Cognition, personality and emotional intelligence among South African rugby union players: An exploratory study

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Examination: November 2019

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This thesis is dedicated to Prof Dawie Malan,

my mentor and friend.

1 March 1953 – 14 September 2018

DECLARATION BY THE RESEARCHER

Herewith I, Ankebé Kruger, declare that this thesis titled *"Cognition, personality and emotional intelligence among South African rugby union players: An exploratory study"* submitted to the North-West University's Potchefstroom Campus, in fulfilment of the requirements for the PhD in Psychology, is my own work which has been language edited and has not been submitted to any other university for examination. I furthermore declare that this thesis is my own work and that all references used has been acknowledged.

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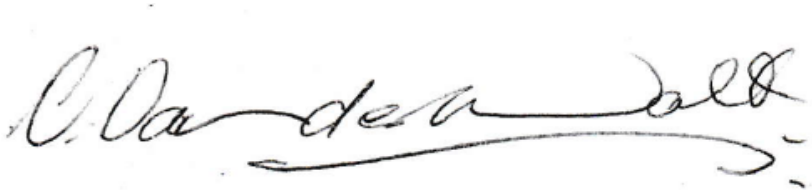

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Note to the examiners

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Cognition, personality and emotional intelligence among South African rugby union players: An exploratory study

At the elite level in sport, the difference between winning and losing is often ascribed to a player's level of psychological abilities. Given that athletes' physical, tactical and technical abilities are fairly equal, an athlete's winning performance usually is ascribed to him/her possessing better mental skills than the rest. In rugby, numerous studies have investigated certain aspects important for performance such as anthropometrical, physiological and biomechanical requirements. However, the psychological characteristics of elite rugby players and the relationship thereof with performance have not yet attracted much attention among researchers. Based on the limited research pertaining to the role of cognition, personality and emotional intelligence with regard to playing level in rugby, the following research questions were formulated: 1) Which neurocognitive variables significantly differ between male, South African professional and semi-professional rugby union players? (Article 1); 2) Which personality traits significantly differ between male, South African professional and semi-professional rugby union players? (Article 2); 3) Which aspects of emotional intelligence significantly differ between male, South African professional and semi-professional rugby union players? (Article 3); and 4) Does a significant interrelationship exist between neurocognitive variables and emotional intelligence and between personality and emotional intelligence among male, South African professional and semi-professional rugby union players? (Article 4).

The objectives of the study were subsequently also formulated as follows: 1) To determine if neurocognitive variables significantly differ between male, South African professional and semi-professional rugby union players; 2) To determine whether personality traits significantly differ between male, South African professional and semi-professional rugby union players; 3) To determine whether aspects of emotional intelligence significantly

differ between male, South African professional and semi-professional rugby union players; and 4) To establish whether a significant interrelationship exists between neurocognitive variables and emotional intelligence and between personality and emotional intelligence among male, South African professional and semi-professional rugby union players.

Since this was an exploratory study, a quantitative empirical research approach with a cross-sectional survey design was used along with a convenience sample. The sample consisted of 79 male South African rugby union players between 19 and 37 years of age participating at national, transnational and university levels. To address objectives 1-3, the total group of players was divided into a professional group (n = 55) and a semi-professional group (n = 24). The professional group consisted of full-time players who were competing at the highest level in a transnational competition and were remunerated for playing rugby, while the semi-professional players were full-time students at a university and competing in the top tier university competition, but therefore not earning a salary for being part of the team. To address objective 4, all the players were treated as one group. The players all completed the WebNeuro Sport online assessment representing a holistic assessment of various factors which might potentially influence an athlete's performance. The assessment consists of a demographic questionnaire (including name, surname, age and gender) and seven assessments, namely the Carlstedt Subliminal Attention, Reactivity and Coping Scale-Athlete Version (CSARCS-A); the cognitive functioning domain; the Brain Resource Inventory for Screening Cases (BRISC) which is a screening tool for markers of self-regulation; the Depression Anxiety Stress Scale (DASS); a sleep assessment questionnaire which evaluates the test taker's quality and frequency of sleep; the Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) and a Personality inventory (NEO-FFI). For this study, only the data of the cognitive functioning domain, the BRIEF, and the NEO-FFI were used.

The results of the quantitative data suggest that no significant neurocognitive difference existed between the professional and semi-professional players. Neuroticism was, however, the only personality trait that was found to differ significantly between players playing at different levels. On emotional intelligence (EI), the external emotional capacity subscale (EEC) obtained a medium worthwhile effect in favour of the professional players. Lastly, the findings indicate a significant correlation between total EI and extraversion, and conscientiousness. Internal emotional capacity (IEC) significantly correlated with extraversion, openness, agreeableness and conscientiousness. External emotional capacity (EEC) showed a significant correlation with extraversion and openness. With regard to cognition, external emotional capacity significantly correlated with verbal ability.

Contrary to our expectations, the findings showed few psychological differences between professional and semi-professional players with only neuroticism and external emotional capacity differing between players playing at different levels. Finally, seen from a theoretical point of view, the results indicated that EI is rather associated with personality than with an individual's cognition.

KEY WORDS: Cognition, emotional intelligence, performance, personality, rugby union, sport psychology

Kognisie, persoonlikheid en emosionele intelligensie onder spelers van die Suid-Afrikaanse Rugbyunie: ’n Verkennende studie

Op elite-vlak in sport word die verskil tussen wen en verloor gereeld toegeskryf aan die speler se psigologiese vaardighede. Gegewe as atlete se fisieke, taktiese en tegniese vermoëns redelik gelyk is, word ’n atleet se wenprestasie gewoonlik toegeskryf daaraan dat die hy/sy oor beter psigologiese vaardighede beskik. In die geval van rugby het talle studies sekere aspekte ondersoek wat belangrik is vir prestasie soos antropometriese, fisiologiese en biomeganiese vereistes, maar die psigologiese eienskappe van elite-rugbyspelers en die verband daarvan met prestasie het nog nie veel aandag onder navorsers getrek nie. Op grond van die beperkte navorsing oor die rol van kognisie, persoonlikheid en emosionele intelligensie met betrekking tot spelvlak in rugby, is die volgende navorsingsvrae geformuleer: 1) Watter neurokognitiewe veranderlikes verskil beduidend tussen manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers? (Artikel 1); 2) Watter persoonlikheidseienskappe verskil beduidend tussen manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers? (Artikel 2); 3) Watter aspekte van emosionele intelligensie verskil beduidend tussen manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers? (Artikel 3); en 4) Is daar 'n beduidende onderlinge verband tussen neurokognitiewe veranderlikes en emosionele intelligensie en tussen persoonlikheid en emosionele intelligensie onder manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers? (Artikel 4).

Die doelstellings van die studie was dus soos volg geformuleer: 1) Om te bepaal of neurokognitiewe veranderlikes beduidend verskil tussen manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers; 2) Om te bepaal of daar ’n beduidende verskil voorkom ten opsigte van persoonlikheidseienskappe tussen manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers; 3) Om vas te stel of aspekte van

emosionele intelligensie beduidend verskil tussen manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers; en 4) Om vas te stel of daar 'n beduidende onderlinge verband bestaan tussen neurokognitiewe veranderlikes en emosionele intelligensie en tussen persoonlikheid en emosionele intelligensie onder manlike, Suid-Afrikaanse professionele en semi-professionele rugbyspelers.

As ’n verkennende studie het dit van ’n kwantitatiewe empiriese navorsingsbenadering en ’n dwarsdeursnit-ontwerp gepaard met ’n beskikbaarheid-steekproef gebruik gemaak. Die steekproef vir die studie het bestaan uit 79 manlike spelers van die Suid-Afrikaanse rugby-unie tussen 19 en 37 jaar wat op nasionale, transnasionale en universiteitsvlakke speel. Om doelstellings 1-3 te verreken is die totale groep spelers verdeel in ’n professionele groep (n = 55) en ’n semi-professionele groep (n = 24). Die professionele groep het bestaan uit voltydse spelers wat op die hoogste vlak in ’n transnasionale kompetisie meegeding het en vergoed is vir hul spel, terwyl die semi-professionele spelers voltydse studente was wat aan ’n universiteit verbonde was en aan ’n topvlak-universiteitskompetisie deelgeneem het, en dus geen salaris vir hul deelname ontvang het nie. Om doelstelling 4 te verreken, is al die spelers as een groep hanteer. Die spelers het die “WebNeuro Sport”-assessering aanlyn voltooi wat ’n holistiese evaluering van verskillende faktore verteenwoordig wat die atleet se prestasie moontlik kan beïnvloed. Die assessering bestaan uit ’n demografiese vraelys (insluitend naam, van, ouderdom en geslag) en sewe assesserings, naamlik die “Carlstedt Subliminal Attention, Reactivity and Coping Scale-Athlete Version (CSARCS-A)”; die kognitiewe funksioneringsdomein; die “Brain Resource Inventory for Screening Cases (BRISC)”, wat ’n siftingsinstrument is vir merkers van selfregulering; die depressie, angs en stresskaal (DASS); ’n vraelys vir slaapassessering wat die kwaliteit van die deelnemer en die frekwensie van die slaap evalueer; die “Brain Resource Inventory for Emotional Intelligence Factors (BRIEF)”

en ’n persoonlikheidsinventaris (NEO-FFI). Vir die doel van hierdie studie is slegs die data van die kognitiewe funksioneringsdomein, die “BRIEF” en die NEO-FFI gebruik.

Die resultate van die kwantitatiewe data het voorgestel dat daar geen noemenswaardige neurokognitiewe verskille bestaan tussen die professionele en semi-professionele spelers nie. Slegs neurotisme het egter as die enigste persoonlikheidseienskap uitgestaan wat beduidend tussen spelers wat op verskillende vlakke deelneem, verskil het. Ten opsigte van emosionele intelligensie (EI) het die eksterne emosionele vermoë ’n medium noemenswaardige effek tot voordeel van die professionele spelers getoon. Laastens dui die bevindinge op ’n beduidende korrelasie tussen totale EI en ekstraversie en pligsgetrouheid. Interne emosionele kapasiteit (IEC) het beduidend gekorreleer met ekstraversie, openheid, inskiklikheid en pligsgetrouheid. Eksterne emosionele kapasiteit (EEG) het 'n beduidende korrelasie met ekstraversie en openheid getoon. Rakende kognisie het eksterne emosionele vermoëns beduidend gekorreleer met verbale vermoë.

In teenstelling met ons verwagtinge het die bevindinge beperkte psigologiese verskille getoon tussen professionele en semi-professionele spelers, met slegs neurotisme en eksterne emosionele vermoë wat verskil het tussen spelers wat op verskillende vlakke deelneem. Laastens, beskou vanuit ’n teoretiese oogpunt, het die resultate aangedui dat EI eerder met persoonlikheid geassosieer word as met ’n individu se kognisie.

