (1965) administered various psychological assessments (e.g., targeting typical responses of personality) to five Grand Prix road racers and five ordinary motorists (i.e., controls). Specifically, she compared the racers and ordinary motorists on the following variables: (a) intelligence, as measured by the Wechsler Adult Intelligence Scale (W.A.I.S.; Wechsler, 1955); (b) visual motor coordination, concentration, level of aspiration, and accuracy of driving judgment, as measured by the Track Tracer task (Krikler, 1965); (c) mental speed, as measured by the Nufferno tests (Furneaux, 1955); (d) reaction time, as measured by the Miles Trainer (Krikler, 1965); and (e) impulsiveness, as measured by the Porteus Mazes (Porteus, 1952). Analyses of the quantitative data suggested that the Grand Prix racing drivers recorded higher levels of intelligence than the average population (Krikler, 1965). Results of independent *t*-tests also suggested that between the racing drivers and controls, the drivers were more stable in their judgment of their performance ($p < .001$), had significantly greater variability of reaction time in the hands ($p < .001$) and feet ($p < .001$), and sped up their reaction time in conditions of stress. Results of qualitative data collection (i.e., interviews and observations) suggested that the societal view of racing drivers as extroverted (i.e., sensation-seeking) is inconsistent with Krikler's findings, as observed through their lack of time to engage in a social life. She further speculated that control is a considerable personality need in racing drivers. Taken together, the results of Krikler's study ultimately suggest that road racing drivers possess typical responses including above average intelligence, fast reaction times, exceptional concentration and control, the ability to judge their performance accurately, and improve their performance under

conditions of stress. In addition, she stated that "personality is clearly of considerable importance in becoming a successful motor racing driver" (Krikler, 1965, p. 193).

Informed by the foundational work of Benton et al. (1961) and Krikler (1965), and motivated by a desire to determine why racing school graduates were not returning to regular competition, Johnsgard and colleagues conducted a series of three studies to examine the relationship between personality and behavior in competitive racing drivers (Johnsgard & Ogilvie, 1968; Johnsgard et al., 1975; Johnsgard, 1977). The following three measures of personality were used to assess the drivers' personality traits (i.e., psychological core) in all of the studies in this series: (a) the Edwards Personal Preference Schedule (EPPS; Edwards, 1956), which measures the significance of basic manifest needs (e.g., achievement, order, autonomy, nurturance, etc.); (b) the Institute for Personality and Ability Testing Sixteen Personality Factor Questionnaire (IPAT 16-PF; Cattell & Eber, 1956), which measures basic personality traits; and (c) the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1951), which measures psychopathology.

The purposes of Johnsgard and Ogilvie's first study (1968) were to begin to describe basic personality characteristics of the competitive racing driver, and to identify personality variables which might differentiate a range of proficiency amongst a sample of 200 racing drivers (i.e., licensed drivers, novice drivers). Descriptive analyses revealed consistent trends in personality traits across the different subgroups of tested drivers. That is, the racecar drivers appeared to be emotionally stable, independent, confident, and aggressive with a high need for dominance and need to achieve challenging tasks. They also exhibited high capacity and potential for leadership and

performing under stress. Results of independent *t* tests suggested that licensed drivers (i.e., highly experienced drivers) were significantly different from novice drivers on 19 of the 38 scales ($p < .10$), with the most significant differences indicating that the licensed drivers' had a greater need to dominate, a greater need for autonomy, higher levels of conscientiousness and confidence, and lower levels of neuroticism than the novice drivers. Results of independent *t* tests also indicated that the better drivers, when compared to poorer drivers, were significantly less autonomous ($p < .05$) and more aggressive ($p < .10$) as seen on the EPPS, and demonstrated significantly more leadership potential ($p < .03$) as seen on the IPAT 16-PF (Johnsgard & Ogilvie, 1968). Taken together, these results identified a basic set of personality characteristics in racecar drivers and demonstrated that these personality characteristics can differ across varying levels of driving skills.

After describing the personality characteristics of racecar drivers and suggesting that personality variables can be used to differentiate levels of driving proficiency, Johnsgard and colleagues (Johnsgard & Ogilvie, 1968; Johnsgard et al., 1975) analyzed archival data in order to compare the personality characteristics of racing drivers and athletes from other sports (i.e., basketball, football, sport parachute). Results of independent *t* tests indicated that drivers differ from basketball players in the sense that they are significantly more dominant ($p < .05$), aggressive ($p < .05$), and achievement-oriented ($p < .05$) (Johnsgard & Ogilvie, 1968). Drivers and sport parachutists elicited higher levels of autonomy than football players ($p < .001$), with racecar drivers scoring the lowest in interpersonal needs. Despite the aforementioned differences, analyses suggest that drivers, football players, and sport parachutists share many of the same

personality characteristics such as high need for achievement, dominance, and exhibition (Johnsgard et al., 1975). Following the comparisons between the different sports, Johnsgard noted once again that drivers possesses unique strengths which allow them to peak under pressure and that they are more motivated, more intelligent, more tough-minded, and more emotionally stable than the other groups (Johnsgard et al., 1975).

In an effort to identify the psychological predictors of race track performance as well as to demonstrate a link between personality and performance, Johnsgard (1977) conducted a third study to investigate the relationship between personality and on-track performance among pairs of drivers (i.e., high finishers and low finishers). Personality was assessed using the measures previously described (i.e., EPPS, IPAT 16-PF, MMPI). On-track performance was assessed through six performance criteria variables: (a) number of races started; (b) number of did-not-finishes (DNFs); (c) number of minor driver errors (i.e., spins, going off course); (d) number of major driving errors (i.e., collisions with other cars, barriers); (e) in-class finishing position; and (f) overall finishing position. Johnsgard found that when compared to drivers with two or more DNFs, drivers who finished more races tended to be less aggressive ($p < .01$), exhibitionistic ($p < .05$), independent and assertive, and more conscientious ($p < .03$), having greater needs for order. These results support the notion that in order to finish towards the top of the championship standings at the conclusion of the racing season, drivers need to be consistent in terms of finishing races, as well as the place in which they finish. Furthermore, related to finishing position, those who finished high in-class (i.e., first through third) were less dominant ($p < .01$), had greater need for order ($p < .05$), and were more deferential ($p < .05$) than those who finished low in-class

(i.e., 13th through 22nd). Johnsgard concluded that successful amateur racers require a set of personality traits somewhat different than those of professional racers whose only job is to practice, race, and win (Johnsgard, 1977). Amateur racers typically hold full-time jobs and privately fund their own race teams, so racing in a more conservative manner is often observed in order to preserve equipment. Johnsgard and colleagues' line of research was instrumental in helping us to understand the link between personality and behavior in competitive racing drivers. The first major contribution to the literature was determining the basic set of personality characteristics of racing drivers (e.g., emotionally stable, independent, aggressive, resilient). Furthermore, the researchers found differences between novice drivers and nationally licensed drivers (Johnsgard & Ogilvie, 1968), and between the sample of racecar drivers and athletes in different sports (Johnsgard et al., 1975). Finally, personality characteristics relevant to on-track performance were identified, indicating that personality can contribute to successful performance during competition (Johnsgard, 1977). While these results, along with those of Benton et al. (1961) and Krikler (1965) provide the initial understanding of the personality of racing drivers, they are also limiting because of the methods employed. Specifically, the personality measures employed (i.e., EPPS, IPAT 16-PF, MMPI) were more commonly used to identify psychopathology than to identify the personality characteristics of well-adjust and/or high-achieving individuals (Arguelles, 2008). To that end, future research was warranted in order to provide data informed by measures of personality which examine specific personality traits.

More than 30 years had passed from the conclusion of Johnsgard and colleagues' research to the time that researchers began to use more specific measures of personality

to study the psychology of racing drivers. In an effort to study the personality of racecar drivers, Arguelles (2008) used the Big Five Inventory (Benet-Martinez & John, 1998) to compare amateur sportscar drivers (n=104) and controls (n=100) on the five main personality traits (i.e., agreeableness, conscientiousness, neuroticism, openness, extraversion). Results of independent t tests identified only one significant difference between the two groups. The controls reported significantly higher levels of agreeableness than the drivers ($p < .005$). This finding, along with the fact that the racecar drivers recorded average scores on extraversion ($M_{\text{extraversion}} = 3.401$, $p = .901$) and openness to experience ($M_{\text{openness}} = 3.971$, $p = .119$), high scores on conscientiousness ($M_{\text{conscientiousness}} = 4.038$, $p = .240$), and low scores on neuroticism ($M_{\text{neuroticism}} = 2.593$, $p = .223$), prompted Arguelles to suggest that his sample of racing drivers presented with a resilient personality type in accordance with the scores on the individual personality trait scales. His findings are consistent with those of Johnsgard and colleagues (1975), who suggest that agreeableness is inherent in interacting with others, ships, and drivers have been shown to have a low desire to have interpersonal relationships. In addition to rekindling an interest in the psychology of auto racing generally and the personality of road racing drivers specifically, Arguelles' work reinforced the need to employ appropriate measures of personality and mental skills.

Summary. According to the literature reviewed above, the racing driver is a resilient, intelligent, controlled, introverted, independent individual with a high ability to perform under pressure. It also appears that elite drivers are significantly less independent, but much more aggressive and have greater leadership potential, when compared to their less successful counterparts. While a comprehensive discussion of the

personality of the road racing driver has been developed, the use of the psychological skills they employ during competition has scarcely been examined (Arguelles, 2008; Ebben & Gagnon, 2012; Ebben & Suchomel, 2012; Ferguson et al., 2011). In addition, the research which has been conducted has been skewed towards road racers with little to no research examining psychological aspects of oval racers. Research concerning the personality of racing drivers has neglected to investigate any differences which may exist between different disciplines of the sport (i.e., oval and road racing) which supports the undertaking of the present study.

Psychological states. While the study of psychological traits, such as personality, is important because of their relationship with sport performance and understanding *who* the athlete is, the study of psychological states may be of more importance because of their capacity to change and develop over time. The malleability of psychological states, such as self-efficacy, is of particular interest for applied sport psychologists who work with athletes to develop psychological skills, since improved psychological skills thereby improve the psychological states which relate to enhanced sport performance. For example, according to Bandura (1977), strategies and/or skills used to improve confidence include goal setting, imagery, relaxation, and self-talk. These psychological states have been investigated extensively in sport, and are just beginning to be examined in auto racing. In the section that follows, literature on the role of psychological states, specifically as they relate to psychological skills will be summarized. Literature specific to auto racing will be preceded literature on sport performance in general.

Psychological states in sport. With reference to sport in general and in an effort to assess the psychological skills relevant to exceptional athletic performance, Mahoney

and colleagues (1987) employed the Psychological Skills Inventory for Sports (PSIS; Mahoney et al., 1987) to examine differences in psychological skill use between: (a) elite athletes (i.e., having placed fourth or above in national championships or the Olympics); (b) pre-elite athletes (i.e., junior national competitors); and (c) non-elite athletes (i.e., collegiate athletes). The authors utilized the PSIS in order to assess five different psychological constructs (i.e., anxiety, concentration, self-confidence, mental preparation, team emphasis). Using Hotelling's T^2 to search for group differences, the researchers found overall differences between elite athletes and both pre-elite ($p < .03$) and non-elite athletes ($p < .0001$). These results showed, not surprisingly, that elite athletes elicit a more positive psychological profile than non-elite athletes, by having: (a) better anxiety management skills; (b) better concentration skills; (c) higher self-confidence; (d) more developed imagery skills; (e) more focused on their own performance; and (f) high motivation to succeed. Taken together, the results from this study indicate that psychological skills may differ according to the athlete's competition level (e.g., elite versus pre-elite).

Several years later, Smith and Christensen (1995) investigated the role of psychological states in *predicting* athletic performance (i.e., batting average, earned run average [ERA]). In this study, 104 minor league baseball players were surveyed with the Athlete Coping Skills Inventory (ACSI-28; Smith, Smoll, Schutz, & Ptacek, 1995), which measures such psychological constructs as peaking under pressure, freedom from worry, and coping with adversity. Following a series of correlations, coping with adversity ($r = .33$, $p < .01$), confidence and achievement motivation ($r = .51$, $p < .01$), and overall personal coping resources ($r = .33$, $p < .01$) were significantly related to batting average,

such that as these psychological skills became more proficient, batting average improved. Furthermore, confidence and achievement motivation (r = -.47, p < .01), and peaking under pressure (r = -.37, p < .01), were significantly related to a better (lower) ERA. The results of this study also support the role of psychological states in sport performance.

As researchers continued to find relevance of psychological skills to performance, Jackson and colleagues (2001) investigated the link between the use of psychological skills and flow, and how this relationship influences performance. In order to assess the psychological skills and strategies used in competition, the Test of Performance Strategies (TOPS; Thomas, Murphy, & Hardy, 1999) was completed by 236 athletes competing in orienteering (n = 112), surf lifesaving (n = 92), and road cycling (n = 32). Results from hierarchical regression indicated that psychological skills use contributed a significant amount of variance in flow state (R^2 = .30, p < .10) and also that flow state predicted finishing position (R^2 = .13, p < .01). The researchers (Jackson et al., 2001) suggested that the three sports comprising this study, that is, those of structured race format, subject to environmental conditions directly affecting the athlete, and of continuous nature, have "potential transferability" (p. 133) to sports containing similar characteristics. The results of this study showed that the use of psychological skills contribute to a flow state which predicts a better finishing position.

In a more recent study, researchers (Taylor, Gould, & Rolo, 2008) investigated differences between Olympic medalists and non-medalists in their use of psychological skills and strategies in both practice and competition settings. In order to assess the various psychological skills and strategies used in both training and competition, the TOPS was administered to 176 United States Olympic athletes following the 2000

Summer Olympics Games. Results from discriminant analyses indicated that during competition, medalists had greater emotional control ($p < .01$) and automaticity ($p < .05$) than non-medalists, and non-medalists reported higher imagery scores than the medalists ($p < .05$). During practice, medalists again exhibited greater emotional control than the non-medalists ($p < .001$). Taken together, results of this study indicated that the use of psychological skills is a strong contributor to Olympic performance.