SLEUTELTERME: Kognisie, emosionele intelligensie, prestasie, persoonlikheid, rugby-unie, sportsielkunde

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 2

CHAPTER 4

CHAPTER 1

Introduction, problem statement, aims and objectives of the study

- **Worldview of the researcher**
- **Introduction and background of the study**
- **Rugby in the Southern Hemisphere**
- **Rugby in South Africa**
- **The WebNeuro Sport**
- **Problem statement**
- **Neurocognitive functioning in sport**
- **Emotional Intelligence (EI) in sport**
- **Personality in sport**
- **The interrelationship between cognition, emotional intelligence and personality**
- **Research questions**
- **Research objectives**
- **Thesis statement**
- **Delineations and limitations**
- **Assumptions**
- **Significance**
- **Chapter overview**
- **References**

World view of the researcher

As a qualified Sport Scientist, I have always been interested in exploring factors which can contribute to an athlete's sport performance. The idea for this research originated from my curiosity in how sport performance can be improved, in addition to physical and physiological factors, and therefore I decided to investigate cognition, personality and emotional intelligence among a cohort of South African rugby union players. With this thesis, I completed a proverbial full circle since I feel it contributes to a holistic approach to sport performance. I have always preferred quantitative research as it provides me with numbers, percentages and graphs, which resonates with my personality.

Introduction and background to the study

In 1823, while playing football, a young boy from Warwickshire, England, William Web Ellis, decided to pick up the ball in his arms, run away with it where after he put it behind the goal line. This was believed to be the beginning of rugby union (hereafter referred to as rugby) (Petru, 2016). At that time there were no rules forbidding football players to touch the ball with their hands and only forty years later the Football Association implemented it as a rule in soccer. By accepting touching the ball by hand and breaking away from the rule, the Rugby Football Union was established. Consequently rugby was born, and it spread to the rest of the world through the British Empire to countries such as France, South Africa, Canada, Argentina, New Zealand, the Pacific Islands, Japan and Australia (Knobel, 2010). Initially, rugby was played for various reasons, such as establishing unity after wars and was originally only played by men (South African Rugby Football Union, 1995). In recent times rugby is played professionally, for reasons such as entertainment and played by pre-teen males, teen males, senior males, pre-teen females, teen females as well as senior females. Presently rugby is also played all over the world as a very popular professional sport. Selected national men's rugby teams from around the world compete for the Rugby World

Cup Webb-Ellis trophy every four years (Knobel, 2010). In addition to rugby union, rugby is also played in other formats such as rugby league and sevens rugby. The present study will, however, focus exclusively on the 15-a-side version of the game known as rugby union. Rugby is a full-contact sport involving two teams consisting, in the case of the 15-a-side version of the game, of 15 players per team (Andrew, Grobbelaar, & Potgieter, 2007) with 8 forward players and 7 backline players with their own physiological, physical, psychological and game-specific requirements (Andrew et al., 2007). Furthermore, rugby is a high-intensity, sporadic evasion game which involves static strength situations, collisions between players, explosive running and jumping activities as well as periods of rest (Petru, 2016).

Rugby in the Southern Hemisphere

Rugby is characterized by national as well as international competitions. After rugby became professional in 1996, in the Southern hemisphere, the rugby boards of the most prominent Southern hemisphere rugby playing nations at the time, namely the Australian, New Zealand and South African rugby boards formed what became known as SANZAAR (South African, New Zealand and Australian Rugby). They aimed to govern an annual, multi-national provincial-based competition among the domestic teams from these three nations against each other which became known as the Super 10 competition, which later expanded to become the Super 12 (SANZAAR Super Rugby, 2018). In 2006 two new franchises, the Western Force from Australia and the Cheetahs from South Africa were added to create the expanded Super 14. With the addition of the Melbourne Rebels from Australia in 2011, the competition changed once more to Super 15 consisting of five teams from each of the three countries. In 2016 three more teams were added to what then became known as the Super Rugby competition. These teams include the Southern Kings from South Africa, the Jaguars from Argentina and the Sunwolves from Japan, bringing the competition to a total of 18 teams. After decreased interest in the competition and a much longer format during the 2016

and 2017 seasons in particular, SANZAAR decided to remove three teams from the Super Rugby competition, namely the Western Force from Australia as well as the Southern Kings and the Cheetahs from South Africa at the end of the 2017 season, which resulted in it reverting back to the previously used 15-team format (SuperXV, 2018). This decision of SANZAAR led to the Cheetahs and Kings being admitted into a Northern hemisphere-based competition comprising European teams, then known as the Pro12. This changed to the Pro14 with the addition of the two new South African teams. The Cheetahs and the Kings now play alongside four teams from Ireland and Wales and two teams each from Italy and Scotland.

Rugby in South Africa

In the South African context, rugby is a very popular sport with 434 219 registered players. According to World Rugby, this total can be subdivided into 157 980 pre-teen males, 121 879 teen males, 143 722 senior males, 1 653 pre-teen females, 5 504 teen females and 3 481 senior females (Wikipedia, 2018). In addition to the Super Rugby and the Pro14 competitions referred to in the previous section, the domestic Currie Cup tournament has been the premier national rugby competition in South Africa since its first edition in 1892. The number of teams participating in this competition has varied from season to season since its inception with the Currie Cup trophy being awarded to the winning team of the top tier section of the competition. In addition to the foregoing, the Varsity Cup competition was introduced in 2008 with the intention so serve as a new breeding ground for young talent. This competition is currently the premier Varsity Rugby competition and is contested on an annual basis between the nine foremost university rugby teams in South Africa. Between 2008 and 2016, eight teams participated in the competition, which was expanded to nine teams from 2017 onwards.

Apart from the competitions already mentioned, South Africa’s national team (better known as the Springboks) also participates in a Southern hemisphere competition on an

annual basis, currently known as the Rugby Championship which includes Argentina, Australia, South Africa and New Zealand. In addition to the Rugby Championship, South Africa also plays test matches against European teams which predominantly participate annually in the European Six Nations competition, namely England, France, Wales, Scotland, Ireland and Italy. Other international competitions which South Africa participates in further include the Rugby World Cup and the Africa Cup as well as games against teams such as Fiji, USA and Samoa.

While South Africa was still under an international boycott due to apartheid, the Springboks did not participate in the first two World Cups held in 1987 and 1991. Since then, South Africa has entered the competition and won the World Cup twice, first in 1995 and again in 2007. Initially, The Tri Nations was an annual competition contested only between New Zealand, Australia and South Africa. In 2012, SANZAAR invited Argentina to join the former Tri Nations tournament which led to the development of the Rugby Championship. South Africa won the Rugby Championship four times: in 1998, 2004, 2009 and 2019. Another international competition is the Africa Cup, an annual competition which involves ten African nations and in which South Africa sent its top amateur players to this competition until 2007.

From the above discussion, it is clear that rugby has a long and rich history and is a popular sport in the South African context with several tournaments in which the South African teams participate annually. However, regarding World Rugby's world rankings, it appears that the standard of professional rugby in South Africa has seen a steady decline over the past ten years. For instance, in 2008, the South African National team (the Springboks) was ranked number one on the world rankings, after which the team systematically dropped to number 6 in 2018 (World Rugby, 2018a). This decrease in performance has prompted researchers to investigate factors capable of predicting performance in rugby. Numerous

studies have identified factors that are related to performance in sport, including rugby, such as the anthropometrical (Duthie, Pyne, & Hooper, 2003; Olds, 2001; Quarrie, Handcock, Toomey, & Waller, 1996; Quarrie & Wilson, 2000), physical (Cunningham et al., 2013; Gabbett, Kelly, & Pezet, 2007), physiological and biomechanical (Trewartha, Munro, & Steele, 2007) requirements as well as the frequency of injuries among players (Kaux et al., 2015; Kemp, Hudson, Brooks, & Fuller, 2008). However, the assessment of the psychological characteristics of elite rugby players and their relationship with performance has not yet attracted much attention among researchers (Downey, 2010). This sparked the interest in the present study.

In the present study the Web-Neuro Sport, an online assessment battery, was used as the primary method of assessment of the rugby players' level of neurocognitive functioning, their personality profile, and their level of emotional intelligence.

The WebNeuro Sport

The Brain Resource Company (BRC) is a service company providing standardized test batteries, measuring cognition and brain function across various applications. Data from the Brain Resource International Database (BRID) includes demographics, brain function (Psychophysiology – EEG/ERP), cognition (online/touch screen test battery), brain structure (sMRI/fMRI) and Genomics (cheek swab or blood sample) (Gorden, Cooper, Rennie, Hermens, & Williams, 2005; Paul et al., 2005; Williams et al., 2005). The BRC provides different assessments suited for profiling during staff recruitment, detection of cognitive deterioration, identification of signs of depression or the effect of sleep deprivation on cognition, general cognitive performance in sport and the effect of concussion, identification of gifted children or those with learning disabilities as well as the quantification of cognitive impairment or disability (Schoeler, 2009).

The assessments are computerized and fully automated and run on a web-based platform, requiring an internet connection and a Windows computer with keyboard and mouse. The assessments are designed to be user-friendly and after completion of the assessment, the data is transmitted to the Brain Resource Central Analysis Facility where a comprehensive report of the test results is generated within 24 hours.

The WebNeuro Sport represents a holistic assessment of various factors which might potentially influence a sport person's performance. The assessment consists of a demographic questionnaire (including name, surname, age and gender) and seven assessments, namely the Carlstedt Subliminal Attention, Reactivity and Coping Scale-Athlete Version (CSARCS-A); the cognitive functioning domain; the Brain Resource Inventory for Screening Cases (BRISC) which is a screening tool for markers of self-regulation; the Depression Anxiety Stress Scale (DASS); a sleep assessment questionnaire which evaluates the test taker's quality and frequency of sleep; the Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) and a Personality inventory (NEO-FFI) (Costa & McCrae, 1992; Costa, McCrae, & PAR Staff, 2010) [Brain Resource Company (BRC), 2010]. The assessment was initially completed as part of various service delivery projects with the respective teams. Therefore, the players provided their names and surnames when they completed their assessments. The data was, however, anonymized for the purposes of this research project. Following a description of the measuring instruments used in the present study, the subsequent section outlines its problem statement.