Psychological states in racing. Psychological states in sport have been researched in many populations of athletes, but the psychological states (e.g., anxiety, concentration) of racing drivers in particular have only recently begun to be examined. While numerous articles have been written about the importance of psychological skills in racecar drivers (Anderson, 2008; Miller, 1989; Spencer, 2001), few have been informed by empirical research. The results of scholarly sources indicate that drivers differ from nonathletes in the value they place on psychological skills (Ebben & Suchomel, 2012) as well as their use of psychological skills (Arguelles, 2008; Ebben & Gagnon, 2012). That said, little empirical evidence exists examining the psychological characteristics of successful racing drivers in the various sub-disciplines of the sport. To highlight the need for additional research, in the section below, both the popular press and scholarly literatures which examine the psychological skills of racing drivers will be summarized.

Popular press works. As indicated above, there is strong anecdotal support for the importance of psychological skills in auto racing. In the book *Short Track Driving Techniques*, Miller (1989) suggests that mental skills are the most valuable asset for a racecar driver. He goes on to identify the specific psychological skills necessary for

successful performance, such as concentration, mental preparation, mental imagery, emotional control and intensity regulation. Drivers interviewed for an article in *Sports Illustrated* (Anderson, 2008) concur with Miller's suggestion, claiming that psychological characteristics are as, if not more, important than physiological characteristics in winning on the NASCAR circuit. Five-time Sprint Cup Champion Jimmie Johnson explained that being relaxed and calm enough in the *crazy* environment of the race itself is a necessity for drivers to be successful. Kyle Busch concurred with Johnson that being confident and trusting your ability is one of the most important attributes that a driver can have.

The aforementioned sources highlight the importance of the driver's psyche to successful racing performance, yet according to another anecdotal article, the psyche of the driver is not the only aspect relevant to successful on-track performance. In an article in the *Sporting News,* Spencer (2001) highlighted the importance of team dynamics in racing. Specifically, she suggested that drivers must have a well-defined relationship with their team, the crew chief in particular. The crew chief is charged with assessing the technical suggestions from the driver and applying them to the racecar in order to optimize the car's performance. The communication and collaboration necessary for optimal on-track performance is represented by the psychological construct of team cohesion, and is thus labeled as essential to success for the racing team (Spencer, 2001).

Scholarly works. Thus far, research investigating psychological skills of racing drivers is in its infancy. In fact, the first study of its kind was conducted only less than a decade ago, examining the psychological skills of road racing drivers (Arguelles, 2008). In the first study conducted to examine the psychological skills important for racing

drivers during competition, Arguelles (2008) used the Athlete Coping Skills Inventory-28 (ACSI-28; Smith et al., 1995) to compare the various mental skills used by racecar drivers (n = 104) and non-athlete controls (n = 100). The ACSI-28 measures eight psychological skills (i.e., coping with adversity, peaking under pressure, goal setting and mental preparation, concentration, freedom from worry, confidence and achievement motivation, coachability), which are combined to form an athlete's overall personal coping resources score. Results from a series of independent t tests indicate differences between the racecar drivers and the controls on all scales except freedom from worry. Drivers scored higher on coping with adversity ($p < .001$), coachability ($p < .001$), concentration ($p < .001$), confidence and achievement motivation ($p < .001$), goal setting and mental preparation ($p < .01$), and peaking under pressure ($p < .001$). In aggregate, the drivers recorded significantly better personal coping resources than the controls ($p < .001$), affirming the hypothesis that the drivers possess more of the essential psychological skills necessary to be successful in competition than the controls.

The research of Arguelles (2008) provided the initial framework for understanding psychological skills used by amateur sportscar racing drivers, and is the only study to date to examine the psychological skills of sportscar (i.e., road racing) drivers. Several studies have since been conducted which examine the psychological skills of *oval* racers, the first of which was originally conducted to examine the physiological responses of pit crew athletes for a NASCAR team, but resulted in groundbreaking findings concerning the psychological responses of these pit crew members (Ferguson, Bowen, & Lightfoot, 2011). The authors of this study concluded that some of their findings (e.g., elevated HR at certain tracks) were most likely due

psychological stressors unique to the races in which data were collected. For example, one of the races was the longest race of the season, another race was held at the *home* track for many of the teams involved, and yet another race was the final race before the *Chase for the Cup.* The pressure of performing at the home track or of races with significant outcomes can lead to anxiety in pit crew members and drivers. The finding that members of a driver's support staff experience psychological stress surrounding competition prompted calls for research on the drivers' themselves.

To that end, Ebben and Suchomel (2012) used their own Stock Car Driver Survey to examine the physiological and psychological characteristics of amateur stock car (i.e., oval) drivers. Sixty-five percent of the drivers surveyed reported that psychological skills (i.e., mental strength, focus, anticipation) are important for racing when prompted "What other performance abilities are required for racing?" (p. 1190). The finding that stock car drivers value psychological skills during competition prompted a second study, whereby Ebben & Gagnon (2012) examined the relationship between psychological skills and performance of 24 amateur stock car drivers. Drivers' mental skills were assessed by the Psychological Skills Inventory for Sports (5th Revision) (PSIS-R5; Mahoney et al., 1987), which identifies the psychological skills (i.e., concentration, motivation, self-confidence, anxiety, mental preparation, team emphasis) used by an athlete. Drivers' performance was assessed by track points standing. Results of Pearson's correlations indicated significant negative correlations between driver's track points standing and mental preparation ($p < .01$) and anxiety coping ($p < .05$), meaning that the better the driver finishes by the end of the season in the overall track point standings, the more developed their mental preparation and anxiety coping skills. Taken together, these

results suggest that stock car drivers who are more successful have more developed psychological skills (i.e., mental preparation and anxiety coping).

Assessing psychological states. As mentioned throughout this literature review, researchers administer questionnaires and/or surveys to participants in research studies in order to assess their psychological skills, or use thereof (Durand-Bush, Salmela, & Green-Demers, 2001). A common survey used by researchers and practitioners alike is the Test of Performance Strategies – 2 (TOPS-2; Hardy, Roberts, Thomas, & Murphy, 2010), which is designed to examine an athlete's use of eight different psychological skills in practice and/or competition, specifically emotional control, activation, relaxation, self-talk, goal setting, imagery, automaticity, negative thinking, and attentional control. In their publication, the authors of the TOPS-2 provided normative data (i.e., population means, standard deviations) for each of these psychological skills. Comprising these norms were 220 Australian (i.e., 9.5% international, 21.80% national, 30.50% regional/junior national), 120 North American (i.e., 22.50% international, 74.20% national, 0.8% regional/junior national), and 225 British (i.e., 3.60% international, 8% national, 14.20% regional/junior national) male and female athletes competing in 48 different sports across international, national, regional, junior national, and club levels. Normative data, as reported by Hardy and colleagues (2010), are reported in Table 1 below.

Table 1. Subscale norms of the TOPS-2

	Practice		Competition	
Measure	*M* (SD)	α	*M* (SD)	α
Emotional Control	3.42 (0.76)	0.80	3.69 (0.83)	0.89
Activation	3.41 (0.63)	0.71	3.84 (0.70)	0.83
Relaxation	2.18 (0.83)	0.85	2.80 (0.94)	0.87
Self-Talk	3.35 (0.80)	0.82	3.42 (0.86)	0.82
Goal Setting	3.24 (0.89)	0.84	3.73 (0.86)	0.83
Negative Thinking	N/A	N/A	2.23 (0.77)	0.8
Imagery	3.02 (0.82)	0.72	3.49 (0.94)	0.86
Attentional Control	3.44 (0.66)	0.78	N/A	N/A
Automaticity	3.47 (0.65)	0.74	3.52 (0.63)	0.62

Note. Adapted from "Test of Performance Strategies (TOPS): Instrument refinement using confirmatory factor analysis," by L. Hardy, R. Roberts, P. R. Thomas, and S. M. Murphy, 2010, *Psychology of Sport and Exercise, 11,* p. 32. Copyright by Elsevier Ltd.

From these normative data, researchers and practitioners can draw conclusions about the current psychological state of a sample of athletes or an individual athlete, which in the context of the current investigations, refers to the extent to which an athlete uses a set of psychological skills in practice and/or competition.

Summary. The literature reviewed in the previous section illustrates the importance that racing drivers put on their psychological skills during competition. In the popular press (Anderson, 2008; Miller, 1989; Spencer, 2001), drivers have indicated that the role psychology plays in their performance is important which has been validated through scholarly work which suggests that various psychological skills (i.e., mental preparation, anxiety coping) are correlated with better on-track performance (Ebben & Gagnon, 2012). Additionally, the research which has been conducted still fails to examine any possible differences in the psychological aspects of oval racers and road racers.

Psychological Profiles

The combination of various psychological characteristics (i.e., traits, states) needed to perform in sport, or required for peak performance, comprise an athlete's *psychological profile.* Interestingly, athletes involved across various sport settings may demonstrate different *ideal* psychological profiles. The psychological profile of an athlete may depend on situational factors such as level of competition (Cameron et al., 2012; Mahoney et al., 1987), type of sport (i.e., team, individual) (Eysenck et al., 1982; Jonker et al., 2010; Mahoney et al., 1987), and position played in the sport (Cameron et al., 2012; Eloff, Monyeki, & Grobbelaar, 2011; Eysenck et al., 1982; Grobbelaar & Eloff, 2011). In so doing, evidence will be provided supporting the notion that drivers in the different disciplines of racing may have different *ideal* psychological profiles, warranting the investigation of their psychological skills in order to understand their psychological profiles.

Level of competition. Research conducted over the past two decades supports the notion that athletes at different levels of competition have different psychological skills proficiencies (Cameron et al., 2012; Mahoney et al., 1987). In a study to identify psychological skills across three levels of competition (i.e., elite athletes, pre-elite athletes, non-elite athletes), researchers (Mahoney et al., 1987) identified differences in psychological constructs (e.g., anxiety, concentration). Results from Hotelling's T^2 illustrated overall differences between elite and pre-elite ($p < .03$) and non-elite ($p < .0001$) athletes in the use of psychological skills. These elite athletes have better anxiety management, concentration, self-confidence, and imagery skills than their

counterparts in lower levels of competition, indicating that psychological skill proficiency may vary depending on the athlete's level of competition.

More recently, Cameron and colleagues (2012) conducted an exploratory study investigating the relationship between level of sport competition and personality traits in 578 male ice hockey players. The researchers administered the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003), a measure of the Big Five dimensions of personality, to 163 defenseman, 305 forwards, and 110 goaltenders who played at either a competitive or a non-competitive level. A 3 (position) x 2 (competition level) ANOVA elicited personality differences with respect to level of play. Athletes who played at the competitive level were more extraverted ($p < .05$) and neurotic ($p < .05$), and less agreeable ($p < .05$) than those playing at the non-competitive level. This research also lends support to the notion that psychological profiles may differ according to an athlete's level of competition.

Type of sport. As above, decades of literature also suggests that the type of sport in which an athlete participates may influence the psychological skills that s/he adopts. Informed by Eysenck et al.'s (1982) early work suggesting that it is unrealistic to assume that athletes who participate in two *different* types of sport (i.e., individual versus team, open versus closed) will record identical personality profiles. Mahoney and colleagues (1987) examined differences in psychological skills between non-elite college athletes who participated in individual sports and team sports. This research added to Eysenck's review by also examining those who participate in open skill sports (e.g., hockey, basketball) and closed skill sports (e.g., running, swimming). Results from Hotelling's T^2 indicated an overall significant difference between individual sport and team sport

athletes ($p < .001$) as well as open skill sport and closed skill sport athletes ($p < .001$). Within this group of non-elite athletes, the individual sport athletes reported more frequent problems with anxiety, confidence, and concentration, as well as different strategies with mental preparation than with those in team sports. Furthermore, athletes in closed skill sports reported more frequent problems related to confidence, anxiety management, and concentration, and also tended to be more motivated and use imagery more extensively, than athletes in open skill sports.

Decades later, a study conducted by Jonker et al. (2010) aimed to examine possible differences in self-regulatory skills within a group of high performing athletes competing in individual sports ($n = 113$) and team sports ($n = 109$). The six self-regulatory skills (i.e., planning, self-monitoring, effort, self-efficacy, evaluation, reflection) were assessed using various scales. Results from an Analysis of Covariance (ANCOVA) indicated that regardless of competitive level (i.e., junior international, junior national), individual sport athletes recorded higher scores than team sport athletes on planning ($p < .05$) and effort ($p < .05$). No significant differences were found between the individual and team sport athletes on the four remaining self-regulatory skills. The authors suggest that sport-specific characteristics, such as the relatively stable and predictable environment of individual sports as compared to the dynamic environment of team sports, make the use of planning strategies more prominent in individual sports. Similarly, since the performance of individual sport athletes is solely dependent on their own effort, effort scores may be higher for this cohort than for team sport athletes who can be more dependent on their teammates. Taken together, the results of this study

indicate that sport-specific characteristics may influence the self-regulatory skills, and that situational factors can influence the use of psychological skills in general.

Position in sport. Eysenck and colleagues' (1982), along with current researchers (Cameron et al., 2012; Eloff et al., 2011; Grobbelaar & Eloff, 2011), postulated that the position played by the athletes should also be taken into consideration when investigating possible differences of psychological characteristics (e.g., personality, psychological skills) between performers within a sport. For example, Eloff and colleagues (2011) investigated the psychological skill levels of field hockey players in different playing positions. A total of 91 athletes, representing four different positions (i.e., goalkeepers [n = 12], forwards [n = 24], midfielders [n = 25], backs [n = 30]) completed the Ottawa Mental Skills Assessment Tool-3 (OMSAT-3; Durand-Bush et al., 2001), to examine psychological skills (e.g., relaxation, focus, imagery). Results of effect size calculations indicated significant practical differences between the various positions with regard to psychological skill levels. As a result of this finding, the researchers posited that there are unique demands for each position and that these differences should be considered when developing psychological skills training interventions.

In a similar study, Grobbelaar and Eloff (2011) examined the psychological skill level of female netball players (N = 185) in seven different playing positions (i.e., goal shooter [n = 21], goal attack [n = 27], wing attack [n = 35], center [n = 29], wing defense [n = 24], goal defense [n = 25], goal keeper [n = 24]). These women completed the ACSI-28, which provides insight into the athletes' overall *coping resources,* as totaled by a combination of their reported psychological skills such as coping with adversity,

peaking under pressure, and concentration. Results of effect size calculations indicated that goal attack, goal defense, and wing defense players scored higher on coping with adversity and peaking under pressure than the goal shooters. Furthermore, defensive players used goal setting and mental preparation more than offensive players. The results of this study also provided support for the notion that players in different positions possess different psychological skill proficiencies.