Problem statement

At the elite level, the difference between good and great players are often ascribed to the players' level of psychological abilities, and how well players can apply their skills during high-pressure situations (Rugby Football Union & Kruger, 2008). Weinberg and Gould (2015) agree in this regard by stating that in cases where an athlete's physical abilities are

fairly equal, the winner is usually the athlete with better mental skills. As it was highlighted in the previous sections, the game of rugby has evolved as a professional sport. Understanding which characteristics a player will need to perform optimally under pressure is a problem that numerous researchers have attempted to solve. It also becomes clear how this understanding can aid professional teams with selecting and contracting the best players and, in the process, gain a competitive advantage for their teams. As stated earlier, numerous studies have identified certain facets of such a profile, including the anthropometrical (Duthie et al., 2003; Olds, 2001; Quarrie et al, 1996; Quarrie & Wilson, 2000), physical (Cunningham et al., 2013; Gabbett et al., 2007), physiological and biomechanical (Trewartha et al., 2007) requirements of rugby, as well as the frequency of injuries among players (Kaux et al., 2015; Kemp et al., 2008). The profile of the rugby player who will be able to perform effectively under pressure has, however, not yet been fully established, particularly within the South African context and from a psychological perspective. As such, this study aimed towards filling this void in the existing research. Furthermore, research regarding the relationship between players' psychological and neurocognitive characteristics and performance in rugby may identify important factors that could contribute to performance, over and above the physiological and technical characteristics of elite rugby players.

The focus of traditional sport psychology has mostly been on the identification of foundational skills such as commitment, attitude, self-confidence and motivation as contributors to success in sport (Poczwardowski, Sherman, & Henschen, 1998). However, these assessments are mostly done by making use of pencil-and-paper questionnaires resulting in a tendency to assess a player's perception of their abilities, instead of assessing their actual abilities. Recent advances in science and technology have however started to allow researchers to start investigating more objective, measurable aspects such as neurocognitive functioning, instead of making use of self-report assessments as a means of

evaluating sport participants' psychological abilities. The following section will provide the reader with an overview of neurocognitive functioning in sport.

Neurocognitive functioning in sport

Recently, Faubert (2013, p. 1) asked the questions: "What makes elite athletes so special? Do the brains of athletes anatomically and functionally differ from non-athletes and does this difference relate to performance level?" In line with this notion, Savelsbergh, Van der Kamp, Williams, and Ward (2005) found that elite athletes exhibit superior abilities on sport-specific perceptual abilities, visual skills and attention (Mann, Williams, Ward, & Janelle, 2007). Furthermore, it has been shown that elite athletes performed better than non-elite athletes on more complex, higher-order, non-sport-specific neurocognitive functioning such as executive functioning and inhibition of behaviour (Alves et al., 2013; Verburgh, Scherder, Van Lange, & Oosterlaan, 2014; Vestberg, Gustafson, Maurex, Ingvar, & Petrovic, 2012). Besides the foregoing, the ability to master complex movements seemed to be another important neurocognitive function in sport (di Cagno et al., 2014; Doyon & Benali, 2005; Yarrow, Brown, & Krakauer, 2009). A study performed on gymnasts found that the rate against which gymnasts learned sport-specific motor skills predicted their competition rankings in later years (di Cagno et al., 2014). Carlstedt (2007) conceptualizes the neurocognitive functioning of an athlete as a construct consisting of memory, attention, behavioural tasks, sensory-motor/spatial functioning, verbal functioning, executive functioning, and emotion recognition. This conceptualization will furthermore be used throughout the present study to guide the discussion of neurocognitive functioning in sport and its relationship with performance. Each of these domains will be discussed individually in the following sections.

Participants in dynamic and ballistic team sports such as rugby often need to select situation-specific appropriate actions quickly and efficiently during high interference situations and under extreme pressure (Furley & Memmert, 2013). Recent research (Furley &

Memmert, 2010; Furley & Memmert, 2013) suggests that a player's attention and working memory (WM) are important cognitive factors in understanding performance in the foregoing situations. Working memory capacity (WMC) is a cognitive ability that allows individuals to attend to, learn, store, retrieve and manipulate new information, which includes both long- and short-term memory (BRC, 2010; Shipstead, Harrison, & Engle, 2016). The word *capacity* in the above-mentioned definition of WMC refers to the differences individuals display in the functionality of this system (Shipstead et al., 2016). Since rugby became a professional sport at the end of 1995 (Mellalieu, Neil, Hanton, & Fletcher, 2009), the game has evolved into a more structured sport with teams displaying more complex match strategies and tactics (Hendricks, Roode, Matthews, & Lambert, 2013). An assumption can therefore be made that to successfully execute these strategies and tactics, a player needs to be able to maintain task- relevant information while facing distracting events on the playing field (Mayers, Redick, Chiffriller, Simone, & Terraforte, 2011). Supporting this assumption, these researchers also speculate that only athletes with a higher WMC will excel in sports such as football and volleyball. The researcher could not identify any studies that have specifically investigated differences of WMC between elite and amateur male, South African rugby union players, therefore further research is deemed necessary to confirm whether higher WMC can distinguish between players of different playing levels.

The necessity for athletes to maintain task-relevant information despite the interference of distractions on the playing field is clear, both for performance and the prevention of physical injuries (Furley, Bertrams, Englert, & Delphia, 2013; Mayers et al., 2011). Parasuraman (as cited in Lezak, Howieson, Bigler, & Tranel, 2012) defined attention and behavioural tasks as the ability to selectively concentrate during cognitive tasks, detect and respond to changes in the environment; sustain attention over time and control impulses. Most team sports, including rugby, provide a source of unpredictability and uncertainty for all players (Passos,

Araújo, Davids, & Shuttleworth, 2008). Therefore, a player's ability to effectively detect and respond to the constantly changing environment might have a significant effect on such a player's performance. Furthermore, attentional lapses in sport are inevitable and occur when an athlete's concentration momentarily becomes disengaged from the task at hand (Moran, 2009). In this regard, Chuang, Huang, and Hung (2013) found that sustained attention led to improved performances among basketball players during free throws. In rugby, Holland, Woodcock, Cumming, and Duda (2010) also identified an appropriate attentional focus as one of nine qualities regarded to be crucial for participation in elite youth rugby. However, no published research could be traced which determined the difference between an elite and amateur rugby player's attention and behavioural tasks, again emphasizing the need for research in this regard. Another important neurocognitive factor which might affect performance is a player's level of sensory-motor functioning.

Sensory-motor functioning refers to the ability to perform motor skills, one's ability to execute a movement, respond to information in a timely fashion and includes reaction time as well as hand-eye coordination (BRC, 2010). According to Ludeke (2003) hand-eye coordination, reaction time and peripheral awareness are visual skills that any rugby player needs to master to perform at an elite level. Hand-eye coordination has been defined as a synchronized perceptual-motor response to visual sensory stimuli, with the hands (Ludeke & Ferreira, 2003). Reaction time refers to the time it takes to perceive and respond to visual stimulation (Ludeke, 2003), while peripheral awareness is the ability of the athlete to maintain central fixation on a target and be aware of what is happening to the sides or in the peripheral visual field (Ludeke, 2003, p. 15). An example in the game of rugby may be a jumper in the lineout who jumps to catch the ball. Such a player will need optimal hand-eye coordination to successfully execute the catch (Van Velden, 2013). Furthermore, to catch a high ball successfully a player needs to catch it at the highest point of the jump and will, as a

result, require exact timing of the jump. Simultaneously with the jump, the player must position his or her body in a way that protects him or herself from approaching defenders while also not knocking the ball forward when he or she makes the catch in the air. The importance of optimal hand-eye coordination in executing this skill becomes clear from this example (Van Velden, 2013). The same line of argument can also be followed for most positions on the rugby field, as the entire game consists of multi-faceted movements and segments of play, which will draw on a wide range of cognitive abilities. To further illustrate the foregoing, Greenwood (1993) indicated that the flyhalf (number 10) and the scrumhalf (number 9) are very important role-players in real-time decision-making on the field. The flyhalf is responsible for the coordination of the backline players while he or she selects the speed and attacking mode. Therefore, the flyhalf requires the ability to quickly summarize the situation well and have excellent peripheral awareness, reaction time and visual concentration so as to act on whatever decision he or she makes next. In most instances, the options include kicking, passing or running the ball into identified space on the field. These factors are extremely important to successfully execute the said tasks. On the other hand, the scrumhalf in many instances controls the attack of the team as the link between the backline players (numbers 9 to 15) and the forwards (numbers 1 to 8) (Greenwood, 1993). The scrumhalf needs to pass the ball to the flyhalf, kick the ball or play on the side to the nearest touchline, often referred to as the blindside. He or she also needs the ability to scan the field and make the correct decisions in a limited time (Ludeke, 2003). In this regard, Ludeke (2003) found that senior professional rugby players performed statistically significantly better ($p<0.05$) compared to club players in terms of eye-body coordination and reaction time. Although not statistically significant, the professional players were also found to outperform their club-level counterparts in hand-eye coordination and peripheral awareness. From the above-mentioned discussion, it is evident that sensory-motor functioning plays an important role in

rugby performance and yet a clear gap exists in the literature pertaining to the difference in a player's sensory-motor functioning between elite and amateur-level rugby players. In addition to the above-mentioned neurocognitive factors that might influence a rugby player's level of performance, another essential component during high-pressure competition situations is the ability to communicate clearly and effectively.

Communication refers to "the act of expressing or transmitting ideas, information, knowledge, thoughts, and feelings, as well as understanding what is expressed by others" (Burton & Raedeke, 2008, p. 16). Communication plays an important role, in everyday life as well as in sport, due to its ability to transfer information (Lyons et al., 2010). With specific reference to rugby, Westgate (2007) identified communication as one of ten key factors for a successful defence in a game. According to Westgate (2007), communication is vital in organizing the team's defenders and to identify potential attacking threats. Furthermore, the defending players on the inside and outside of the ball carrier have to communicate clearly and loudly while they are pushing forward in their effort to defend. Despite the benefit of communication to the team, it is also being used to exert pressure on the opposition through so-called 'big talk' (intimidation) and 'small talk' (organization). Also, Laycock and Midcalf (2008) stated that effective communication might be the difference between players being able to prevent a challenging situation from happening and players having to react to a particular situation. Optimal communication can also be the difference between making an informed decision about a specific situation and an educated guess about what to do (Laycock & Midcalf, 2008). Effective communication plays an important role in rugby, but no studies could be identified that have thus far investigated the difference between elite and amateur players' language or verbal processing abilities. Furthermore, executive functions appear to be of significant importance in sport.

Executive functions refer to the ability to plan, strategize, execute complex tasks, abstract thinking, rule acquisition, inhibiting inappropriate actions and ignoring irrelevant sensory information (BRC, 2010; Verburgh et al., 2014). Also, executive functioning can include problem-solving, inhibition and decision-making (Jacobson & Matthaeus, 2014). Several researchers agree that efficient decision-making is of crucial importance in a team sport (Furley et al., 2013; Tavares, 1997), referring to a player's ability to make quick and accurate tactical decisions that might be significant to the entire team. Rugby is also played in a dynamic environment where players need to make continuous decisions (Tavares, 1997). The quality and speed of a player's decision-making depend on various factors such as speed and accuracy of information received, tactical knowledge, skill level and the player's experience (Tavares, 1997) which might relate to 'pattern recognition'. A player does not only make decisions when in possession of the ball but also when his or her teammates have the ball. When a player has possession of the ball, he or she must mostly decide whether to run with it, to retain possession, to kick for better field position or pass the ball to a teammate. Essentially the aim for most players is to put the ball into space, either through kicking, running or passing. If the player decides to pass the ball, he or she must therefore determine to whom it should be passed in the most effective way as well as at the most appropriate moment (Allen, 2007).

To further underline the importance of decision-making in sport, Ibáñez et al. (2008) found that poor decision-making is one of the most important predictors of losses of the ball in basketball as it leads to turnovers, particularly in closely contested games (Lorenzo, Gómez, Ortega, Ibáñez, & Sampaio, 2010). Supporting the previous researchers, a study was performed by Raab, Masters, and Maxwell (2005) on table tennis players which indicated that players who focus on decision-making during training showed improvements in performance. The important role of executive functions in sport, and especially rugby, is clear

from the foregoing discussion. Despite the importance thereof in rugby, no published research could be found which specifically focussed on the difference between a player's level of executive functioning and the level at which he or she was playing. According to the conceptualization of Carlstedt (2007) of neurocognitive functioning, another important neurocognitive factor to consider in sport is emotional recognition.

The BRC (2010) defines emotion recognition as the ability to recognize interpersonal emotions through facial expression. Literature reveals six universal emotions that are disclosed by different facial expressions, namely anger, surprise, fear, sadness, happiness and disgust (Batty & Taylor, 2003; Boloorizadeh & Tojari, 2013; Ekman & Friesen, 1971). Coaches' ability to recognize emotions is of utmost importance in sports where the outcome of a competition is highly dependent on the effective identification and regulation of emotions by players and coaches alike. A coach should therefore be able to detect and perceive an athlete's feelings in fractions of a second to be able to identify a problem, change their decisions, provide suitable guidance, make the necessary alterations accordingly and in doing so ensure improved performance (Bolaarizadeh & Tojari, 2013). Although not yet scientifically proven, the effect of emotional identification on players could lead to activation of the limbic system and hence indirectly impact on decision-making and/or motor execution (Luo & Yu, 2015). Furthermore, for players, self-regulation of emotions would be more important than the recognition of emotions.

Although emotional recognition might not be an essential component for players during an on-field performance, the BRC sub-test (consisting of two parts) measuring emotional recognition raised an interesting question. During the second part of the test (Emotion bias) the individual is presented with two sets of faces on the screen of which one face is repeated from the previous part of the emotion identification task. The player selects the face they remembered from the previous task as quickly as possible. Thus, it is clear that the

participants need sound judgement and be able to make very quick decisions to optimally perform on this test. In essence, this sub-test is measuring pattern recognition which is a fundamental ability required for performance in team sports (Smeeton, Ward, & Williams, 2004). Pattern recognition in sport requires that players make a judgement based on familiarity to identify structured game-play patterns as new or similar to patterns encountered previously (Smeeton et al., 2004). On the field, rugby players are continually faced with situations in which they need sound judgment and to take decisions very quickly. Therefore it can be hypothesized that players who are participating at different levels will exhibit differences in their judgement and ability to make quick decisions based on their performance in the emotion-bias task. Although emotional recognition is more advantageous for coaches and pattern recognition more applicable to players, no studies could be traced which investigated the difference between emotional recognition (especially performance on the emotion-bias task) of rugby players playing on different levels.

From the foregoing discussion it is clear that the different measures of cognition, namely memory, attention and behavioural tasks, sensory-motor/spatial functioning, verbal functioning, executive functioning, and emotion recognition all play an important role in sport performance, including rugby. In addition to optimal neurocognitive functioning, emotional intelligence (EI) has also begun to receive more attention in the sporting domain with specific reference to its relationship to optimal performance and will subsequently be discussed in the following section.

Emotional Intelligence (EI) in sport

Given the competitive nature of sports, the interest in the relationship between sports performance and EI is understandable (Crombie, Lombard, & Noakes, 2011). Emotional intelligence is defined as “an ability to recognise the meanings of emotions and their relationships and to reason and problem-solve based on them. Emotional intelligence is

involved in the capacity to perceive emotions, assimilate emotion-related feelings, understand the information of those emotions, and manage them" i.e. effective self-regulation (Mayer, Caruso, & Salovey, 1999 p. 267).

One type of self-regulation, namely emotion regulation, became of interest to sport and exercise psychologists. Emotion regulation refers to any process or processes that might influence the start, extent, duration, intensity or quality of one or more factors relating to the emotional response (McRae, Ochsner, & Gross, 2011). There is a growing body of scientific evidence supporting that emotion regulation plays an important role in sport pertaining to individual (Lane, Beedie, Jones, Uphill, & Devonport, 2012; Uphill, McCarthy, & Jones, 2009), team (Tamminen & Crocker, 2013; Wagstaff & Weston, 2014) and organizational (Wagstaff, Fletcher, & Hanton, 2012) performance outcomes.

Kemp and co-workers (2005) developed a self-report measure of EI (known as the Brain Resource Inventory for Emotional intelligence Factors, or BRIEF) which conceptualizes EI as comprising an internal emotional capacity which involves the perception of emotions in oneself as well as in others (including intuition and empathy), an external emotional capacity which involves interpersonal relationships (including social skills and the management of relationships) as well as self-concept. Although self-concept per se has not generally been viewed as part of EI, certain aspects of self-concept were already included in measures developed previously, for example, the Emotional Quotient Inventory (EQ-I) (including emotional self-awareness, self-regard, self-actualization). Therefore self-concept is regarded as critical for the perception and management of emotions, as it may offer the critical self-image and confidence which is required for enhanced empathic behaviour and for the refinement of skills necessary to build relations (Kemp et al., 2005). The BRIEF is included in the WebNeuro Sport which was used for assessment of the participants in the current study.

Seeking an understanding of the nature of sports performance cannot depend solely on the important physical skills necessary for the successful execution of sporting tasks. This is the case as even the most physically strong, highly trained and skilled sport participants and teams often fail to perform at certain times (Crombie, Lombard, & Noakes, 2009). It appears that the ability to apply physical skill under pressure is even more important than possessing these physical skills to perform. To apply these physical skills effectively under pressure, an individual would need the necessary psychological skills such as self-regulation, sustained concentration, optimal decision-making, and composure. In the competitive world of sport, achieving high performance at both an individual and team level requires control over emotions as opposed to being controlled by emotions. In the pursuit of victory and for a competitive advantage over opponents, emotional control is therefore regarded as a critical aspect to compliment a player's physical game (Crombie et al., 2009). In support of this notion, preliminary research suggests that EI has significant implications on the outcomes of sport performance. In this regard, Crombie and co-workers (2009) found that a higher EI has been associated with better performance in team sports such as cricket, hockey (Perlini & Halverson, 2006) and baseball (Zizzi, Deaner, & Hirschhorn, 2003). In addition to having control over one's own emotions, performance in especially team sports requires team members to communicate and work together in their pursuit to achieve a common goal. To do so, researchers state that it is important to be aware of the feelings of other team members and to act according to the perceived emotions to not disrupt the balance (Abraham, 1999; Mullen & Copper, 1994).

Facing anxiety and stress is normal for athletes (Laborde, Brüll, Weber, & Anders, 2011) irrespective of their age (Reeves, Nicholls, & McKenna, 2009), gender (Kaiseler, Polman, & Nicholls, 2009) or level of expertise (Mellalieu et al., 2009). It is therefore important for athletes to appropriately cope with the stress they experience to perform at the highest level

in their respective sports (Haney & Long, 1995). Regarding the relationship between EI and coping with stress among athletes, Lane and co-workers (2010) suggested that EI is positively associated with precompetitive emotions that are conducive for performance and with less precompetitive anxiety. In addition to the effect of EI on precompetitive emotions, Petrides (2009) found that trait EI is related to task-oriented coping in both Chinese and French table tennis players in different stressful situations (Laborde, You, Dosseville, & Salinas, 2012). Despite the seeming importance of EI in sport performance, only one study could be found that investigated the predictive value of EI for rugby performance and with contradictory results (Knobel, 2010). Knobel (2010) found that certain spiritual and social predictor aspects were significantly related to performance in rugby but not emotional intelligence. No studies were, however, found which investigated the difference in EI among rugby players playing on different levels. In addition to EI, personality-trait-like individual differences also seem to play an important role in human performance under pressure (Allen, Geenless, & Jones, 2011, 2013; Laborde, Lautenbach, Allen, Herbert, & Achtzehn, 2014). This will be highlighted in the following section.

Personality in sport

Apart from the neurocognitive factors and emotional intelligence which might influence sport performance, there is still the interesting area of the impact of personality on sport performance. According to Obmiński, Mroczkowska, Kownacka, and Stabno (2011), an athlete's personality profile may be valuable in estimating the athlete's ability to cope with typical future challenges. Furthermore, some coaches believe that personality is a key aspect of predicting the development of an athlete's sporting career (Obmiński et al., 2011). Personality has been defined as "psychological qualities that contribute to an individual's enduring and distinctive patterns of feeling, thinking and behaving" (Pervin & Cervone, 2010, p. 8). Personality theory has a long history and comprehensive records of personality

structure can be found in the work of Hippocrates, Galen, and other natural philosophers. Scientific research in the modern era of personality continues to accept the idea of personality dimensions and the hierarchical approach to personality structure (Allen et al. 2013).

The assessment of personality follows two main approaches: type-based assessments (which categorize individuals as one type or another) and trait-based assessments (an individual is positioned on a series of bipolar linear continua). Although personality research still makes use of type-based assessments (mainly in clinical settings to identify individuals with personality disorders), a consensus was achieved after many years of research on a general taxonomy of personality traits: The “big five” personality dimensions. The big five personality dimensions are not underpinned by a particular theoretical perspective but resulted from the analysis of the natural language and describe the most general and basic dimensions in which individuals are typically perceived to differ (John, Naumann, & Soto, 2008). The most significant progress in this area was probably the development of the five-factor model/five-factor theory of personality (NEO-FFI) (McCrae & John, 1992; McCrae & Costa, 2008).