Summary. The research reviewed above provides support for the notion that athletes in different sports may possess different psychological characteristics and therefore report different psychological profiles, depending in part on their level of competition (Cameron et al., 2012; Mahoney et al., 1987), the type of sport played (Eysenck et al., 1982; Jonker et al., 2010; Mahoney et al., 1987), and the position played (Cameron et al., 2012; Eloff et al., 2011; Eysenck et al., 1982; Grobbelaar & Eloff, 2011). Altogether, these results suggest that different ideal psychological profiles may exist depending on the nature of the sport, providing support for the notion that psychological profiles may also differ between the different disciplines of racing (i.e., oval and road).

Psychological Skills Training

To this point, the role of psychological characteristics (i.e., psychological traits and states) in sport performance generally, and auto racing specifically have been the sole focus. These traits (i.e., personality) and states (e.g., concentration, anxiety) together combine to form the psychological profile of an athlete, which as discussed, may differ due to a variety of situational factors (i.e.,, level of competition, type of sport, position played within sport). Also discussed previously, psychological states (e.g., concentration,

arousal) are of particular interest to practitioners and researchers as they are dynamic and may be altered through consistent use of a psychological skills training (PST) regimen by improving the appropriate psychological skills. Therefore, it is important to review the efficacy of PST interventions in order to illustrate if and how these programs can assist in the development of psychological skills to foster more ideal performance states for athletes.

The goal of a PST intervention is to enhance the psyche, and ultimately the performance, of an athlete in accordance with his or her needs. It should be noted that effective PST programs do not target one individual state for development, such as confidence, but rather utilize an integrative approach to help an athlete develop their entire psyche (Gould, 2009; Horn, Gilbert, Gilbert, & Lewis, 2011). To that end, a rich body of literature exists to guide sport psychology professionals in their PST work with athletes and teams. In this section of the literature review, literature examining the efficacy of such PST interventions will be reviewed. Once it is understood what the various racers need in accordance with their discipline, practitioners can intervene appropriately and effectively.

PST interventions. Researchers and practitioners are interested in the efficacy of PST interventions targeting the improvement of an array of psychological skills in athletes (Fournier, Calmels, Durand-Bush, & Salmela, 2005; Horn et al., 2011; Sheard & Golby, 2006), as well as the efficacy of PST interventions targeting the development of a specific psychological skill in particular (e.g., confidence, arousal regulation, concentration) (Bar-Eli, Dreshman, Blumenstein, & Weinstein, 2002; Callow, Hardy, & Hall, 2001; Latinjak, Torregrosa, & Renom, 2011).

Efficacy of interventions targeting an array of psychological skills. In order to assess the efficacy of PST interventions, researchers typically investigate the psychological development of athletes from pre- to post-intervention. Fournier and colleagues (2005) studied the effects of a season-long PST intervention on the on psychological skill development and performance of elite female gymnasts (n = 10). The intervention consisted of five phases, totaling 25 sessions for 30 minutes per week, each phase representing a different psychological skill (i.e., relaxation, self-talk, goal setting, focusing, visualization). Athletes completed the OMSAT-3 a total of nine times during the season. Performance variables (i.e., starting scores, final scores, national ranking) were collected after each competition. Performance results indicated a five percent improvement in performance over the control group (i.e., 11 gymnasts competing at the same level but without the PST), for each of the three competitions (i.e., bar, beams, floor). Repeated measures ANOVA calculations indicated a significant improvement over time for relaxation ($p < .001$), activation ($p < .01$), imagery ($p < .01$), focusing ($p < .05$), and refocusing ($p < .05$). While no significant improvements in performance were noted for the vault competition possibly due to the characteristics of the event (i.e., vault lasts about five seconds whereas other competitions last upwards of a minute), anecdotal evidence from the athletes and coaches suggested that they observed a noticeable improvement in the performance. Taken together, these results suggest that this PST program was successful in that it improved several of the psychological skills targeted by the intervention, and also that it had an impact on the coaches' view of the performances.

Following Fournier and colleagues (2005) intervention study, Horn and colleagues (2011) conducted a 10-week PST intervention with community college softball players (*n* = 19) in an effort to investigate if the athletes could learn, and implement during practice and competition, the skills taught to them. The intervention consisted of: (a) two weeks of introducing the athletes to sport psychology, PST, and commitment; (b) seven weeks of teaching each sport psychology skill; and (c) one week of review. The PST content delivered in the 7-week training period was framed around the acronym *UNIFORM,* whereby each letter represented a different sport psychology skill:

- U – Use goal setting
- N – No mistakes, only learning opportunities
- I – Imagery
- F – Fully focused
- O – Overtly positive
- R – Relaxation and stress control
- M – Make routines

Athletes' use of psychological skills during practice and competition was assessed before and after the 10-week intervention. Specifically, the Test of Performance Strategies (TOPS; Thomas, Murphy, & Hardy, 1999) was used to assess the psychological skills taught during the intervention (i.e., goal setting, imagery, attentional control, self-talk, relaxation, emotional control), while the Evaluation of the Intervention Survey (Horn et al., 2011) was used to assess two of the *UNIFORM* concepts not addressed by the TOPS: (a) no mistakes, only learning opportunities; and (b) make routines. Paired sample *t* tests

revealed significant differences between pre- and posttest scores on two of the TOPS' practice subscales (i.e., relaxation, goal setting) and three of the TOPS' competition subscales (i.e., relaxation, imagery, self-talk), suggesting that the UNIFORM intervention may help athletes to utilize these specific skills in both practice and competition environments. While differences between pre- and posttest scores were not identified for the other nine TOPS subscales, qualitative observations from the athletes' coach suggest that the softball players did apply UNIFORM-based psychological skills to their sport. Failure to identify other significant findings may be due to the duration of the PST intervention employed, as novice athletes may require more than 10 weeks of consistent application to learn the psychological skills (Weinberg & Williams, 2010). In all, some of these psychological skills as measured by the TOPS (e.g., arousal control, imagery) have been shown to improve over the course of PST interventions. The literature reviewed in this section provides support for the efficacy of comprehensive PST programs, such that sport psychology practitioners who work with racing drivers may use a PST program of comprehensive nature, if warranted.

Efficacy of interventions targeting specific psychological skills. In addition to PST interventions geared for developing several psychological skills, researchers have also investigated specific strategies to develop individual psychological skills. Examples of these psychological skills commonly targeted for development by practitioners include confidence, arousal regulation, and concentration.

Confidence building. Those in the field of sport psychology have long been interested in targeting the development of self-confidence in athletes, and have had success with improving confidence from pre- to post-intervention (Callow et al., 2001;

Hatzigeorgiadis, Zourbanos, Mpoumpaki, & Theodorakis, 2009; Munroe-Chandler, Hall, & Fishburne, 2008). For example, Callow and colleagues (2001) implemented a 24-week imagery intervention targeting the development of confidence in high-level junior badminton players ($n = 4$). Individualized imagery interventions were developed for each participant, with frequency of use assessed at the beginning and midpoint of the study. Athletes completed the State Sport Confidence Inventory (SSCI; Vealey, 1986) each week, prior to their competitive matches, for a total of 21 times. Results of Binomial tests indicated sport confidence scores significantly increased in three of the four participants ($p < .001$). Results of qualitative analyses (i.e., interviews) with the participant whose confidence did not improve revealed that his or her confidence actually became more consistent, although lower, and that competition had become more challenging (i.e., increased skill of competitors). Taken together, the results of this study provide some support that individual psychological skills (i.e., confidence) may be improved even without a comprehensive psychological skills training program.

Arousal regulation training. Sport psychology practitioners typically educate athletes on arousal regulation skills by means of biofeedback techniques and relaxation strategies. Current research suggests that both biofeedback (Bar-Eli et al., 2002; Beauchamp, Harvey, & Beauchamp, 2012; Edmonds, Tenenbaum, Mann, Johnson, & Kamata, 2008) and progressive muscle relaxation (Hashim & Yusof, 2011; Navaneethan & Rajan, 2010) are effective in improving these particular psychological skills, and ultimately improving athletic performance.

In an effort to add to the understanding of arousal regulation techniques (i.e., biofeedback), Bar-Eli and colleagues (2002) examined the relationship between

biofeedback training and performance. A total of 38 male (*n* = 31) and female (*n* = 7) adolescent swimmers were randomly assigned to an experimental group or a control group, both of which met a total of 38 times over the course of 14 weeks. The experimental group was taught various arousal regulation techniques, such as imagery and biofeedback, whereas the control group was instructed to continue with regular training and relaxing activities (e.g., listening to quiet music, watching nature movies). The results of a 2 (condition) x 3 (measurement) mixed-factorial ANCOVA indicated that the experimental group performed significantly better (i.e., faster swim times) than those in the control group. The results of this study lend support to athletes' abilities to learn arousal regulation skills and subsequently apply them during competition to improve their performance.

Concentration training. Another psychological skill addressed in many performance enhancement plans is concentration. Researchers have examined various methods of improving athletes' concentration skills, such as self-talk (Edmonds et al., 2008; Hatzigeorgiadis, Theodorakis, & Zourbanos, 2004; Hatzigeorgiadis, Zourbanos, & Theodorakis, 2007; Latinjak et al., 2011) and imagery (Calmels, Berthoumieux, & d'Arripe-Longueville, 2004), which function to help athletes reduce task-irrelevant thoughts.

Further examining the role between self-talk and concentration, Latinjak and colleagues (2011) conducted an intervention with male leisure tennis players (*n* = 48). The researchers randomly assigned the athletes into one of three experimental conditions: (a) self-talk and feedback (i.e., use of cue words, positive and/or negative self statements); (b) regular instructional self-talk (i.e., saying *yes* or *no* following task

execution); and (c) no self-talk or feedback. The performance task was to hit 20 tennis balls to the right backcourt area of the opposite side of the tennis court a total of eight times: (a) twice to warm-up; (b) twice for pre-test; (c) twice during the intervention for familiarity; and (d) twice for post-test. Perceived performance and concentration were scored on an 11-point scale, ranging from 0 (completely unsatisfied) to 10 (completely satisfied). Repeated measures ANOVA calculations indicated a significant improvement pre- to post-intervention in concentration for the instructional self-talk group ($p < .05$) and the self-talk and feedback group ($p < .001$), and concurrent improvement in self-reported performance for the instructional self-talk group ($p < .001$) and the self-talk and feedback group ($p < .001$). Altogether, the results of this study show support for the notion that an intervention including self-talk and feedback can be effective in assisting the development of an athlete's concentration skills and further improve their performance.

Summary. Each of the previously reviewed sources demonstrates the efficacy of comprehensive PST interventions, as well as interventions targeting a psychological skill in particular. The recurring themes in these sources illustrate that efficacious PST interventions are based on developing the psychological *skills* of the athlete through a variety of techniques and strategies. The desired outcome of developing these skills is to improve psychological *states*, and as such, ultimately improve the athlete's overall psychological profile. Further understanding the psychological skills of racing drivers competing in the two disciplines will guide the efforts of practitioners who work with them, so that they can intervene appropriately and effectively, if the athletes demonstrate areas for development with their psychological skills profiles.

Conclusion

The literature reviewed above provides support for the role of psychology as it relates to sport performance, namely personality and psychological skills. There has been much literature examining the psychological traits of racing drivers, beginning in the 1960s and continuing through the 1970s, which helped to identify the personality traits of racing drivers. More recently, research has been undertaken to understand the psychological skills of racing drivers as they relate to performance and differ from the general population. Furthermore, research from the general sport literature suggests that the psychological profile of athletes may depend of factors such as level of competition, type of sport played, and position played within the sport. These findings suggest that there may be psychological differences between athletes participating in different sub-disciplines within a sport, specifically oval racers and road racers. Additionally, a large body of literature exists which provides support for the notion that psychological skills can be effectively improved with a comprehensive psychological skills training intervention, or smaller-scale interventions targeting the development of a specific psychological skill (e.g., confidence, arousal regulation, concentration). Still, no research has been conducted in an effort to identify any possible differences in psychological skills proficiencies among those competing in two of the most prominent disciplines of auto racing in the United States, namely oval and road racers. To that end, the purpose of the current study is to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers.

Chapter III: Methodology

Introduction

In an effort to better understand the psychology of racing drivers, and consequently augment the sport psychology literature on this population of athletes, the purpose of the current study is to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers. In this chapter, the study methodology will be described, specifically: the research design, the tools used to gather psychological data, the procedures, the individuals targeted for inclusion, and the statistical analyses.

Research Design

To identify differences between the two samples of racing drivers, a quantitative investigation of two independent samples (i.e., oval racers, road racers) was undertaken. The two samples were compared on the Test of Performance Strategies-2 (TOPS-2; Hardy, Roberts, Thomas, & Murphy, 2010), which examines the use of eight psychological skills and techniques in both practice and competition settings.

Measures

Demographic questionnaire. Each participant completed a 20-item demographic questionnaire, specifically designed for the purpose of this study (see Appendix C). Topics queried in this questionnaire include, but are not limited to: (a) type of racing discipline (i.e., oval, road); (b) primary means of income (i.e., racing, other); (c) highest level of racing participation; and (d) psychological skills training experience.

Test of Performance Strategies – 2 (Hardy et al., 2010). Each participant also completed the 56-item TOPS-2, scored on a 5-point Likert-type response scale (i.e., 1 = *never*, 5 = *always*), which assesses the psychological skills and techniques used by athletes in both practice and competition settings (see Appendix D). Both the practice and competition subscale query information about eight psychological skills (i.e., goal setting, emotional control, relaxation, self-talk, imagery, negative thinking, activation, attentional control [i.e., concentration]). Confirmatory factor analysis calculations indicate adequate reliability of the two subscales, observing internal consistencies ranging from Cronbach alpha levels of .62 to .89 for the eight factors within each of the two subscales (Hardy et al., 2010). Results indicated a good fit for both the eight-factor competition subscale (χ^2 = 695.16; SRMR = 0.06; RMSEA = 0.05; NNFI = 0.97; CFI = 0.97) and the eight-factor practice subscale (χ^2 = 603.39; SRMR = 0.06; RMSEA = 0.04; NNFI = 0.96; CFI = 0.96). The TOPS-2 appears to be an instrument with sound psychometric properties, demonstrating both strong validity and reliability (Hardy et al., 2010). The normative data seen below in Table 2 were derived from 220 Australian, 120 North American, and 225 British male and female athletes competing in 48 different sports at the international, national, regional, junior national, or club level, as reported by Hardy and colleagues (2010).