The Five-Factor Model of Personality (FFM) consists of the five personality dimensions, namely extraversion, neuroticism, openness, agreeableness, and conscientiousness, each encompassing several more specific traits or sub-facets (Allen et al., 2013). Extraversion refers to individuals’ tendency to experience positive emotions. They are energetic, talkative, enthusiastic, cheerful and sometimes even dominant. Individuals who score high in this personality trait generally enjoy large groups of people while seeking other people’s company as well as excitement and stimulation (Costa & McCrae, 1992). The neuroticism personality trait assesses an individual’s tendency to be emotionally unstable and includes facets of anxiety, hostility, depression, self-consciousness, impulsivity as well as vulnerability (Allen et al., 2013). The openness personality trait refers to an individual’s tendency to look out for

new experiences or his level of experimental curiosity (Allen et al., 2013; Schoeler, 2009). These individuals are usually creative, innovative, imaginative and not traditional (Schoeler, 2009). Agreeableness refers to an individual's concern for cooperation and social harmony with others (Allen et al., 2013). Individuals who score high in this personality trait tend to be cooperative, trusting, caring and generous (Zhao & Seibert, 2006). The last of the five personality traits, conscientiousness, describes an individual's ability to work hard (Barrick & Mount, 1991), his or her organizational skills and goal-directed behaviour (Allen et al., 2013).

A variety of research designs have been used to explore the relationship between personality and performance in sport (Allen et al., 2013). One approach has been to compare the test scores on personality assessments between athletes who are competing at a lower level with athletes who are competing at a higher performance level. A recent study done by Allen and co-workers (2011) found that athletes who were competing in higher levels were more conscientious, compassionate and emotionally stable compared to their lower-level counterparts. By contrast, Garland and Barry (1990) explored differences in performance by comparing the personality profiles of starting and non-starting collegiate football players and found no meaningful differences in personality characteristics among the participants. Two studies which correlated personality scores with season-long performance indicators have been found. The first study was among the top Croatian basketball players. The results indicated positive, significant correlations between agreeableness and number of assists ($r = 0,25$; $p<0,05$), the number of unsuccessful free throws ($r = 0,25$; $p<0,05$), the number of balls lost ($r = 0,27$; $p<0,05$), and between Conscientiousness and three points utilization coefficient ($r = 0,24$; $p<0,05$) (Sindik, 2010). The second study compared women Paralympic basketball players who progressed to an elite level of competition (Martin, Malone, & Hilyer, 2011). With regard to the relationship between personality and season-long performance indicators,

the multivariate analysis of variance with follow-up tests showed that athletes who made the Paralympic team scored higher on tough-mindedness (M = 5.7 vs. 4.3) and lower in anxiety (M = 5.6 vs. 7.8).

However, personality is not only important for interpersonal relationships, but also for behaviours which are related to the functioning and integration in sports teams (Allen et al., 2013). Since rugby is a team sport, it is deemed necessary to investigate personality characteristics, as personality plays a significant role in an individual's behaviours which are related to the functioning of successful teams. Two recent systematic reviews explored the contribution of personality with team performance (Allen et al., 2013). In the first systematic review of ten independent samples and 527 teams, a positive association was found between team levels of agreeableness and conscientiousness and team performance, and that greater within-team variability in agreeableness and conscientiousness was negatively associated with team performance (Peeters, Van Tuijl, Rutte, & Reymen, 2006b). In the second review, a meta-analysis of 22-39 independent samples and 1,439-2,243 teams revealed a positive association between the average team levels of agreeableness, conscientiousness, extraversion and team performance (Bell, 2007). It therefore seems clear that personality traits could play a significant role in individual as well as team performance in sport. Despite the important role of personality in sport performance, no studies could be found that specifically investigated the differences in personality amongst elite and amateur rugby players.

The above discussions highlighted cognitive functioning, emotional intelligence and personality to each play an important role in individual and team sport performance. Since an individual is a holistic being, these domains are interrelated and do not function individually and therefore it is also deemed important to investigate the interrelationship among these variables.

The interrelationship among cognition, emotional intelligence and personality

According to Checa and Fernández-Berrocal (2015), EI is usually conceptualized from two perspectives, namely the ability model and mixed models. Mixed models conceptualize EI as a collection of an individual's mental abilities as well as personality traits such as optimism, motivation and his or her stress tolerance (Mayer, Roberts, & Barsade, 2008; Webb et al., 2013). Based on the mixed models' conceptualization it is clear that EI does not function independently but might be influenced by an individual's mental abilities and/or their personality traits. In contrast to the mixed models' conceptualization of EI, the ability model defines EI as the combination of various abilities: the ability to accurately perceive, appraise and express emotions; the ability to enter and/or create feelings when they enable thought; the ability to comprehend emotion and emotional knowledge; and the ability to control emotions to enhance emotional and intellectual growth (Mayer & Salovey, 1997).

Based on the mixed models' definition of EI, it seemed important to explore the current literature on the interrelationship between cognitive functioning, emotional intelligence, and personality in addition to the importance of the individual aspects. In this regard, a study which investigated the cognitive performance as well as the personality traits of 25 male international level hockey players using the WebNeuro Sport, found various significant correlations between the personality traits and cognitive performance of the hockey players (Schoeler, 2009). The personality trait of neuroticism significantly correlated with the cognitive tasks of emotion recognition, attention, and sensory-motor tasks, while openness to experiences also correlated significantly with emotion recognition. The players' level of 'agreeableness' showed a significant correlation with memory while 'conscientiousness' revealed a significant correlation with the cognitive function of emotion recognition, attention and sensory-motor tasks. Lastly, the researchers found a significant correlation between the

personality trait of ‘extraversion’ and the players’ cognitive function of language (Schoeler, 2009).

Although not about sport performance per se, personality, cognition, and EI are becoming noteworthy in influencing job performance, decision-making, promotion and career planning (Sale, 2014). A study performed in the Industrial and Organisational Psychology domain on 352 workers (mean age of 38.81 years, with a minimum age of 23 and a maximum age of 63 years) from an engineering and construction organisation in South Africa, for example, investigated whether a statistically significant relationship existed between personality, EI and cognition. With regard to the relationship between personality and EI the results revealed a statistically significant correlation with a medium effect size between the total EI score and all of the personality scales: Extraversion ($r = 0.33$; $p < 0.01$); Openness to experience ($r = 0.20$; $p < 0.01$); Emotional stability ($r = 0.40$; $p < 0.01$); Agreeableness ($r = 0.20$; $p < 0.01$); and Conscientiousness ($r = 0.31$; $p < 0.01$). Interestingly, the relationship between the total EI score and cognition showed a statistically significant negative correlation with a small effect size with analysis ($r = –0.15$; $p < 0.01$), struturing ($r = –0.10$); $p < 0.05$) and transformation ($r = –0.11$; $p < 0.05$), all constructs of cognitive competencies of the Cognitive Process Profile (Sale, 2014). The results above seem to indicate that a higher level of cognitive processing is not necessarily related to a higher level of EI and on the other hand, that a higher level of EI will not necessarily be related to better performance in cognitive tasks.

By contrast, Goleman (2009) referred to a study of star performances at Bell Labs, the world-famous scientific think tank near Princeton. These labs are made up of people who are all in the top range of academic intelligence (IQ) tests, engineers and scientists. Within this pool of talented people, some developed into stars while others delivered average output. The results of the study revealed that difference between the stars and the others could be attributed to their EI, not their academic IQ. The stars were better in motivating themselves

and better in working their informal networks into ad hoc teams. Based on the results of these above-mentioned studies, clarity regarding the relationship between EI and IQ and how it relates to performance still seems to be lacking.

Checa and Fernández-Berrocal (2015) found that EI improves one's ability to learn and solve problems. Individuals with a higher level of EI were able to create a mood assisting them in doing better on challenging cognitive tasks. Schutte and co-workers (2001) substantiate in this regard by finding that participants with a higher level of self-reported EI performed better on resolving more cognitive tasks compared to their counterparts with lower levels of EI.

Although there is a scarcity in the scientific literature pertaining to the reciprocal relationship between cognitive functioning, personality, and emotional intelligence and its relationship with especially sport performance, it seems that the following preliminary conclusions can be drawn from the studies referred to above: Firstly, differences in elite hockey players' cognitive performance can be partly ascribed to differences in their personalities and secondly, differences in individuals' personalities and their cognitive functioning can be ascribed to differences in their level of EI in an organisational setting. No studies could be traced which investigated the difference between the cognitive functioning, personality, and EI of elite and amateur rugby players. Therefore research in this area is deemed important to address the lack of current scientific literature in this regard.

From the problem statement discussed above, it is clear that cognitive functioning, personality, and EI each play a significant role in sports performance. Furthermore, despite the individual role of each of these aspects, literature shows a relationship among an individual's level of cognitive functioning, personality and his/her level of EI and performance. However, despite the seemingly important roles of these facets in sport as well as general performance, only one study could be found which investigated the predictive

ability of EI in rugby performance and the study revealed contrasting results. No other studies could be traced investigating the differences in neurocognitive factors, personality, and EI among a cohort of male, elite and amateur South African rugby players. Also, no study could be found which explored the relationship between these above-mentioned variables and an individual's level of performance. There appears to be a gap in the current literature regarding the relationship between these variables and performance, especially in rugby. This lack of research was identified by using the following databases and search engines: Academic Search Premier; EBSCOHost; Google Scholar; ProQuest Dissertations & Thesis database; PubMed; SA ePublications; Science Direct and SPORTDiscus. These online searches were performed using the following keywords: cognition, emotional intelligence, performance, personality, rugby union, sport psychology. Given the popularity of rugby and how teams strive to be the best, the results of this study will fill a void in the current literature and might contribute to current aspects which contribute to performance in rugby. Given the limited research involving the role of these different psychological factors concerning the playing level in rugby, the following research questions were developed from which the hypotheses were formulated:

Research questions

1. Which neurocognitive variables significantly differ between male, South African professional and semi-professional rugby union players?
2. Which personality traits significantly differ between male, South African professional and semi-professional rugby union players?
3. Which aspects of emotional intelligence significantly differ between male, South African professional and semi-professional rugby union players?

4. Is there a significant interrelationship between neurocognitive variables and emotional intelligence and personality traits and emotional intelligence among male, South African professional and semi-professional rugby union players?

Research objectives

1. To determine whether neurocognitive variables significantly differ between male, South African professional and semi-professional rugby union players.
2. To determine whether personality traits significantly differ between male, South African professional and semi-professional union players.
3. To determine whether aspects of emotional intelligence significantly differ between male, South African professional and semi-professional rugby union players.
4. To establish whether a significant interrelationship between neurocognitive variables and emotional intelligence and personality traits and emotional intelligence exist among male, South African professional and semi-professional rugby union players.

Thesis statement

Firstly, memory capacity, attention and behavioural tasks, sensory-motor functioning, verbal tasks, executive functioning, and emotion identification will significantly differ between male, South African professional and semi-professional rugby union players. Secondly, regarding personality, extraversion, openness, agreeableness, and conscientiousness will significantly differ between male, South African professional and semi-professional rugby union players. Thirdly, empathy/intuition, social relationships, and self-esteem will significantly differ between male, South African professional and semi-professional rugby union players and lastly, a significant relationship will exist between the neurocognitive variables and emotional intelligence and between personality traits and emotional intelligence among male, South African professional and semi-professional rugby union players.

Delineations and limitations

Although there are different conceptualizations of cognitive functioning among researchers, this study will use the conceptualization of Carlstedt (2007). Carlstedt (2007) conceptualizes the neurocognitive functioning of an athlete as consisting of memory, attention and behavioural tasks, sensory-motor/spatial functioning, verbal functioning, executive functioning, and emotion recognition. Therefore the study will only investigate the above-mentioned cognitive variables of rugby performance. Regarding personality, the relationship between personality dispositions and rugby performance will be studied from a trait perspective, and more specifically the five-factor model of personality dimensions as defined by Costa and McCrae (1992). All other methods of studying personality will therefore fall outside the scope of the present study. The five-factor model of personality includes neuroticism, extraversion, openness, agreeableness, and conscientiousness. The relationship between EI and rugby performance will be explored from the conceptualization of Kemp and co-workers (2005). These researchers developed a self-report measure of EI (known as the Brain Resource Inventory for Emotional Intelligence Factors or BRIEF), which conceptualizes EI as comprising an internal emotional capacity which involves the perception of emotions in oneself as well as in others (including intuition and empathy), an external emotional capacity which involves interpersonal relationships (including social skills and the management of relationships) as well as self-concept. The motivation behind exploring these specific variables is because it forms part of the WebNeuro Sport which was used to assess the psychological profile of the rugby players in this study. The researchers do acknowledge that there are various other definitions and conceptualizations of these variables.

This work will however not consider other definitions or conceptualizations of cognitive functioning, personality, or EI. Furthermore, since the participants in this study include only

one university and one provincial team, we would be careful to not generalize the findings of this study to the greater rugby community. Therefore further research in this domain might be needed in addition to the present study to investigate the applicability of the findings to other rugby teams, and even international teams. Furthermore, since the study made use of a non-probability sampling technique, known as a convenience sample, it is recommended that similar studies in the future should aim to make use of probability sampling techniques in an effort to enable the generalization of the findings. With regard to the methodology, a further limitation might be that we will not be able to determine the reliability and validity of the neurocognitive assessment for our population since we do not have access to the compilation of the assessment. As such, we do not know which variables contribute to which component of cognition as defined by Carlstedt (2007). An investigation to determine the reliability and validity of the assessment therefore also fell outside the ambit of the present study.

Assumptions

In the present study we assume that all the participants did their best in the psychological assessments and were honest in answering the questions regarding personality and emotional intelligence. Unfortunately, it is impossible to test for the above-mentioned assumptions. Another assumption we would like to mention is regarding the neurocognitive function of emotion recognition. The test which assesses a player's ability to recognize emotion consists of two tests. By investigating the sub-test (Emotion bias), we assume that this test will determine a player's ability to recognize patterns, which is an important aspect in sport performance.

Significance

Findings of this research can be used by coaches, sport psychologists and sport scientists to select players who, taking into account the various other aspects that can play a role in performance, exhibit the best level of cognitive functioning, personality, and emotional

intelligence profile to be successful in rugby. An additional benefit of the results of this study is that cognitive training programs can be implemented proactively, which specifically are targeted at the improvement of players' cognitive functioning and emotional intelligence with the ultimate goal of improving their on-field performance.

Chapter overviews

Following this introductory chapter (Chapter 1), the present study will further be presented in the form of four individual studies, in article format, with each article addressing a different aim, followed by the final chapter. Each study will be prepared in accordance with a specific journal's author guidelines and will include a specific research hypothesis, delineations, etc., specific literature review, method, findings, analysis, and conclusions. Following an outline of the four articles in terms of a proposed title and the journal, each article will be submitted for publication.

Chapter 2: Article 1 – Differences in the neurocognitive profile of professional and semi-professional male South African rugby union players. This article was published as a brief report in the *Journal of Psychology in Africa*, 29:2, 172-175.

Chapter 3: Article 2 – Personality profiling of South African rugby union players. This article was accepted for publication in the *Journal of Psychology in Africa*, 29:4.

Chapter 4: Article 3 –The effect of expertise on emotional intelligence of professional and semi-professional South African rugby players. This article was submitted to the *South African Journal for Research in Sport, Physical Education and Recreation.*

Chapter 5: Article 4 – The relationship between cognitive functioning, personality and emotional intelligence and its relation to performance in South African rugby union players. This article was submitted to the *South African Journal for Research in Sport, Physical Education and Recreation.*

Chapter 6: The final chapter will include the summary of the findings, conclusions, a summary of the contributions of the study and recommendations for future research.

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CHAPTER 2

Article 1

Differences in the neurocognitive profiles of professional and semi-professional male South African rugby union players

- **Introduction**
- **Goal of the study**
- **Method**
  - **Participants and procedure**
  - **Measures**
    - **Memory task**
    - **Attention and behavioural task**
    - **Sensory-motor task**
    - **Executive function task**
    - **Verbal task**
    - **Emotion identification task**
  - **Data analysis**
- **Results and discussion**
- **References**

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BRIEF REPORT

Differences in the neurocognitive profiles of professional and semi-professional male South African rugby union players

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This study investigated possible cognitive functioning profile differences between professional and semi-professional rugby players. Seventy-nine male rugby union players (professional = 55, semi-professional = 24; age range = 19–37 years) participated in the study. The players completed a battery of neuropsychological functioning tests covering the following domains: memory tasks, attention and behavioural tasks, sensory-motor tasks, executive functioning tasks, verbal tasks, and emotion identification tasks. Results following Fisher's exact test comparisons revealed no significant group differences in the cognitive functioning profiles.

Keywords: cognition, rugby union, sport performance, team sport

Introduction

Success in competitive sports such as rugby union (hereafter referred to as rugby) is explained, not exclusively by physical or technical skills, but also by cognitive abilities and integrative functions (Cona, Cavazzana, Paoli, Marcolin, Grainer, & Bisiacchi, 2015; Coughlan, Green, Pook, Toolan, & O'Connor, 2011; Yarrow, Brown, & Krakauer, 2009). For instance, rugby players have to react in a dynamically changing, unpredictable, and fast-paced environment (Wang, Tsai, Tu, Muggleton, Juan, & Liang, 2015). Players cannot fully anticipate the moves of the opposing side and must quickly oppose or react to opponents' movements. Players make choices based on the information they recognise within the context of a match (i.e. visual-processing speed and working memory). For successful execution of these functions, players need cognitive flexibility or the ability to make alternative choices in any situation and to adapt to novel circumstances (Huijgen et al., 2015; Martin & Anderson, 1998).

In striving for a win, teams display ever increasing complex match strategies and tactics (Hendricks, Roode, Matthews, & Lambert, 2013). Therefore, one can assume that in order to successfully execute these strategies and tactics, a player needs to be able to maintain task relevant information while facing distracting events on the playing field (Mayers, Redick, Chiffriller, Simone, & Terraforte, 2011). Consequently, cognitive performance in areas such as attention, working memory and executive functioning seems to be important in rugby performance (MacDonald & Minahan, 2016).

Voss and colleagues (2010) reported differences in cognitive functions between professional and non-professional athletes participating in static, interceptive, and strategic sports (attentional cueing, processing speed, and varied attention paradigms); with the largest effect size seen for processing speed. Related studies are premised on the presumption that better cognitive and integrative functioning skills might lead to better performance in sport. For instance, studies involving volleyball (Alves et al., 2013; Fontani, Lodi, Felici, Migliorini, & Corradeschi, 2006) and soccer players (Savelsbergh, Williams, Van der Kamp, & Ward, 2002; Vaeyens, Lenoir, Williams, & Phillippaerts, 2007) revealed a positive correlation between cognitive functions such as vigilance, working memory, and decision-making and proficiency in these respective team sports.

Additionally, another soccer-related study found that the high-division players outperformed their low-division counterparts on executive functioning and, in turn, the low-division players outperformed the standardised norm group (Vestberg, Gustafson, Maurex, Ingvar, & Petrovic, 2012). Supporting the previous findings, Alves and colleagues(2013) found that volleyball players performed better than non-active controls on tasks involving executive control as well as visuospatial attentional processing. These relationships between expertise and enhanced cognitive functioning are in need of further study among rugby players.

Most studies that explored cognitive functioning among rugby players were focused on traumatic brain injuries and concussion (Alexander, Shuttleworth-Edwards, Kidd, & Malcolm, 2015; Hume et al., 2017; Maite, Nel, & Govender, 2016; Nel, Govender, Rapetsoa, & Nel, 2017). In light of the lack of research on the relationship between cognitive functioning and performance in rugby, the present study sought to investigate cognitive functioning profile differences among South African rugby players by contrasting professional and semi-professional players. Professional players are those with a history of competitive team membership at a level which pays a salary for their participation; whereas semi-professional players are on teams but not remunerated for being part of the team (Voss et al., 2010). Findings may inform players'

support programs aimed at enhancing their neurocognitive functioning and ultimately on-field performance in rugby.

Goal of the study

Our specific research question was: Is there a difference in the cognitive functioning profile among South African rugby players when professional and semi-professional players are compared?

Method

Participants and procedure

The Health Research Ethics Committee (HREC) of North-West University approved the study (NWU-00026-18-S1). Seventy-nine male, South African rugby players, aged 19–37 years, participated in the study. They were divided into a professional group (n = 55; age: 26.16 ± 3.76 years) and a semi-professional group (n = 24; age: 22.17 ± 1.31). All participants were literate in English, were injury free on their dominant hand, and free from any serious injuries and known illnesses, including mental illnesses. All the players were informed about the nature of the study and gave consent for their data to be used for future research. The study was conducted at the venues where the respective teams were based.

Measures

Participants completed measures from the WebNeuro Sport online assessment (Brain Resource Company: BRC, 2010). The WebNeuro Sport assessment comprised a demographic questionnaire (name, surname, age, and gender) and seven individual assessments. The cognitive assessment comprised the following tasks: memory, attention and behavioural, sensory-motor, executive functioning, verbal, and emotion identification tasks.

Memory task

Memory was measured by applying the memory recognition/verbal list learning task. Twelve genuine English words were presented to the participants. The words were matched as closely as possible regarding concreteness, number of letters, and frequency; and were presented four times. After each trial the participants had to recognise as many words as possible by choosing between 20 pairs of words on the computer screen (one word was correct, the other word was a distractor). After approximately 10 minutes and a few intervening tasks, a delayed memory recognition trial was completed. Participants were scored for the number of correctly identified words across the four learning trials as well as the delayed trial.

Attention and behavioural task

These comprised a digit span recall test (forwards and backwards) as well as a letter recall test. Both tests were timed. For the digit span recall test, participants were scored for number of correct recalls. For the letter recognition test, participants were scored for number of errors or omissions and false positives.