Table 2. Subscale norms of the TOPS-2

	Practice		Competition	
Measure	*M* (SD)	α	*M* (SD)	α
Emotional Control	3.42 (0.76)	0.80	3.69 (0.83)	0.89
Activation	3.41 (0.63)	0.71	3.84 (0.70)	0.83
Relaxation	2.18 (0.83)	0.85	2.80 (0.94)	0.87
Self-Talk	3.35 (0.80)	0.82	3.42 (0.86)	0.82
Goal Setting	3.24 (0.89)	0.84	3.73 (0.86)	0.83
Negative Thinking	N/A	N/A	2.23 (0.77)	0.8
Imagery	3.02 (0.82)	0.72	3.49 (0.94)	0.86
Attentional Control	3.44 (0.66)	0.78	N/A	N/A
Automaticity	3.47 (0.65)	0.74	3.52 (0.63)	0.62

Note. Adapted from "Test of Performance Strategies (TOPS): Instrument refinement using confirmatory factor analysis," by L. Hardy, R. Roberts, P. R. Thomas, and S. M. Murphy, 2010, *Psychology of Sport and Exercise, 11,* p. 32. Copyright by Elsevier Ltd.

The TOPS-2 was selected over related measures of psychological skills, such as the Athletic Coping Skills Inventory-28 (ACSI-28; Smith, Smoll, Schutz, & Ptacek, 1995), the Psychological Skills Inventory for Sports (PSIS-R5; Mahoney, Gabriel, & Perkins, 1987), and the Ottawa Mental Skills Assessment Tool (OMSAT-3; Durand-Bush, Salmela, & Green-Demers, 2001) in order to add to the understanding of the psychological skills of racing drivers. The ACSI-28, used previously with road racers (Arguelles, 2008), has shown issues with internal consistency, ranging from 0.62 to 0.78 for the individual scales, indicating only adequate psychometric properties (Smith et al., 1995). Furthermore, the ACSI-28 does not provide a comprehensive assessment of psychological skills since it does not measure skills and strategies such as imagery, self-talk, and relaxation (Thomas, Murphy, & Hardy, 1999). The PSIS-R5, used previously with oval racers (Ebben & Gagnon, 2012), has shown poor reliability in five of its six subscales (i.e., anxiety control, concentration, mental preparation, motivation, team emphasis), with internal consistency estimates considerably below 0.80 (Chartrand,

Jowdy, & Danish, 1992). The OMSAT-3 has not been applied to examine the psychological skills of racing drivers, but the psychometric properties are inferior to those of the TOPS-2, namely the CFI which is 0.87, markedly below the 0.90 criterion (Durand-Bush et al., 2001). Additionally, the OMSAT-3 does not possess a practice subscale, but rather examines many of the same variables in the competition setting as the ACSI-28 and PSIS-R5. Therefore, the TOPS-2 is the best available assessment tool to examine the use of psychological skills by oval racers and road racers, and help to provide a more comprehensive investigation of the psychological skills of racing drivers.

Procedures

Prior to the start of recruitment, the University of Wisconsin-Milwaukee (UWM) Institutional Review Board (see Appendix E) approved the current investigation (IRB # 13.300). Data collection (i.e., consent, demographics, TOPS-2) was performed entirely online via a secure online website. Prior to completion of the demographic and TOPS-2, participants were required to complete an informed consent document (see Appendix B). Upon completion of the informed consent document, participants completed the demographics questionnaire and be instructed to complete the TOPS-2.

Participants. Drivers from amateur oval racing and amateur road racing series' were recruited to participate in the study. Following consultations with individuals who have professional practice experience with driver development, drivers must meet a minimum standard of skill acquisition (i.e., reached a minimum level of experience) in order to be considered an *oval* racer or a *road* racer. Specifically, the drivers must have competed in their respective disciplines for at least two years in order to be included in

the study. There were no exclusions based on factors such as gender and ethnicity, however, participants must be at least 18 years of age.

According to a power analysis, assuming a large effect (i.e., Cohen's $d = 0.70$) requires at least 26 drivers in each sample to satisfy 80% power. Additionally, assuming a medium effect (i.e., Cohen's $d = 0.50$) requires at least 51 drivers in each sample to adequately power the analyses. Arguelles (2008), in a comparison of the psychological skills of racecar drivers against the general population, reported estimated effect sizes between 0.43 and 0.63. Therefore, 102 total participants, 51 oval racers and 51 road racers were needed to adequately power the analyses. In total, 53 oval racers and 60 road racers participated and after initial examination of the data, a total of 51 oval racers and 55 road racers that met all inclusion criteria were included in the current investigation.

Road racers. The sample of road racers came from individuals competing in series' which race exclusively on road courses, and having competed in road racing for at least two years. Due to the principal investigator's (PI) personal connections with drivers, the primary sample of road racers were recruited from the North American Road Racing Association (NARRA) and also the Sportscar Vintage Racing Association (SVRA).

Oval racers. The sample of oval racers came from individuals competing in series' which race exclusively on ovals, and having competed in oval racing for at least two years. Two main series' that were targeted were the United States Auto Club (USAC) and United Midwestern Promoters (UMP) Modifieds.

Recruitment. Recruitment took place primarily through word of mouth and personal contacts of the PI. Racers were contacted via e-mail, telephone, and social

media (i.e., Facebook, Twitter). Given this recruitment strategy, post-hoc screening procedures (i.e., removing from data analysis if demographics indicates violations of inclusion criteria) were used in order to exclude participants who are not competing at the amateur level, and/or not participating in a purely oval or road racing series, and/or not having competed in their respective discipline for at least two years (i.e., to set a minimum standard for skill acquisition).

Data management. As mentioned above, study data were collected via online platform. The completion of online surveys has been shown to be as, if not more, effective than traditional paper-pencil methods (Buchanan & Smith, 1999; Lonsdale, Hodge, & Rose, 2006; Meyer, Cashin, & Massey, 2012; Meyerson & Tryon, 2003; Preckel & Theimann, 2003). Participants were ensured that their confidentiality will remain intact. Data were safeguarded in a password protected online database through the secure UWM Survey website (i.e., Qualtrics) and furthermore in a password protected folder on the UWM network's research drive, within a password protected computer inside of Pavilion 375.

Statistical Analysis

Analyses in the current study were conducted using IBM Statistics SPSS 20. It should be noted that screening for violations of assumptions were performed for all statistical hypothesis tests. If violations are evident, nonparametric tests will be used as appropriate. In the subsections to follow, a description of the statistical analyses that were utilized in the current study will be provided.

Independent *t* tests. A total of 14 independent *t* tests were calculated to examine differences between the oval racers and the road racers on their use of the eight

psychological skills across practice and competition settings, represented by the TOPS-2. Additionally, a Bonferroni adjustment was performed in an effort to protect against Type I error at the alpha level of .05.

Effect sizes. Following data collection, effect sizes were calculated in order to conclude whether or not the sample size for the current investigation is adequate. The effect size obtained provided insight into how large the sample *n* needed to be in order to elicit significant results. Cohen's *d* was calculated in order to determine effect size.

Reliability. In an effort to investigate internal consistencies (i.e., Cronbach alphas) of the various scales comprising the TOPS-2, reliability coefficients were calculated.

Chapter IV: Results

Researchers have only recently begun to examine the psychological aspects of auto racing (Arguelles, 2008; Ebben & Gagnon, 2012), and to date, have not yet investigated psychological differences among drivers in two of the most prominent forms of the sport (i.e., oval, road). The findings of previous researchers, who identified differences in the psychological profiles of athletes participating in different sports (Jonker, Elferink-Gemser, & Visscher, 2010; Mahoney, Gabriel, & Perkins, 1987) and different positions within the same sport (Eloff, Monyeki, & Grobbelaar, 2011; Grobbelaar & Eloff, 2011), support the assertion that differences may exist in the psychological profiles of athletes participating in the different disciplines of auto racing. The purpose of the current study was to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers. In order to accomplish this objective, participants completed the Test of Performance Strategies – 2 (TOPS-2; Hardy, Roberts, Thomas, & Murphy, 2010), a measure of an athlete's use of psychological skills in practice and competition. A series of independent *t* tests were calculated to investigate differences between the two groups of drivers on the various scales comprising the TOPS-2. In the section that follows, the demographic and psychological characteristics will be provided, including group comparisons and comparisons to a general population of athletes.

Descriptive Data by Group

The current sample consisted of drivers with experience in either the oval discipline or the road discipline. Sanctioning bodies for the road racers in the current

study included, but were not limited to the: (a) Sports Car Club of America (SCCA); (b) Sportscar Vintage Racing Association (SVRA); and (c) North American Road Racing Association (NARRA). Sanctioning bodies for the oval racers in the current study included, but were not limited to: (a) United Midwestern Promoters (UMP); (b) United States Auto Club (USAC); and (c) Automobile Racing Club of America (ARCA).

The age and gender characteristics of the drivers in the current sample, along with their racing credentials, are described in Table 3. Years of racing experience was not significantly different between the two groups of racing drivers. The total number of races participated in the past two seasons by the oval racers was significantly greater ($p < .0001$) than the road racers.

Table 3. Frequency of age and gender in current sample

	Groups	
Characteristic	Oval (n = 51)	Road (n = 55)
Age		
18-23	28	3
24-29	10	2
30-35	4	3
36-41	6	3
42-47	2	5
48-53	0	10
54-59	1	12
60-65	0	4
66-71	0	10
72-77	0	2
78+	0	1
Gender		
Male	48	51
Female	3	4
Racing History	M (SD)	M (SD)
Experience (years)	11.73 (5.94)	15.09 (13.94)
Races in Past 2 Seasons	37.59 (25.41)	14.00 (10.42)

Group Comparisons

A total of 14 independent samples *t* tests were used to identify differences between oval racers and road racers on psychological skills use in practice and competition. A Bonferroni adjustment altered the alpha level to .004 to protect against Type I error. Results indicated significant differences between the two groups of drivers on only the emotional control ($p < .001$) and negative thinking ($p < .004$) competition subscales. Road racers scored significantly higher on emotional control ($M_{road} = 4.15$, $M_{oval} = 3.62$), and significantly lower on negative thinking ($M_{road} = 1.88$, $M_{oval} = 2.25$). No significant differences were identified between the two groups of drivers on psychological skills use in practice settings. See Table 4 for details of the psychological skills use by the drivers in the current sample and Table 5 for a summary of the independent samples tests, including *p* values.

Effect sizes were calculated in an effort to confirm that the sample size obtained was sufficient to detect significant results. Effect sizes ranged from 0.01 to 0.72. Furthermore, Cronbach alpha reliability coefficients were calculated in order to investigate the internal consistencies of the various scales comprising the TOPS-2. Cronbach alpha reliability coefficients ranged from .618 to .913. In Table 5, effect sizes and Cronbach alpha reliability coefficients are reported.

In an effort to compare both samples of drivers (i.e., oval, road) to previously reported normative data of athletes (Hardy et al., 2010), *z* tests were calculated. Results indicated significant differences between the oval racers and a general population of athletes on activation in competition ($p < .004$) and imagery in both practice ($p < .004$) and competition ($p < .004$). Oval racers scored significantly higher on imagery in

practice (M_{oval} = 3.35, $M_{athlete}$ = 3.02), and significantly lower on activation in competition (M_{oval} = 3.47, $M_{athlete}$ = 3.84). Results also indicated significant differences between the road racers and a general population of athletes on emotional control in practice ($p < .004$) and competition ($p < .004$), activation in competition ($p < .004$), self-talk in practice ($p < .004$) and competition ($p < .004$), goal setting in practice ($p < .004$), imagery in practice ($p < .004$), and negative thinking in competition ($p < .004$). Road racers scored significantly higher on emotional control in practice (M_{road} = 3.77, $M_{athlete}$ = 3.42) and competition (M_{road} = 4.15, $M_{athlete}$ = 3.69), goal setting in practice (M_{road} = 3.65, $M_{athlete}$ = 3.24), and imagery in practice (M_{road} = 3.36, $M_{athlete}$ = 3.02), and significantly lower on activation in competition (M_{road} = 3.41, $M_{athlete}$ = 3.84), self-talk in practice (M_{road} = 2.98, $M_{athlete}$ = 3.35) and competition (M_{road} = 2.90, $M_{athlete}$ = 3.42), and negative thinking in competition (M_{road} = 1.88, $M_{athlete}$ = 2.23). In Table 6, *z* test scores are reported for each scale of the TOPS-2.