Sensory-motor task

Sensory-motor ability was assessed using a simple tapping test and a choice reaction time. With the simple motor tapping test, the participants were required to tap the space bar on the computer's keyboard with their index finger of the dominant hand as fast as possible for the duration of 30 seconds. They were scored on total number of taps within the allocated period.

The choice reaction time test compels the players to attend to the computer screen as one of two target circles was illuminated in a random sequence over a series of 20 trials with a random delay of 2–4 seconds between trials. For each trial, the participants had to press the left or right arrow button, indicating which of the two circles lit up. Participants were scored on mean reaction time across the 20 trials which was the dependant variable.

Executive function task

Executive functioning was assessed by means of switching the attention test, the verbal interference test, the maze test, and the go-no-go test. The switching of the attention test presented the participants with a pattern comprising numbers (1–13) and 12 letters (A–L) for matching on the computer screen. Participants were scored on time to completion.

The verbal interference test was a standard Stroop test and determined the participants' ability to inhibit automatic and irrelevant responses. Participants responded to coloured-coded words by first naming each word as quickly as possible, and then naming the colour of each word as quickly as possible. Participants were scored for accuracy.

Verbal task

The participants' verbal skills were assessed using the spot the real word test. For each of this task's trails, the participants were presented with two words on the computer screen. One of the two words was a genuine word in the English language ("true" target word) while the second word was one that was made up. The participants were required to identify, by clicking with the mouse, which of the two words was the true target word. They were scored on the number of correct responses.

Emotion identification task

Emotion recognition was determined by the emotion perception test, which determined the participants' ability to recognise emotions. The participants were presented with a series of faces with different emotional expressions, for example fear, disgust, happiness, and neutral. By using the mouse, the participants had to identify the correct emotional expression presented by the face on the computer screen. Each participant's score was the total of correctly identified emotional expressions.

Data analysis

The Statistical Data Processing Package (SPSS) for Windows (Version 25.0) was used to analyse the data for between group comparisons: professional versus semi-professional. A Kolmogorov Smirnov statistic test suggested a normal distribution of the data. We computed independent t-tests for differences between professional and semi-professional players in the memory task, the

attention and behavioural task, the sensory-motor task, the verbal task, the executive function task, and the emotion identification task. Significance was set at $p < 0.05$.

We also examined effect sizes (ES; *d*) following Cohen's (1988) guidelines using the following thresholds: < 0.2, trivial; 0.2–0.6, small; 0.6–1.2, moderate; 1.2–2.0, large; 2.0–4.0, very large, and > 4.0, extremely large (see Hopkins, 2004). We considered whether the *z*-score was either below or above the mean for the average peers by calculating the smallest practically meaningful effect (SPME) in *z*-scores for each cognitive variable. The SPME for each variable was calculated by multiplying the between-participant *z*-score SD by 0.2, which is typical of a small effect (Pyne, Saunders, Montgomery, Hewitt, & Sheehan, 2008). Since these were standardised scores, the SD is 1.0, and therefore the SPME equals 0.2 either positive or negative with values implicating either the professional group (negative) or the semi-professional group (positive). Effects with confidence intervals overlapping small positive or small negative effects were defined as unclear.

Results and discussion

Table 1 presents the descriptive statistics and mean comparisons for the study variables. As can be observed from Table 1, a significant difference was found between the professional and semi-professional groups' age ($p < 0.000$; $d = 1.24$). Pertaining to the cognitive tasks, there were no significant differences between the two groups. However, there was a small effect ($d = -0.39$) for the better score of 0.24 in memory for the semi-professional group when compared with the professional group. However, this was not statistically significant ($p = 0.06$).

The mean *z*-scores for the professional and semi-professional groups are depicted in Figure 1, in addition to the SMPE, both above (*z*-score = 0.2) and below (*z*-score = –0.2) the overall mean for average peers. The *z*-scores of the cognitive tasks are normalised for age, gender, and years of education. This implies that differences from zero are indicative of differences from the average peer. Positive *z*-scores can be regarded as a strength; while a negative *z*-score is indicative of a

Table 1. Cognitive characteristics (mean ± SD; 90% CI) of the professional and semi-professional rugby union players

Characteristics	*n*	Professional group	*n*	Semi-professional group	90% CI	*p* value	d
Age	55	26.16 ± 3.76	24	22.17 ± 1.31	0.79–1.66	<0.000*	1.24
Memory task	52[a]	0.11 ± 0.69	24	0.35 ± 0.43	–0.79–0.03	0.06	–0.39
Attention & behavioural tasks	51[b]	0.03 ± 0.66	24	–0.04 ± 0.68	–0.30–0.51	0.70	0.11
Sensory-motor task	55	0.70 ± 0.68	24	0.84 ± 0.75	–0.60–0.21	0.41	–0.20
Verbal task	54[c]	–0.67 ± 0.86	23[d]	–0.75 ± 0.97	–0.32–0.50	0.71	0.09
Executive function task	55	–0.05 ± 0.88	24	–0.07 ± 0.82	–0.38–0.43	0.94	0.02
Emotion identification task	55	0.47 ± 0.91	24	0.35 ± 0.85	–0.27–0.54	0.60	0.13

CI = confidence interval; d = effect size. [a]Three professional players did not complete this task. [b]Four professional players did not complete this task. [c]One professional player did not complete this task. [d]One semi-professional player did not complete this task.
* $p < 0.05$

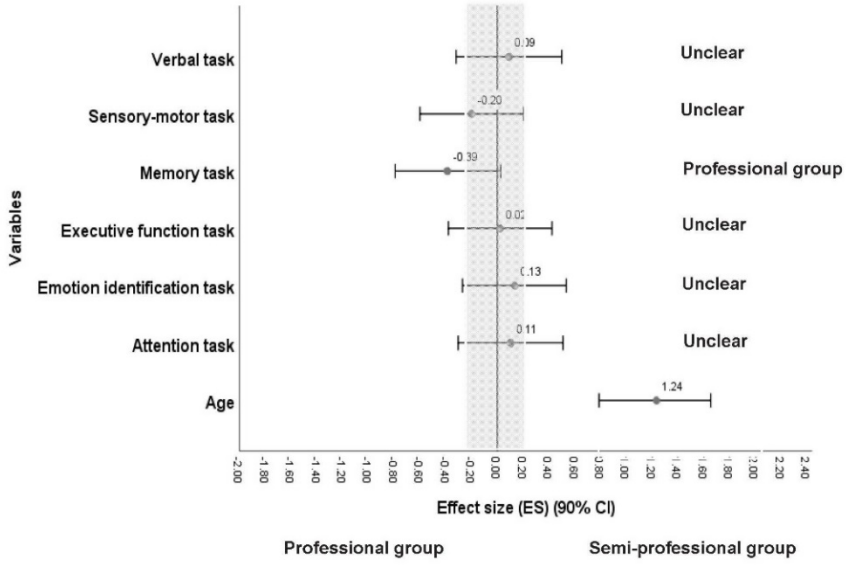

Figure 1. Z-scores (mean ± SD) and smallest practically meaningful effect above or below the mean for average peers for the professional and semi-professional group of rugby union players for age and the cognitive tasks.

possible deficit. *Z*-scores beyond –2 or +2 are statistically significant (BRC, 2010).

Our findings are supported by the cognitive component skills approach which views sport as a medium which might lead to more efficient brain networks; resulting in a particular cognitive skills profile among participants of the same sport (Voss et al., 2010). Furthermore, another possible explanation for our contradictory results might be that previous studies that investigated cognitive functioning of athletes compared professional athletes with non-active controls (Alves et al., 2013; Vestberg et al., 2012; Wang et al., 2015) while all the players in our group belong to the group of strategic sports which could have diminished possible expertise effects (Voss et al., 2010).

This was a small exploratory study of limited generalisability of the findings. Future studies should utilise a larger sample size to further investigate the findings we report here.

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CHAPTER 3

Article 2

Personality profiling of South African rugby union players

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Personality profiling of South African rugby union players

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This study aimed to investigate whether differences exist in the personality profiles of professional and semi-professional rugby union players. Participants were 73 male rugby players, 52 professional players and 21 semi-professional players. All participants completed the NEO Five-Factor Personality Inventory (NEO-FFI) as part of the WebNeuro Sport online assessment. An independent sample *t*-test showed a statistically significant difference in neuroticism between the professional and semi-professional players. The magnitude-based inference method confirmed the results of the independent sample *t*-test with a moderate effect. The potential practical value of these findings is that the Neuroticism scale of the Big Five personality dimensions can be used as a screening tool for indicating which players a team would want to recruit and invest time and money in since these players will most likely be capable of progressing to the top level in their sport.

Keywords: expertise, performance, personality, professional rugby union players, semi-professional, sport

Introduction

Rugby has become a multi-billion-pound business which competes for limited resources (Robinson, 2003). While performance analysis in rugby has focused on numerous variables in explaining physical performance, limited research is available about the comparison of personality characteristics between professional and semi-professional rugby players. For instance, previous research regarding performance analysis in rugby has investigated anthropometrical (Duthie, Pyne, & Hooper, 2003; Olds, 2001; Quarrie, Handcock, Toomey, & Waller, 1996; Quarrie & Wilson, 2000), physical (Cunningham et al., 2013; Gabbett, Kelly, & Pezet, 2007), physiological, and biomechanical (Trewartha, Munro, & Steele, 2007) factors of successful sport performance. However, what distinguishes "the good from the great" is not only dependent on a robust genetic make-up, innate talent, and physical abilities. It also depends on mental aspects, including certain personality traits (Twist & Hutton, 2007).

Personality refers to the "psychological qualities that contribute to an individual's enduring and distinctive patterns of feeling, thinking, and behaving" Cervone & Pervin (2010, p. 8). It is defined by a set of behavioural traits an individual tends to display in a consistent manner (Digman, 1990). However, individuals may behave in different ways depending on the contexts (or situations) which they find themselves in (Vorster, 2011). In this regard, in particular situations, some individuals will exhibit extraverted behaviour while at other times, the same individuals will behave in an introverted manner. Therefore, introversion and extraversion is measured on a continuum with ambivert people falling in the middle of the extravert-introvert scale (Psychologist World, 2019).