Table 4. Psychological skills use by racing drivers

	Groups			
Measure	Oval (*n* = 51)		Road (*n* = 55)	
	M (SD)		*M* (SD)	
	Practice	Competition	Practice	Competition
Emotional Control	3.38 (0.77)	3.62 (0.80)*	3.77 (0.66)	4.15 (0.65)*
Activation	3.41 (0.71)	3.47 (0.79)	3.46 (0.58)	3.41 (0.69)
Relaxation	2.21 (0.91)	2.93 (0.87)	2.12 (0.88)	2.65 (0.80)
Self-Talk	3.06 (0.89)	3.10 (0.99)	2.98 (0.91)	2.90 (0.99)
Goal Setting	3.57 (0.69)	3.87 (0.75)	3.65 (0.64)	3.86 (0.80)
Imagery	3.35 (0.91)	3.33 (0.88)	3.36 (0.77)	3.24 (0.91)
Negative Thinking	N/A	2.25 (0.72)*	N/A	1.88 (0.57)*
Attentional Control	3.48 (0.69)	N/A	3.68 (0.55)	N/A

Note. Psychological skills use is reported in sum scores, out of 5 possible. *$p < .004$

Table 5. Independent samples *t* test summary table

Measure	*df*	*t*	*p*	*d*	*α*
Emotional Control - Competition	104	-3.707	0.000*	0.72	0.82
Emotional Control - Practice	104	-2.846	0.005	0.55	0.77
Activation - Competition	104	0.362	0.718	0.07	0.78
Activation - Practice	104	-0.417	0.678	0.08	0.72
Relaxation - Competition	104	1.730	0.087	0.34	0.78
Relaxation - Practice	104	0.504	0.615	0.10	0.91
Self-Talk - Competition	104	1.053	0.295	0.20	0.85
Self-Talk - Practice	104	0.492	0.624	0.10	0.79
Goal Setting - Competition	104	0.059	0.953	0.01	0.86
Goal Setting - Practice	104	-0.594	0.554	0.12	0.69
Imagery - Competition	104	0.530	0.597	0.10	0.83
Imagery - Practice	104	-0.096	0.924	0.02	0.76
Negative Thinking - Competition	104	2.970	0.004*	0.57	0.75
Attentional Control - Practice	104	-1.627	0.107	0.31	0.62

Note. Equal variances assumed for all subscales due to nonsignificant Levene's Tests. *$p < .004$

Table 6. *Z* test summary table

	Groups			
Measure	Oval ($n = 51$)		Road ($n = 55$)	
	Z Test Score		Z Test Score	
	Practice	Competition	Practice	Competition
Emotional Control	-0.35	-0.58	3.49*	4.07*
Activation	-0.04	-3.82*	0.58	-4.52*
Relaxation	0.22	0.96	-0.55	-1.22
Self-Talk	-2.56	-2.63	-3.46*	-4.49*
Goal Setting	2.64	1.18	3.38*	1.15
Imagery	2.86*	-1.23	3.11*	-2.00
Negative Thinking	N/A	0.23	N/A	-3.36*
Attentional Control	0.44	N/A	2.67	N/A

*$p < .004$

Summary. Independent *t* test calculations revealed two significant differences between the oval racers and the road racers in their psychological skills use in competition. Road racers scored significantly higher than the oval racers on emotional

control ($p < .001$) and significantly lower than the oval racers on negative thinking ($p < .004$). No differences were observed between the two groups on any of the practice subscales of the TOPS-2.

A series of z test calculations elicited two significant differences between the oval racers and a general population of athletes, and eight significant differences between the road racers and a general population of athletes. Oval racers scored significantly higher on imagery in practice ($p < .004$), and significantly lower on activation in competition ($p < .004$). Road racers scored significantly higher on emotional control in practice ($p < .004$) and competition ($p < .004$), goal setting in practice ($p < .004$), and imagery in practice ($p < .004$), and significantly lower on activation in competition ($p < .004$), self-talk in practice ($p < .004$) and competition ($p < .004$), and negative thinking in competition ($p < .004$).

Chapter V: Discussion

The psychological aspects of auto racing have been scarce in the scholarly literature despite the mass appeal of, and large sponsorship dollars involved in, the sport (Corso, 2013, "NASCAR Racing Statistics," 2012). The major auto racing series' in the United States (i.e., Indycar, NASCAR) are comprised of different types of racing (i.e., oval, road), and given the mass appeal and investment within the sport, team owners seek to hire drivers who can succeed at both types of racing in these series'. Because the oval and road disciplines are different in a technical sense (e.g., number of corners, length of straightaways, shifts per lap), it is reasonable to consider that the psychological skills necessary for success in each may be different. Researchers have shown that the psychological profiles of athletes can differ depending on the type of sport in which they participate (Jonker, Elferink-Gemser, & Visscher, 2010; Mahoney, Gabriel, & Perkins, 1987), and the position played within the sport (Eloff, Monyeki, & Grobbelaar, 2011; Grobbelaar & Eloff, 2011). The purpose of the current study was to examine the use of psychological skills by athletes who participate in distinct sub-disciplines within the sport of auto racing, specifically oval racers and road racers. In order to accomplish this objective, participants completed the Test of Performance Strategies – 2 (TOPS-2; Hardy, Roberts, Thomas, & Murphy, 2010), which measures the athletes' use of psychological skills in practice and competition. In the section that follows, the results of the current investigation will be discussed and compared to previous research, as will implications for future research and professional practice.

Comparisons between Oval Racers and Road Racers

In the current study, two significant differences were identified between the two groups of racers. That is, the road racers recorded significantly higher ($p < .001$) scores than the oval racers on the use of emotional control in competition ($M_{road} = 4.15$, $M_{oval} = 3.62$) and significantly lower ($p < .004$) scores than the oval racers on the use of negative thinking in competition ($M_{road} = 1.88$, $M_{oval} = 2.25$).

Emotional control. As indicated above, the road racers in the current study scored significantly higher on their use of emotional control strategies (i.e., ability to effectively manage negative emotions such as anxiety and frustration [Thomas, Murphy, & Hardy, 1999]) during competition than the oval racers. Although no previous research has examined the differences in emotional control strategies between oval and road racers, this finding is consistent in part with the results of an earlier study in which road racing drivers were found to record higher scores for coping with adversity and peaking under pressure when compared to a population of nonathletes (Arguelles, 2008). Other researchers (Smith & Christensen, 1995; Thomas et al., 1999) have suggested the importance of emotional control strategies in sport performance, such that as an athlete uses these skills more often, performance is improved. In road racing, drivers may have more time to control anxiety and other emotions than their oval racing peers due to the technical aspects of road racing (i.e., number of corners, long straightaways). Using these strategies to the extent which road racers have shown, affirms that this is an important skill for athletes to have at their disposal.

Although emotional control strategies are important for sport performance, researchers have not yet examined the relationship between psychological skills use and

race frequency (e.g., 7 races in an 8 month season versus 19 races in an 8 month season). In the current study, the road racers participated in significantly fewer races ($p < .0001$) than the oval racers ($M_{road} = 14.00$, $M_{oval} = 37.59$). These results prompt us to consider whether road racers use emotional control strategies to a greater extent than the oval racers due fewer opportunities for competition. Athletes with fewer opportunities for competition success may feel increased pressure to perform (i.e., Olympics only every four years [Gould & Maynard, 2009; Greenleaf, Gould, & Dieffenbach, 2001]), and use emotional control strategies in competition to a greater extent than athletes with more opportunities for competition success. In the current study, a single road race represents 14% of the racing season, whereas a single oval race represents 5% of the racing season. These findings suggest that the extent to which an athlete uses psychological skills, such as emotional control, may differ depending on the number of competition opportunities.

Negative thinking. Also indicated above, the road racers in the current study scored significantly lower than the oval racers on negative thinking during competition. Although no previous research has examined the competition thoughts of oval and road racers, this finding is not surprising given that the road racing drivers use emotional control strategies more often, which may allow them to avoid thinking negatively. This can be explained by the significant negative relationship ($r = -0.68$, $p < .05$) between emotional control and negative thinking in competition (Hardy et al., 2010), such that a driver's use of emotional control strategies to manage frustration and negative emotions (Thomas et al., 1999) may be related to the diminished occurrence of his/her negative thinking. In addition to the inverse relationship between emotional control strategies and negative thinking, previous research has shown that experienced drivers were more

tough-minded and less guilt-prone than inexperienced racing drivers (Johnsgard & Ogilvie, 1968). Given that road racers in the current study reported more years of racing experience than oval racers (M_{road} = 15.09, SD = 13.94; M_{oval} = 11.73, SD = 5.94), it makes sense that they think negatively less often during competition than the oval racers.

Non-significant findings. That significant differences between the oval and road racers were identified for only two of the 14 scales is consistent with a previous study, in which researchers examined the personality characteristics of a sample of road racing drivers (Johnsgard & Ogilvie, 1968). Licensed drivers differed significantly ($p < .10$) from novice drivers on 19 of 38 scales (i.e., Edwards Personal Preference Schedule, IPAT-16PF) and better licensed drivers differed significantly ($p < .10$) from poorer licensed drivers on only four of the 38 scales. Combined, the results of this earlier study as well as the current study suggest that it may be difficult to find differences between groups of drivers who possess a similar skill level. Researchers (Johnsgard & Ogilvie, 1968) suggested that as the range of driver skill increased, the differences in personality became more apparent. Additionally, since the data analyses were largely preliminary, these researchers set alpha levels to .10 in order to suggest trends (Johnsgard & Ogilvie, 1968). This heightened alpha level increases the chances of finding significant differences on the scales, differences which may not have been elicited otherwise.

Racing Drivers and Other Athletes

Although there were few statistically significant differences between the two groups of drivers in the current study, an examination of the differences between the two samples of racing drivers and a general population of athletes may help us to understand the psychological skills necessary for auto racing as a whole. In an effort to better

understand the extent to which the drivers used various psychological skills, *z* tests were calculated to compare the mean use of a particular psychological skill of the two groups of drivers in the current study to the normative data of the TOPS-2 (i.e., 565 Australian, British, and North American athletes participating in 48 different sports from club to international levels) (Hardy et al., 2010).

Oval racers. Statistical analyses indicate that the use of psychological skills by oval racers in the current study differs from that of athletes who participate in other sports (Hardy et al., 2010) on only two measures: use of activation strategies in competition ($z = -3.82$, $p < .004$) and use of imagery skills in practice ($z = 2.86$, $p < .004$). The differences highlighted above, notably the frequent use of imagery in practice, may illustrate a unique characteristic of auto racing in that imagery is a common way to actually practice the sport. As noted previously, the cost of the sport is extremely high, so drivers may use alternative ways to practice (e.g., simulators) which do not necessitate traveling to a racetrack to practice outside of a competition weekend or fielding a car on the track for extra practice sessions during a competition weekend.

Although no previous research has directly compared the use of psychological skills by oval racers to a general population of athletes, the findings of the current study are similar to previous research (Ebben & Gagnon, 2012) in that drivers place importance on mental preparation (i.e., imagery) and anxiety coping (i.e., emotional control). Links between psychological skills use and performance were not examined in the current study, yet Ebben and Gagnon (2012) demonstrated that drivers who improve mental preparation and anxiety coping place better during a race, thereby suggesting that imagery and emotional control may be important skills for oval racers to use. These

researchers did not suggest the setting in which the oval racers tend to use imagery, thereby limiting the ability for a sport psychology practitioner to provide specific imagery recommendations. Similarly, the specific type of imagery used by the drivers (i.e., cognitive-specific, cognitive-general, motivational specific, motivational general-arousal, motivational general-mastery [Martin, Moritz, & Hall, 1999; Nordin & Cumming, 2008]), has yet to be empirically determined. If imagery is used to *practice* the sport, thereby avoiding the financial and logistic challenges of auto racing, cognitive-general imagery may be used in order to assist with strategy learning and strategy execution (Nordin & Cumming, 2008). While the results of the current study indicate that the use of imagery is specifically emphasized in practice settings (i.e., at/during, before practice), the type of imagery used by racing drivers needs to be empirically determined.

Road racers. Statistical analyses also indicate that the use of psychological skills by road racers differs from that of athletes who participate in other sports (Hardy et al., 2010), specifically: (a) emotional control in practice ($z = 3.49$, $p < .004$) and competition ($z = 4.07$, $p < .004$); (b) activation in competition ($z = -4.52$, $p < .004$); (c) self-talk in practice ($z = -3.46$, $p < .004$) and competition ($z = -4.49$, $p < .004$); (d) negative thinking in competition ($z = -3.36$, $p < .004$); (e) goal setting in practice ($z = 3.38$, $p < .004$); and (f) imagery in practice ($z = 3.11$, $p < .004$). These data lend support to the notion that road racers may require different psychological skills than other athletes, notably their use of emotional control strategies in both practice and competition, as well as their use of imagery in practice.

Although no previous research has directly compared the use of psychological skills by road racers to a general population of athletes, results of the current study are consistent with previous research (Ebben & Gagnon, 2012) in that racing drivers have been shown to value mental preparation (i.e., imagery). Preparation (i.e., practice) for road racing may require the extensive use of imagery, as indicated by the finding that racers in the current study reported greater use of imagery in practice than a general population of athletes (Hardy et al., 2010). As was the case with the oval racers discussed above, financial constraints may prompt road racers to use simulation of sorts (i.e., imagery) to practice before race weekends. This finding is consistent with the previous assertion that practice habits (i.e., use of simulation) are quite different for racing drivers compared with the athletes who comprised the norms of the TOPS-2. As mentioned previously, further investigations are warranted in order to determine the type of imagery used by racing drivers.

In addition to imagery being used by the racing drivers to a greater extent in practice settings than other athletes, emotional control strategies may be used by the road racers to a greater extent than other athletes due to the demands of road racing. Specifically, the technical demands (e.g., shifts per lap) and the physiological demands (e.g., frequent acceleration and deceleration) may contribute to the drivers' more extensive use of emotional control. As mentioned earlier, the road racers do not have a large proportion of races over the course of their season compared to the oval racers, which limits their opportunities for performance success. Having fewer opportunities for competition success may result in an increased pressure to succeed, thus warranting a greater use of emotional control strategies in competition.

Consistencies between oval and road racers. In addition to the differences between the oval and road racers, and the racing drivers and a general athlete population, there are also consistencies between the two samples of racing drivers which warrant discussion. First, the oval and road racers used activation strategies less frequently than other athletes in competition settings only ($p < .004$), but used imagery more frequently than other athletes in practice settings ($p < .004$). Second, the oval racers and road racers used self-talk strategies less frequently than other athletes in practice and competition settings. Specifically, oval racers exhibited a z test score of -2.56 ($p = .0052$) for self-talk during practice and -2.63 ($p = .0043$) for competition, while road racers demonstrated -3.46 ($p < .004$) for self-talk during practice and -4.49 ($p < .004$) for competition. It is somewhat surprising that the racers in the current study used confidence-building strategies such as self-talk to a lesser extent than other athletes, given that confidence has been suggested as important for effective racing (Ebben & Gagnon, 2012). On the other hand, the results of previous research suggest that the racing driver is a confident individual (Johnsgard & Ogilvie, 1968). If the racing driver is inherently confident, s/he may not need to use confidence-building strategies such as self-talk to the same extent as other athletes.

While a comparison of racing drivers to a general population of athletes (Hardy et al., 2010) highlights a few notable differences in their use of psychological skills (i.e., self-talk, imagery), racing drivers seem comparable to athletes in sports sharing characteristics similar to auto racing (i.e., structured race format of a continuous nature, environmental conditions that can affect performance [Jackson, Thomas, Marsh, & Smethurst, 2001]). When compared to road cyclists, surf lifesavers, and orienteerers

(Jackson et al., 2001), oval racers differed only in their use of relaxation strategies in competition, using these strategies less often than the other athletes. Consistent with previous findings, the road racers still differed in terms of emotional control and negative thinking, but also used relaxation strategies in competition less often than the road cyclists, surf lifesavers, and orienteerers. Taken together, these findings suggest that compared to a general population of athletes, racers use imagery more often in practice and confidence-building strategies less often in both practice and competition settings. Racers also appear comparable in their psychological skills use to athletes participating in sports sharing similar characteristics, providing support for the assertion that the characteristics of a sport may be related to athlete psychological skills use.

Summary. The results of the current study indicate that the oval and road racers do not exhibit meaningful differences from each other in terms of using psychological skills to manage the characteristics of the track itself (e.g., layout), but do exhibit differences from each other in terms of how they manage the pressure of race frequency (e.g., 7 races, 19 races) across a given time frame (e.g., 8 months). Although not a purpose of the current study, results also indicate that certain psychological skills (i.e., imagery) are used by racing drivers to a greater extent than other athletes, lending insight into the psychological skills necessary for auto racers in general. With these findings in mind, implications of the current study for both future research and professional practice will be discussed below.

Study Limitations and Implications for Future Research

Limitations exist in the design of the current study which should be addressed in future research endeavors. Fourteen independent *t* tests were conducted in the current

study, necessitating use of an a priori Bonferroni adjustment to protect against committing Type I error. However, this adjustment concurrently increased the likelihood of committing Type II error. As such, and to minimize the need for this conservative approach to assessing group differences, researchers should consider alternative adjustments (e.g., Šidák *p*-value [Holland & Copenhaver, 1987; Šidák, 1967]) for multiple comparisons when using investigating a large number of psychological skills. Alternatively, a qualitative study may provide valuable information to assist researchers and practitioners who are interested in determining the characteristics of a successful oval racer, road racer, or a racer who can excel in both disciplines.

The current sample was limited to racers participating at the amateur level, a decision made to be consistent with the identification of differences in psychological skills use among elite and preelite athletes (Mahoney et al., 1987), and to ensure that drivers had only competed in one of the two disciplines (i.e., oval, road). In the future, researchers should examine psychological skills use in professional racing drivers, specifically the psychological skills which may be related to better performance (e.g., wins, position in overall point standings) at the professional level of auto racing.

Certain limitations are also evident in the demographic questionnaire. First, age was collected as a range (e.g., 18-23, 24-29) rather than an individual value in order to protect the confidentiality of the drivers. In so doing, it was not possible to test for age as a potential confounding variable. In future studies, researchers should be encouraged to collect data on specific ages. Second, a measure of performance (i.e., finishing position) was not collected in the current study. This omission limits the ability to identify the psychological skills which may be related to improved performance. In the future,

researchers should collect a performance measure in order to establish a link between the use of certain psychological skills and performance in auto racing.

The TOPS-2 was selected for use in the current study due in large part to sound psychometric properties. That said, measurement concerns emerged which should be addressed in future research. First, weak alpha reliability coefficients were present in the current study for both the goal setting and attentional control practice subscales. Given that these scales had acceptable alpha reliability coefficients during instrument development (Hardy et al., 2010), more research is warranted to determine if these scales are problematic for use with athletes and/or sports outside of the original population. Second, the TOPS-2 was not used in conjunction with another instrument in the current study. The researchers who developed the TOPS-2 (Hardy et al., 2010) suggested that until such a time as more research has been conducted using the instrument across a range of sports, the TOPS-2 should be paired with other measures in order to provide a more comprehensive description of an athlete's psychological skills profile. For example, the TOPS-2 does not allow researchers to determine the specific *type* of imagery used by racing drivers, which has yet to be empirically determined. Therefore, researchers may consider administering the Sport Imagery Questionnaire (SIQ; Hall, Mack, Paivio, & Hausenblas, 1998) alongside their measurements of psychological skills (e.g., TOPS-2) in order to better understand the imagery practices of racing drivers.

In addition to the preceding recommendations for research in the sport of auto racing specifically, recommendations are also made for research in sport generally. For example, results of the current study indicate that psychological skills use may be related to the proportion of competition opportunities. Since investigating the potential

relationship between psychological skills use and frequency of competition was not a primary aim of the current study, future research is warranted to examine whether there is a relationship between psychological skills use and frequency of competition.

Implications for Professional Practice

Although the aforementioned weaknesses may limit the generalizability of these results to other racing populations (i.e., professionals), the results of the current study still offer a number of suggestions for working to enhance the performance of racing drivers. The road racers reported significantly fewer races per season and more frequent use of emotional control strategies in competition than the oval racers. Thus, individual racing drivers may need to use psychological skills to a different extent to effectively manage their emotions during a limited number of competitions (i.e., cope with challenges of fewer opportunities for competition). Sport psychology practitioners should consider how the driver copes with the frequency of races, and when necessary to teach effective coping skills.

Racing drivers appear to rely on the use of imagery in practice settings. As such, the work of practitioners should target the development of imagery skills. Although the type of imagery used by racing drivers has not yet been identified (i.e., cognitive-specific, cognitive-general, motivational-specific, motivational general-arousal, motivational general-mastery [Martin et al., 1999]), if racers use imagery to practice the sport, cognitive-general imagery should be targeted in order to assist with strategy learning and strategy execution (Nordin & Cumming, 2008). That said, once the type of imagery used by the drivers is determined, sport psychology practitioners can assist the drivers in

further developing those specific imagery skills (e.g., cognitive-specific, cognitive-general).

As a group, the racing drivers used self-talk strategies less frequently than the general athlete population in both practice and competition settings. When working with racing drivers, sport psychology practitioners should work to develop confidence-building strategies (i.e., self-talk) to be used in both practice and competition. Although racing drivers have been found to be confident individuals in terms of their personality, confidence-building strategies should still be used by the drivers given the links identified between confidence and sport performance (Callow, Hardy, & Hall, 2001; Hatzigeorgiadis, Zourbanos, Mpoumpaki, & Theodorakis, 2009; Munroe-Chandler, Hall, & Fishburne, 2008).

Results of the current study indicate few meaningful differences between oval racers and road racers in their psychological skills use, yet also indicate that racing drivers as a group use imagery to a greater extent than other athletes in practice settings and confidence-building strategies to a lesser extent than other athletes in both practice and competition settings. Although these findings indicate that racing drivers may need to focus on the development of specific psychological skills (i.e., imagery, self-talk), researchers assert that psychological skills training programs should be tailored to an athlete's individual strengths and weaknesses (Martindale, Collins, & Daubney, 2005). Consistent with other researchers (Gould, 2009; Horn, Gilbert, Gilbert, & Lewis, 2011), it is also recommended that a comprehensive rather than an a la carte approach be used to develop and train psychological skills. A comprehensive approach allows for development of the entire psyche of an athlete, in that an athlete acquires a repertoire of

skills to be used in practice and competition settings, in accordance with their individual needs. Taken a step further, a comprehensive approach to athlete development in general is suggested in the Meyer Athlete Performance Management Model (MAPM; Meyer, Merkur, Ebersole, & Massey, in press), whereby an athlete's sport performance is comprised of physical, technical, and psychological factors. Psychological factors are important for sport performance, but so too are physical and technical factors. With that in mind, those interested in studying or working with racing drivers should look for opportunities to collaborate with other professionals (e.g., strength and conditioning coach, mental training coach, driver coach, crew chief) so that they can focus on driver development by utilizing an integrated approach to performance enhancement.

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APPENDIX A

Waiver to Document Informed Consent Form

Waiver to Obtain/Document/Alter Informed Consent

Instructions: Each Section must be completed unless directed otherwise. Incomplete forms will delay the IRB review process and may be returned to you. Enter your information in the **colored boxes** or place an **"X"** in front of the appropriate response(s).

SECTION A: Request to Waive Informed Consent/ Request to Alter Informed Consent
Section Notes… • Complete this section **ONLY** if you are requesting a Waiver to Obtain Consent or requesting to Alter Informed Consent.

Answer all A's OR B's

[__] **A1.** The research or demonstration project is to be conducted by, or subject to the approval of, state or local government officials, and is designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs; and
Explain:

[__] **A2.** The research could not practicably be carried out without the waiver or alteration.
Explain:

[__] **B1.** The research involves no more than minimal risk to the subjects;
Explain:

[__] **B2.** The waiver or alteration will not adversely affect the rights and welfare of the subjects;
Explain:

[__] **B3.** The research could not practicably be carried out without the waiver or alteration; and
Explain:

[__] **B4.** Whenever appropriate, the subjects will be provided with additional pertinent information after participation.
Explain:

SECTION B: Request to Waive Documentation of Informed Consent

Section Notes…
• Complete this section if you are requesting a Waiver to Document Informed Consent.
  ○ I.E., the research participant is not signing the consent form.
• Skip this section if you are **not** requesting a Waiver to Document Informed Consent.
• Answer all A's **OR** all B's
  ○ If A1, A2, or A3 is marked "No", a request to waive documentation of informed consent cannot be granted.
  ○ If B1 or B2 is marked "Yes", a request to waive documentation of informed consent cannot be granted.

Answer A's OR B's

A1. If consent was documented, would the only record linking the subject and the research be the informed consent form?

[__] **Yes**
[__] **No**

A2. If consent was documented, would the principal risk to the subject be the potential harm from a breach of confidentiality?

[__] **Yes**
[__] **No**

A3. Will each subject be asked whether he/she wants documentation linking the subject with the research, and the subjects wishes will govern?

[__] **Yes**
[__] **No**

B1. Does the research present more than minimal risk of harm to subjects?

[__] **Yes**
[X] **No**

B2. Are any procedures involved for which written consent is normally required outside of the research context?

[__] **Yes**
[X] **No**

IMPORTANT – Make sure all applicable sections are complete and attach this document to your IRBManager web submission in the Attachment Page (Y1).

APPENDIX B

Consent Form

University of Wisconsin – Milwaukee
Consent to Participate in Online Survey Research

Study Title: An examination of the psychological profiles of oval racers and road racers.

Person Responsible for Research: Principal Investigator (PI): Andrew Morgan; Co-I: Barbara B. Meyer

Study Description: The purpose of this research study is to examine the psychological profiles of oval racers and road racers. Approximately 200 subjects will participate in this study. If you agree to participate, you will be asked to complete a battery of online psychological questionnaires that will take approximately 30 minutes to complete. The questions will ask about your thoughts, perceptions, and/or abilities about personality, anxiety, self-esteem, goal orientation, stages of change, decisional balance, self-efficacy, mental toughness, grit, self-regulation, and use of psychological skills.

Risks / Benefits: Risks to participants are considered minimal. There is an inherent increased risk to the confidentiality of electronic data. We have outlined how we will protect you against these risks in the confidentiality section below. Collection of data and survey responses using the internet involves the same risks that a person would encounter in everyday use of the internet (such as breach of confidentiality). While the researchers have taken every reasonable step to protect your confidentiality, there is always the possibility of interception or hacking of the data by third parties that is not under the control of the research team.

There will be no costs for participating. Benefits of participating include advancing the knowledge of the psychology of racing drivers. We will also include a written summary of the data to any participant that requests this information. If you would like a summary of the research, please email the research study email address (racing.psychology.research@gmail.com) and request a copy of the data summary.

Limits to Confidentiality: Identifying information such as your name, email, and Internet Protocol (IP) address of your computer will not be asked or recorded. Your responses will be treated as confidential and all reasonable efforts will be made so that no individual participant will be identified with his/her answers. Data will be retained on the Qualtrics website server for 30 days and will be deleted after this time. However, data may exist on backups or server logs beyond the timeframe of this research project. Data transferred from the survey site will be saved in an encrypted format for 10 years. Only the PI, Co-I, and study staff will have access to the data collected by this study. The research team will remove any possible identifying information (such as racing series' participated in) once you are appropriately categorized as either an oval racer or road racer, no later than 30 days of your participation, in order to protect your confidentiality. At this point, data will be deleted from the online server, and all study results will be reported without identifying information so that no one viewing the results will ever be able to match you with your response. For participants requesting a summary of the research, a password protected, research project email account will be used (racing.psychology.research@gmail.com). Similar to the procedures above, within 30 days of study completion, all data will be deleted from the research project email address. Only the PI will have access (i.e., the password) to the research study email address.

Voluntary Participation: Your participation in this study is voluntary. You may choose to not answer any of the questions or withdraw from this study at any time without penalty. Your

decision will not change any present or future relationship with the University of Wisconsin Milwaukee.

Who do I contact for questions about the study: For more information about the study or study procedures, contact Andrew J. Morgan at ajmorgan@uwm.edu or 630-687-0611 or Barbara Meyer at bbmeyer@uwm.edu.

Who do I contact for questions about my rights or complaints towards my treatment as a research subject? Contact the UWM IRB at 414-229-3173 or irbinfo@uwm.edu

Research Subject's Consent to Participate in Research:
By entering this survey, you are indicating that you have read the consent form, you are age 18 or older and that you voluntarily agree to participate in this research study.

Thank you!

APPENDIX C

Demographic Questionnaire

Demographics – An Examination of the Psychological Profiles of Oval Racers and Road Racers.

Please respond to the following questions.

1. Gender (Male, Female, Other, Prefer not to answer):

2. Age:
    Prefer not to answer
    18-23
    24-29
    30-35
    36-41
    42-47
    48-53
    54-59
    60-65
    66-71
    72-77
    77+

3. Ethnicity (mark all that apply):
    White Caucasian
    African American
    Asian
    Hispanic
    Native American
    Pacific Islander
    Other (please specify)
    Prefer not to answer

4. Is racing your primary means of income (Y/N)?

5. Type of major funding/sponsorship (e.g., personal, business, etc.):

6. Type of racing discipline in which you exclusively participate (oval/road):

7. Number of years participated in your primary discipline (oval OR road racing):

8. Highest level of racing participation (amateur/professional/other: please specify):

9. Current level of racing participation (amateur/professional/other: please specify):

10. Series' participated in previously:

11. Series participating in currently:

12. How many races have you participated in the last 2 years at your current level?

13. How many podiums have you had in the last 2 years?

14. On a scale of 1 to 10 (1 being completely dissatisfied and 10 being completely satisfied), how satisfied are you with your performance (i.e., race results)?

15. Have you had any prior experience with psychological skills training (Y/N)? If so, when and for how long?

16. If you answered yes to Q15, how did you receive psychological skills training (check all that apply)?

Reading popular magazines
Reading books
Reading articles written in journals or on the Internet
Attending conferences and seminars
Work with a mentor
Other (please specify)
I have had no exposure to psychological skills principles.
Mental skills coach

17. If you answered NO to Q15, would you be willing to seek psychological skills training?

18. Have you had any racing accidents? If so, how many?

19. If you answered YES to Q18, how many would you consider "serious"?

20. Describe any physical and/or psychological impact the racing accident(s) has had on your current participation in racing.

APPENDIX D

Test of Performance Strategies-2

This questionnaire measures performance strategies used by athletes in various sport situations. Because individual athletes are very different in their approach to their sport, we expect the responses to be different. We want to stress, therefore, that there are no right or wrong answers. All that is required is for you to be open and honest in your responses. Each of the following items describes a specific situation that you may encounter in your training and competition. Please circle how frequently these situations apply to you on the following 1-5 scale:

	Never	Rarely	Sometimes	Often	Always
I set realistic but challenging goals for myself					
I say things to myself to help my practice performance					
During practice I visualize successful past performance					
My attention wanders while I am training					
I practice using relaxation techniques at workouts					
In practice, I use relaxation techniques to improve my performance					
During competition I set specific goals for myself					
In competitions I use relaxation techniques to improve my performance					
My self-talk during competition is negative					
During practice, I am able to perform skills without consciously thinking about it					
I trust my body to perform skills during competition					
I rehearse my performance in my mind before practice					
I can psych myself to perform well in competitions when necessary					
	Never	Rarely	Sometimes	Often	Always
During competitions I have thoughts of failure					
I use practice time to work on my relaxation techniques					
I manage my self-talk effectively during practice					
In competition, I use relaxation as a coping strategy					
I visualize my competition going exactly the way I want it to go					
I am able to control distracting thoughts while I am training					
I get frustrated and emotionally upset when practice does not go well					
I have specific cue words or phrases that I say to myself to help my performance during competition					

I evaluate whether I achieve my competition goals					
During practice, I perform automatically without having to consciously control each movement					
When I need to, I can relax myself at a competition to get ready to perform					
I have difficulty controlling my emotions if I make a mistake in competition					
I set very specific goals for competition					
	Never	**Rarely**	**Sometimes**	**Often**	**Always**
I practice using relaxation techniques at workouts					
I psych myself up at competitions to get ready to perform					
At practice, I can allow the whole skill of movement to happen naturally without concentrating on each part of the skill					
During competition I am sufficiently prepared to perform on "Automatic Pilot"					
I have difficulty with emotions at competitions					
I keep my thoughts positive during competition					
I say things to myself to help my competitive performances					
At competitions, I rehearse the feel of my performance in my imagination					
I can get my intensity level just right at practice					
I manage my self-talk effectively during competition					
I set goals to help me use practice time effectively					
I can get myself "up" if I feel flat during practice					
My performance suffers when something upsets me in practice					
	Never	**Rarely**	**Sometimes**	**Often**	**Always**
I can psych myself up to perform well during practice					
During competition, I am unable to perform skills without consciously thinking					
At practice, when I visualize my performance, I imagine what it will feel like					
During competition, if I am starting to "lose it" I use a relaxation technique					
I can get myself up if I feel flat at a competition					
During practice I focus my attention effectively					
I set personal performance goals for competition					
I motivate myself to train through positive self-talk					

During practice, I monitor the details of each move to successfully execute skills					
In practice, I have difficulty getting into an ideal performance state					
I have trouble maintaining my concentration during long practices					
I talk positively to myself to get the most out of practice					
I can increase my energy level to just the right level of performance					
	Never	**Rarely**	**Sometimes**	**Often**	**Always**
I have very specific goals for practice					
During competition I allow the skill to happen naturally without focusing on each part					
I imagine my competitive routine before I do it at a competition					
I imagine screwing up during competition					
I talk positively to myself to get the most out of competitions					
I dont set goals for practices; I just go out and do it					
I rehearse my performance in my mind at competitions					
I have trouble controlling my emotions when things are not going well at practice					
Emotions keep me from performing my best in practice					
Emotions keep me from performing my best at competitions					
My emotions get out of control under pressure in competition					
At practice, when I visualize my performance, I imagine watching myself as if on a video replay					

APPENDIX E

IRB Manager Protocol Form

IRBManager Protocol Form

Instructions: Each Section must be completed unless directed otherwise. Incomplete forms will delay the IRB review process and may be returned to you. Enter your information in the **colored boxes** or place an **"X"** in front of the appropriate response(s). If the question does not apply, write **"N/A."**

SECTION A: Title

A1. Full Study Title:

An examination of the psychological profiles of oval racers and road racers.

SECTION B: Study Duration

B1. What is the expected start date? *Data collection, screening, recruitment, enrollment, or consenting activities may not begin until IRB approval has been granted. Format: 07/05/2011*

Upon IRB Approval

B2. What is the expected end date? *Expected end date should take into account data analysis, queries, and paper write-up. Format: 07/05/2014*

03/04/2015

SECTION C: Summary

C1. Write a brief descriptive summary of this study in Layman Terms (non-technical language):

To date, there is a lack of research examining athletes in one of the most popular sports in the world – motorsports. Specifically, personality was examined in the 1960's and 1970's, but the research never gained traction. In the late 2000's, there was a resurgence in the literature concerning racing drivers since the popular press began to explain how racing drivers cited psychological factors as important for their performance. The literature has examined oval racers and road racers, but never examining the two simultaneously.

Just as physical and technical requirements for a sport (or position played within a sport) may differ, so too may the psychological requirements. For example, research has shown that the psychological profiles of hockey goaltenders differ from that of hockey forwards and defensemen. To that end, the research question for the proposed study aims to examine the psychological profiles between oval racers and road racers, in an effort to investigate what oval racers and what road

racers need differently, in a psychological context.

A demographics questionnaire, designed to collect data to classify the participants into the appropriate sample (i.e., oval, road) as well as a battery of psychological surveys will be used to identify the psychological profiles of the two independent samples of drivers. The statistical measurement of interest for this study will be an independent *t* test.

C2. Describe the purpose/objective and the significance of the research:

The primary purpose of the proposed study is to examine the psychological profiles of oval racers and road racers. The scientific significance of this study is that this will be the first of its kind to examine the psychological profiles of both oval and road racers. In addition, it will be the first of its kind to examine the psychological skills used by motorsport athletes in both practice as well as competition settings. Furthermore, it will add to a very limited body of literature concerning the psychological differences of participants in sub-disciplines within a sport.

The practical significance of this study is that it will add to the understanding of driver's strengths and areas of development in the two different disciplines of motorsports. Elite drivers are ones who excel in both disciplines (i.e., oval, road). Thus, they may possess different personality traits and psychological skills necessary for successful performance in the different disciplines. If differences are found (or not found) in the current study, these understandings can help inform practitioners who work with drivers in order to enhance their performance in accordance with the demands of the discipline in which the driver is unfamiliar with, through appropriately individual psychological skills training interventions. The purpose of this study is to examine the psychological profiles of oval racers and road racers.

C3. Cite any relevant literature pertaining to the proposed research:

Anderson, L. (2008). What it takes to take the wheel. *Sports Illustrated*

Arguelles, R. (2008). *Race-car driver psychology and personality.* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (Accession Order No. 3318650)

Benton, J. L. (1961). Auto driver fitness: An evaluation of useful criteria. *The Journal of the American Medical Association, 176*(5), 419-423.

Castillo, I., Tomás, I., Balaguer, I., Fonseca, A. M., Dias, C., & Duda, J. L. (2009). The task and ego orientation in sport questionnaire: Testing for

measurement invariance and latent mean differences in Spanish and Portuguese adolescents. *International Journal of Testing, 9,* 21-32.

Clough, P., Earle, K., & Sewell, D. (2002). Mental toughness: The concept and its measurement. *Solutions in Sport Psychology,* 32-45.

Duckworth, A. L., Kirby, T. A., Tsukayama, E., Berstein, H., & Ericsson, K. A. (2011). Deliberate practice spells success: Why grittier competitors triumph at the national spelling bee. *Social Psychological and Personality Science, 2*(2), 174-181.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 2007, 92,* 1087-1101.

Duda, J. L. (1989). The relationship between task and ego orientation and the perceived purpose of sport among male and female high school athletes. *Journal of Sport and Exercise Psychology, 11,* 318-335.

Duda, J. L., & Whitehead, J. (1998). Measurement of goal perspectives in the physical domain. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 21-48). Morgantown, WV: FIT.

Ebben, W. P., & Gagnon, J. (2012). The relationship between mental skills, experience, and stock car racing performance. *Journal of Exercise Physiology Online, 15*(3), 1-8.

Hardy, L., Roberts, R., Thomas, P. R., & Murphy, S. M. (2010). Test of performance strategies (TOPS): Instrument refinement using confirmatory factor analysis. *Psychology of Sport and Exercise, 11,* 27-35.

Hausenblas, H. A., Nigg, C. R., Dannecker, E. A., Downs, D. S., Gardner, R. E., Fallon, E. A., Focht, B. C., & Loving, M. G. (2001). A missing piece to the transtheoretical model applied to exercise: Development and validation of the temptation to not exercise scale. *Psychology and Health, 16,* 381-390.

Johnsgard, K. W., & Ogilvie, B. C. (1968). The competitive racing driver: A preliminary report. *The Journal of Sports Medicine and Physical Fitness, 8*(2), 87-95.

Johnsgard, K. W., Ogilvie, B. C., & Merritt, K. (1975). The stress seekers: A psychological study of sport parachutists, racing drivers, and football players. *The Journal of Sports Medicine and Physical Fitness, 15,* 158-

169.

Johnsgard, K. W. (1977). Personality and performance: A psychological study of amateur sports car race drivers. *The Journal of Sports Medicine and Physical Fitness, 17*(1), 97-104.

Krikler, B. (1965). A preliminary psychological assessment of the skills of motor racing drivers. *The British Journal of Psychiatry, 111*(471), 192-194.

Leffingwell, T. R., Rider, S. P., & Williams, J. M. (2001). Application of the transtheoretical model to psychological skills training. *The Sport Psychologist, 15,* 168–187.

Marcus, B. H., Rakowski, W., & Rossi, J.S. (1992). Assessing motivational readiness and decision making for exercise. *Health Psychology, 11,* 257-261.

Marcus, B. H., Selby, V. C., Niaura, R. S., & Rossi, J. S. (1992). Self-efficacy and the stages of exercise behavior change. *Research Quarterly for Exercise and Sport, 63*, 60-66.

Miller, B. (1989). Physical and mental preparation for racing. [in Short track Driving Techniques]

Rosenberg, M. (1979). *Conceiving the Self.* New York: Basic Books.

Saucier, G. (1994). Mini-markers: A brief version of Goldberg's unipolar big-five markers. *Journal of Personality Assessment, 63*(3), 506-516.

Spencer, L. (2001). Drivers, crew chiefs must communicate to win.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *The State-Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

Toering, T., Elferink-Gemser, M. T., Jonker, L., van Heuvelen, M. J. G., & Visscher, C. (2012). Measuring self-regulation in a learning context: Reliability and validity of the self-regulation of learning self-report scale (SRL-SRS). *International Journal of Sport and Exercise Psychology,* 1-15.

SECTION D: Subject Population
Section Notes… • D1. If this study involves analysis of de-identified data only (i.e., no human subject interaction), IRB submission/review may not be necessary. Visit the Pre-Submission section in the IRB website for more information.

D1. Identify any population(s) that you will be specifically targeting for the study. Check all that apply: (Place an "X" in the column next to the name of the special population.)			
	Not Applicable (e.g., de-identified datasets)		Institutionalized/ Nursing home residents recruited in the nursing home
	UWM Students of PI or study staff		Diagnosable Psychological Disorder/Psychiatrically impaired
	Non-UWM students to be recruited in their educational setting, i.e. in class or at school		Decisionally/Cognitively Impaired
	UWM Staff or Faculty		Economically/Educationally Disadvantaged
	Pregnant Women/Neonates		Prisoners
	Minors under 18 and ARE NOT wards of the State		Non-English Speaking
	Minors under 18 and ARE wards of the State		Terminally ill
x	Other (Please identify): Racing drivers over the age of 18		

D2. Describe the subject group and enter the total number to be enrolled for each group. For example: teachers-50, students-200, parents-25, parent's children-25, student control-30, student experimental-30, medical charts-500, dataset of 1500, etc. Enter the total number of subjects below.

Describe subject group:	**Number:**
Oval racers	100
Road racers	100
TOTAL # OF SUBJECTS:	200
TOTAL # OF SUBJECTS (If UWM is a collaborating site):	

D3. List any major inclusion and exclusion criteria (e.g., age, gender, health status/condition, ethnicity, location, English speaking, etc.) and state the justification for the inclusion and exclusion:

Participants for the proposed study will be racing drivers participating and having participated exclusively in oval racing or road racing series'. In order to be eligible for the proposed study, participants must meet the following criteria: (a) amateur level of participation; (b) currently participating in a series which is

exclusively oval or road racing (i.e., only experienced with one discipline); (c) over the age of 18 years old; and (d) English-speaking and reading. Participants will be excluded from the proposed study if: (a) they do not meet all four eligibility criteria; or (b) they are unable or unwilling to give their informed consent to participate in the study.

SECTION E: Informed Consent
Section Notes… • E1. Make sure to attach any recruitment materials for IRB approval. • E3. The privacy of the participants must be maintained throughout the consent process.

E1. Describe how the subjects will be recruited. (E.g., through flyers, beginning announcement for X class, referrals, random telephone sampling, etc.). If this study involves secondary analysis of data/charts/specimens only, provide information on the source of the data, whether the data is publicly available and whether the data contains direct or indirect identifiers.

Drivers from amateur oval racing and amateur road racing series' will be recruited to participate in the study. There will be no exclusions based on factors such as gender, age, and ethnicity. Recruitment will take place primarily through word of mouth and personal contacts of the PI. Racers will be contacted via phone, e-mail, and social media (i.e., Facebook, Twitter). A sample email script for recruitment has been attached. Racers will be contacted a maximum of two times by the PI: (a) once for the initial contact; and (b) once for a follow-up. If racers stated they were uninterested in participating during the initial contact, they will not be contacted again.

E2. Describe the forms that will be used for each subject group (e.g., short version, combined parent/child consent form, child assent form, verbal script, information sheet): If data from failed eligibility screenings will be used as part of your "research data", then these individuals **are** considered research subjects and consent will need to be obtained. Copies of all forms should be attached for approval. If requesting to waive documentation (not collecting subject's signature) or to waive consent all together, state so and complete the "Waiver to Obtain-Document-Alter Consent" and attach:

3M (Saucier's Mini-Markers). Saucier's Mini-Markers (3M) Set is a 40-item scale used to assess the Big Five personality traits in an abbreviated manner, when compared with the Big Five Model itself. This survey can be completed within about five minutes, while producing reasonable Big-Five traits (Saucier, 1994). The 3M is attached.

TAI. Taken from Spielberger's State-Trait Anxiety Inventory (STAI), the Trait Anxiety Inventory (TAI) will measure athletes' general tendency to feel anxious. The STAI is a 40-item measure which distinguishes between state anxiety, commonly felt during specific situations; and trait anxiety, the general tendency to experience anxiety (Spielberger, Gorsuch, & Lushene, 1970). We will be using the 20 items measuring trait anxiety. The TAI is attached.

RSE. The Rosenberg Self-Esteem Scale (RSE) is a 10-item questionnaire used to

measure self-esteem. The scale has been used in a large variety of groups, with norms existing from the various measured groups. This scale demonstrates sufficient test-retest reliability (.85 and .88) over a period of two weeks (Rosenberg, 1979). The RSE is attached.

TEOSQ. The Task and Ego Orientation in Sport Questionnaire (TEOSQ) will be used to assess individual differences in emphasizing task and ego orientation within athletic settings (Duda, 1989; Duda & Whitehead, 1998). The instrument has acceptable reliability and validity and has been successfully employed across various populations (Castillo et al., 2009). The TEOSQ is attached.

Stages of Change Questionnaire. An initial pool of 89 items was generated from reviewing the literature (Leffingwell et al., 2001; Marcus and Colleagues, 1992), and the experiences of the PI and a member of the lab. The initial pool contained items representing each of the five proposed stages of change (i.e., precontemplation, contemplation, preparation, action, maintenance). Content validity was established by consensus agreement of three judges with expertise in elite sport. Items without 100% agreement were eliminated, resulting in a final scale of 35 items. The Stage of Change questionnaire is attached.

Decisional Balance Questionnaire. The Decisional Balance questionnaire will be used to assess the benefits (i.e., pros) and costs (i.e., cons) of participating in PST. The questionnaire developed by Leffingwell et al. (2001) will be utilized to measure decisional balance in the proposed study Leffingwell et al. tested the decisional balance questionnaire in two samples yielding an adequate fit for a two-factor model in both sample one (CFI = .94, RMSEA = .072) and sample two (CFI = .92, RMSEA = .072). Leffingwell et al. also reported acceptable levels of internal reliability for the decisional balance measure for both the Pros scale (α's = .92, .94) and Cons scale (α's = .90, .82). The questionnaire is attached.

Self-Efficacy Questionnaire. An initial pool of 21 items was generated from reviewing the literature (Hausenblaus et al., 2001; Leffingwell et al., 2001; Marcus and Colleagues, 1992), and the experiences of the PI and a member of the lab. The initial pool contained items representing self-efficacy and temptation. Content validity was established by consensus agreement of three judges. Items without 100% agreement were eliminated, resulting in a final scale of 19 items. The questionnaire is attached.

Mental Toughness Inventory 48. This inventory is based on how the participants would generally respond to situations. The questions specifically target characteristics of control, commitment, challenge and confidence (Clough et al.,

2002.). The MT-48 is attached.

Grit-12. The online survey will be the 12-Item Grit Scale (Duckworth et al., 2007). The scale consists of 12 questions that offer insight into the psychological characteristics of perseverance and passion for long-term goals of athletes. The Grit-12 is attached.

Self-Regulation. The Self-Regulation of Learning Self-Report Scale (SRL-SRS; Toering et al., 2012) is a 50-item scale which will be used to reliably measure self-regulation as a stable attribute in learning domains, such as sports in this case. This scale is further broken down into 6 subscales – planning, self-monitoring, evaluation, reflection, effort, and self-efficacy. The SRL-SRS is attached.

Test of Performance Strategies-2. The Test of Performance Strategies-2 (TOPS-2; Hardy et al, 2010) will be used to assess psychological skills training (PST) in the proposed sample of athletes. The TOPS-2 will measure the frequency of strategies used for goal setting, emotional control, automaticity, relaxation, self-talk, imagery, attentional control, and activation. Internal consistencies for the eight sub-scales have been shown to range from alpha levels of .63 - .94. The TOPS-2 form is attached.

E3. Describe who will obtain consent and where and when consent will be obtained. When appropriate (for higher risk and complex study activities), a process should be mentioned to assure that participants understand the information. For example, in addition to the signed consent form, describing the study procedures verbally or visually**:**

Consent will be obtained from the participants for the various measures via the UWM survey website, prior to the completion of the demographics and various scales. Without fully completing the consent form, the participants will not be allowed to respond to the questions comprising the demographics and various surveys.

SECTION F: Data Collection and Design
Section Notes… • F1. Reminder, all data collection instruments should be attached for IRB review. • F1. The IRB welcomes the use of flowcharts and tables in the consent form for complex/ multiple study activities.

F1. In the table below, chronologically describe all study activities where human subjects are involved.

- In **column A**, give the activity a short name. E.g., Obtaining Dataset, Records Review, Recruiting, Consenting, Screening, Interview, Online Survey, Lab Visit 1, 4 Week Follow-Up, Debriefing, etc.
- In **column B**, describe in greater detail the activities (surveys, audiotaped interviews,

tasks, etc.) research participants will be engaged in. Address where, how long, and when each activity takes place.

- In **column C,** describe any possible risks (e.g., physical, psychological, social, economic, legal, etc.) the subject may ***reasonably*** encounter. Describe the **safeguards** that will be put into place to minimize possible risks (e.g., interviews are in a private location, data is anonymous, assigning pseudonyms, where data is stored, coded data, etc.) and what happens if the participant gets hurt or upset (e.g., referred to Norris Health Center, PI will stop the interview and assess, given referral, etc.).

A. Activity Name:	**B. Activity Description:**	**C. Activity Risks and Safeguards:**
Recruitment	The PI will contact subjects through personal contact via phone, email, and social media (e.g., Facebook, Twitter). A sample email recruitment script is attached. Racers will be contacted a maximum of two times by the PI: (a) once for the initial contact; and (b) once for a follow-up. If racers stated they were uninterested in participating during the initial contact, they will not be contacted again.	Recruitment involves minimal risk to participants. The PI will verbally and in written form remind all contacts that data is confidential and potential participants are not to be coerced. Potential identifiers will be removed from the data once a driver is assigned to the appropriate category (i.e., oval racer OR road racer) for analysis, within 30 days of their participation.
Online Surveys	Participants will fill out surveys online through Qualtrics at their own leisure. Completing the online surveys will be a one-time occurrence and will take approximately 30 minutes to complete.	Data collection involves minimal risk to participants, with the major risk being breach of confidentiality. The PI will verbally and in written form remind all contacts that data is confidential and potential participants are not to be coerced. In an effort to

		minimize the risk of confidentiality, participants will not be asked to report their names or IP addresses. Data will be exported into a statistical software package within 30 days of the completion of their involvement. Potential identifiers will be removed from the data once a driver is assigned to the appropriate category (i.e., oval racer OR road racer) for analysis, within 30 days of their participation. At this point, data will be deleted from the online server. While it is possible that the athletes may become upset while answering the online surveys, the risk is no greater than that typically encountered when performing online work.
Analysis	Data analysis will be conducted using SPSS 20. Statistical measurement of interest for this study would be an independent *t* test.	Data analysis involves minimal risk. Safeguards include keeping the data in a password protected online database through the secure UWM Survey website and in a secure, password protected folder on the UWM network's research drive.

F2. Explain how the privacy and confidentiality of the participants' data will be maintained after study closure:

The confidentiality of the participants' data will be intact because no names are required on the surveys and also electronic data will be stored inside a password-protected database, on a password-protected computer inside of Pavilion 375 at the University of Wisconsin-Milwaukee. Only the PI and study staff will be able to access these data. Potential identifiers will be removed from the data once the driver is assigned to the appropriate category (i.e., oval racer OR road racer) for analysis, within 30 days of the completion of the surveys, at which point data will be deleted from Qualtrics (according to the process described above in F1).

F3. Explain how the data will be analyzed or studied (i.e. quantitatively or qualitatively) and how the data will be reported (i.e. aggregated, anonymously, pseudonyms for participants, etc.):

The data will be analyzed quantitatively and will be reported aggregated and anonymous. Potential identifiers, such as racing series' participated in, will be removed from the data once the driver is assigned to the appropriate category (i.e., oval racer OR road racer) for analysis, within 30 days of their participation.

SECTION G: Benefits and Risk/Benefit Analysis

Section Notes…

- Do not include Incentives/ Compensations in this section.

G1. Describe any benefits to the individual participants. If there are no anticipated benefits to the subject directly, state so. Describe potential benefits to society (i.e., further knowledge to the area of study) or a specific group of individuals (i.e., teachers, foster children). Describe the ratio of risks to benefits.

There are no direct benefits to the subjects, but we will include a written summary of the research to any participant that requests this information. The description and assessment of the psychological profiles of oval racers and road racers will add to the body of scientific literature on the psychology of racing drivers. Results of this study will also help inform professional practice by helping us to better understand what the different disciplines of racing require psychologically. We believe the risk-to-benefit ratio for this study to be quite low.

G2. Risks to research participants should be justified by the anticipated benefits to the participants or society. Provide your assessment of how the anticipated risks to

participants and steps taken to minimize these risks, balance against anticipated benefits to the individual or to society.

There will be no greater risk to the completion of the various online surveys (e.g., demographics, TEOSQ, MT-48, TOPS-2) than the completion of any other survey about attitudes or experiences about something. Similarly, there will be no greater risk than any other online activity (ex. Email, Facebook, etc.). While it is possible that the athletes may become upset while answering the online surveys, this risk is no greater than that typically encountered when performing online work. Data collection involves minimal risk to participants, with the major risk being breach of confidentiality. Data will be collected using Qualtrics, a password protected, online survey and database. Names will not be required on the surveys, in an effort to minimize the risk to confidentiality. Once a participant is categorized as either an oval racer or road racer, possible identifying information (i.e., current & previous racing series' participated in) will be removed from the data and exported into a statistical software package, within 30 days of the completion of their involvement. At this point, data will be deleted from the online server.

SECTION H: Subject Incentives/ Compensations

Section Notes…

- H2 & H3. The IRB recognizes the potential for undue influence and coercion when extra credit is offered. The UWM IRB, as also recommended by OHRP and APA Code of Ethics, agrees when extra credit is offered or required, prospective subjects should be given the choice of an equitable alternative. In instances where the researcher does not know whether extra credit will be accepted and its worth, such information should be conveyed to the subject in the recruitment materials and the consent form. For example, "The awarding of extra credit and its amount is dependent upon your instructor. Please contact your instructor before participating if you have any questions. If extra credit is awarded and you choose to not participate, the instructor will offer an equitable alternative."
- H4. If you intend to submit to the Travel Management Office for reimbursement purposes make sure you understand what each level of payment confidentiality means **(click here for additional information).**

H1. Does this study involve incentives or compensation to the subjects? For example cash, class extra credit, gift cards, or items.

[__] Yes
[X] No [SKIP THIS SECTION]

H2. Explain what (a) the item is, (b) the amount or approximate value of the item, and (c) when it will be given. For extra credit, state the number of credit hours and/or points. (e.g., $5 after completing each survey, subject will receive [item] even if they do not complete the procedure, extra credit will be award at the end of the semester)**:**

H3. If extra credit is offered as compensation/incentive, an alternative activity (which can be another research study or class assignment) should be offered. The alternative activity (either class assignment or another research study) should be similar in the amount of time involved to complete and worth the same extra credit.

H4. If cash or gift cards, select the appropriate confidentiality level for payments (see section notes):

[__] **Level 1** indicates that confidentiality of the subjects is not a serious issue, e.g., providing a social security number or other identifying information for payment would not pose a serious risk to subjects.

- Choosing a Level 1 requires the researcher to maintain a record of the following: The payee's name, address, and social security number and the amount paid.
- When Level 1 is selected, a formal notice is not issued by the IRB and the Travel Management Office assumes Level 1.
- Level 1 payment information will be retained in the extramural account folder at UWM/Research Services and attached to the voucher in Accounts Payable. These are public documents, potentially open to public review.

[__] **Level 2** indicates that confidentiality is an issue, but is not paramount to the study, e.g., the participant will be involved in a study researching sensitive, yet not illegal issues.

- Choosing a Level 2 requires the researcher to maintain a record of the following: A list of names, social security numbers, home addresses and amounts paid.
- When Level 2 is selected, a formal notice will be issued by the IRB.
- Level 2 payment information, including the names, are attached to the PIR and become part of the voucher in Accounts Payable. The records retained by Accounts Payable are not considered public record.

[__] **Level 3** indicates that confidentiality of the subjects must be guaranteed. In this category, identifying information such as a social security number would put a subject at increased risk.

- Choosing a Level 3 requires the researcher to maintain a record of the following: research subject's name and corresponding coded identification. This will be the only record of payee names, and it will stay in the control of the PI.
- Payments are made to the research subjects by either personal check or cash.
- Gift cards are considered cash.
- If a cash payment is made, the PI must obtain signed receipts.

SECTION I: Deception/ Incomplete Disclosure (INSERT "NA" IF NOT APPLICABLE)
Section Notes… • If you cannot adequately state the true purpose of the study to the subject in the informed consent, deception/ incomplete disclosure is involved.

I1. Describe (a) what information will be withheld from the subject (b) why such deception/ incomplete disclosure is necessary, and (c) when the subjects will be debriefed about the deception/ incomplete disclosure.

NA

IMPORTANT – Make sure all sections are complete and attach this document to your IRBManager web submission in the Attachment Page (Y1).