Studies on personality profiles among athletes are on the rise (Bäckmand, Kaprio, Kujala, & Sarna, 2001; Dobosz & Beaty, 1999; Fletcher & Dowell, 1971; Frederick, 2000; Saint-Phard, Van Dorsten, Marx, & York, 1999; Stephens, 2001; Stoner & Bandy, 1977; Valliant, Bennie, & Valiant, 1981; Yeung & Hemsley, 1996). To be considered an athlete, Araujo and Scharhag (2016) proposed four criteria that should be fulfilled: a) training in sport with the aim to improve performance; b) actively participates in sport competitions; c) formally registered as competitor in a local, regional or national sport federation; and d) to have sport as the major activity or focus of personal interest, devoting several hours of most days to these activities, exceeding the allocated time for other types of professional or leisure activities ("Athlete", n.d.). There is evidence to suggest the existence of a personality profile for athletes which differentiate competitive athletes from other populations. For instance, athletes generally present with higher levels of emotional stability, extroversion, self-confidence, and higher mental resistance than non-athletes (Butt, 1987; Cox, 1994; Saint-Phard et al., 1999). Moreover, team sport participants were more extroverted, less dependent, held higher levels of abstract reasoning abilities, and a higher sense of self as opposed to non-athletes (Steca, Baretta, Greco, D'Addario, & Monzani, 2018). Furthermore, individual sport participants displayed greater objectivity, more dependency, less anxiety, and more abstract thinking than non-athletes (Schurr, Ashley, & Joy, 1977).

However, other studies reported athletes to differ from non-athletes as in the case of runners who were generally more withdrawn, more thoughtful, and presented with lower anger levels than non-athletes (Dineen, 2003). Conversely, other studies concluded that personality differences between athletes and non-athletes do not exist (Auweele et al., 1993; Guillén & Castro, 1994; Vealey, 1992). However, few studies have assessed personality profiles among athletes differentiating by their professional standing (e.g. provincial, transnational. and national levels versus lower club and amateur levels).

Results of studies on personality profiles of athletes competing on national or international level suggest that professional athletes display higher levels of

conscientiousness and agreeableness with associated lower levels of neuroticism than athletes competing on lower levels (Allen, Greenlees, & Jones, 2013). Moreover, studies on successful track and field athletes, soccer players, and basketball players found them to display higher levels of conscientiousness as well as more emotional stability as compared to the less successful athletes (Gee et al., 2007). Among successful athletes, the trait of conscientiousness showed the most significant effect size, suggesting that characteristics such as diligence and responsibility are skills typical of high-level athletes (see also Gee et al., 2007). Furthermore, athletes with higher extraversion, conscientiousness, emotional stability, and openness to experience with lesser agreeableness yielded better performance (Khan, Ahmed, & Abid, 2016).

Professional rugby league players had higher levels of hardiness than their sub-elite counterparts (Golby, Sheard, & Lavallee, 2003) or players competing at lower levels (Golby & Sheard, 2004). Similarly, Sheard and Golby (2010) reported that international rugby union players scored significantly higher than national, county, and club players in total hardiness. In turn, national and county level players scored significantly higher in total hardiness than club level players. Conflicting findings on the association between professional athletes and peers at lower levels of play suggest a need for further studies to clarify these relationships which may be of importance to talent identification and retention in this professional sport.

Goal of the study

The present study explored personality characteristics that differentiated professional and semi-professional South African rugby union players. Our specific research question was: Is there a significant difference in the personality characteristics between professional and semi-professional South African rugby union players? The evidence from this study might be of assistance to sports psychologists and coaches to understand personality traits that make for thriving athletes across careers.

Method

Participants and setting

We accessed a convenience sample of 73 male South African rugby union players, aged 19 to 37 years. Of these, 52 were professional players (mean age = 26.12, SD = 3.83 years) and 21 were semi-professional players (mean age = 22.43, SD = 1.17 years). The professional group formed part of elite competitive teams (which participated in national and trans-national competitions) where players were paid a salary for their participation. The semi-professional group consisted of players who were registered students at a university and therefore not remunerated for being part of their team, although some had received bursaries to play rugby (Voss, Kramer, Basak, Prakash, & Roberts, 2010).

Measures

The participants self-reported their demographic information (name, surname, age, and gender) and completed the NEO Five-Factor Personality Inventory (NEO-FFI) (Costa & McCrae, 1992). The NEO-FFI is a 60-item self-report measure to assess five personality dimensions; namely extraversion, neuroticism, openness, agreeableness, and conscientiousness. The extraversion dimension distinguishes between individuals who are unsociable, quiet, and passive (also referred to as introverted); and those who are sociable, outgoing and active (also referred to as extraverted). The neuroticism dimension distinguishes between people who are calm, controlled, and even-tempered (emotionally stable); from people who are anxious, aggressive, and ill-tempered (emotionally unstable). Openness differentiates curious, inventive, and imaginative individuals (also referred to as open to new experiences); from conventional, uncreative, and unimaginative individuals or individuals who prefer the familiar. The agreeableness dimension distinguishes between people who are good-natured, generous, and forgiving; and those who tend to be pessimistic, discourteous, and uncooperative. The conscientiousness dimension differentiates between individuals who are organised, prompt, and hardworking; and those who are untrustworthy, lazy, and careless (Allen, Greenlees, & Jones, 2011). The participants were required to respond to each statement, on a 5-point Likert scale anchored by 0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree, and 4 = strongly agree. Twelve items load on each of the five domains with some negative statements to which reverse scoring applies. Scores from the NEO-FFI have acceptable levels of reliability (0.68 to 0.89) across a range of diverse populations (McCrae & Costa, 2007). The reliability of scores from the NEO-FFI in the present sample varied between 0.66 to 0.79. Openness yielded a reliability score of 0.66 which is below the acceptable score of 0.70 which can be seen as a limitation in the present study.

Procedure

The Health Research Ethics Committee (HREC) of North-West University granted permission for the study (NWU-00026-18-S1). All participants granted informed consent for participation in the study. We collected data by means on an online survey at the venues where the respective teams were based. Completion of the full online assessment took approximately 90 minutes.

Data analysis

The Statistical Package for the Social Sciences (SSPS) software programme (Version 25) was used for the statistical analysis of the research data. For the reader to secure an overview of the personality scores of both groups, we present descriptive statistics (mean ± SD; 90% confidence interval [CI]). An independent sample *t*-test determined the statistically significant differences between the two groups. Furthermore, effect sizes (ES; *d*) were calculated for the between-group comparison, where the difference between the groups' means was divided by the pooled standard deviation (SD) (Cohen, 1988). In an attempt to confirm or disconfirm the results of the independent sample *t*-test, irrespective of the *p*-value, the magnitude-based inference method (MBI) was included in this study.

Results and discussion

Table 1 provides descriptive statistics (mean ± SD), between-group comparison, 90% confidence interval, effect size, and interpretation of Cohen's *d*-value of the data and reliability coefficients of the NEO-FFI. It also reports the results of the between-group comparison regarding personality characteristics.

Only neuroticism showed a statistically significant difference between the professional and semi-professional rugby players. The magnitude-based inference (MBI) method was included in this study to confirm or disconfirm the results, irrespective of the *p*-value. Based on the MBI method, neuroticism differed with a moderate effect between the two groups with the semi-professional players scoring higher on this trait than their professional counterparts.

Our finding of a significantly lower neuroticism score by professional rugby players directly mirrors the findings of Allen and colleagues (2011) in which high-level performers scored lower on neuroticism than the lower-level athletes. This finding might be explained by a self-selection factor in that those who achieve professional player status are more emotionally stable and with follow-through of the coaches' instructions (coach-ability). Additionally, they may be good team players (Coyne & Wright, 2014; Piedmont, Hill, & Blanco, 1999). Lower neuroticism also makes for greater self-control (Baniassadi, Javanmard, Zivarirahman, Shokouhimoqhaddam, & Adhami, 2015; Baumeister, Vohs, & Tice, 2007; Coyne & Wright, 2014; Tianxin et al., 2018) or the ability to overcome their natural and automatic tendencies, desires and behaviours, and to their resistance of the short-term temptations to achieve their long-term goals (Baumeister, Vohs, & Tice, 2007).

Contrary to our expectation, we found no significant difference in extraversion between the players of the different groups. These findings differed somewhat from previous research in sports literature that had demonstrated a link between extraversion and level of participation (Egloff & Gruhn, 1996; Kirkcaldy, 1982). Allen and colleagues (2011) found that athletes participating in team sports were more extraverted than those competing in an individual sport. It is not apparent as to why our findings turned out differently. Similarly, we observed no differences in conscientiousness, agreeableness, and openness scores between professional rugby players and semi-professional rugby players. A possible explanation for our contradictory results might be that our semi-professional group was one of the best teams in their league and therefore already at the very top end of the spectrum in their category and much closer to their professional counterparts than an average sample of club and university rugby players perhaps would have been. Thus, they were already at the very top end of the spectrum in their category and much closer to their professional counterparts so that any differences are less pronounced.

Limitations of the study and suggestions for further research

The present study also had some limitations that need to be noted, and which could be addressed in future research. First, the generalisation of the results to the greater rugby community is limited and should be done with caution, given the relatively small sample size that was included in the present study from South Africa. The authors would, therefore, suggest using more elite rugby players from different countries in similar future studies. Additionally, because participants of only one team sport were considered, the results might have been affected by sport specificity – in other words, the notion that participation in rugby might have led to the development of individual personality characteristics. These issues might limit the generalisability of the current results to other sports contexts.

Furthermore, as we included only male participants in our study, the possibility that different findings could arise about female rugby players cannot be excluded. In order to determine whether rugby players exhibit a specific personality profile, we would further suggest that professional participants of different sports be compared with the results presented in this study. Having used a cross-sectional self-report design, it is not possible to determine causality, and it is also possible that other confounding variables, some of which have already been alluded to, might account for the results. We suggest that for future studies researchers also consider other important outcomes such as multiple key performance indicators, the amount of time spent on-field playing as well as years of experience in rugby. Furthermore, we suggest that future research investigate the relationship between the success of the team and the level of variation in the team members' personality traits. Lastly, because South Africa is a multicultural and multilingual country, we suggest that future similar research make use of

Table 1. Descriptive statistics, between-group comparison, 90% confidence interval, effect size, qualitative interpretation of Cohen's *d*-value and reliability coefficients of the NEO-FFI

Personality trait	Professional group ($n = 52$)	Semi-professional group ($n = 21$)	90% CI	*p* value	*d*	*d* Strength	Cronbach alpha
Age	26.12 ± 3.83	22.43 ± 1.17					
Neuroticism	16.31 ± 5.94	19.86 ± 6.63	−1.09–0.06	0.03*	−0.58	Moderate	0.76
Extraversion	32.12 ± 5.68	31.24 ± 4.88	−0.35–0.67	0.54	0.16	Trivial	0.76
Openness	22.27 ± 5.49	22.86 ± 5.49	−0.61–4.40	0.69	−0.11	Trivial	0.66
Agreeableness	29.73 ± 5.39	28.29 ± 4.46	−0.23–0.79	0.25	0.28	Small	0.72
Conscientiousness	35.23 ± 5.92	33.33 ± 4.79	−0.18–0.84	0.16	0.34	Small	0.79

Note. CI = confidence interval; *d* = effect size; * $p < 0.05$

personality assessments that account for differences in culture, education, employment status, and the distribution of socioeconomic resources of the participants.

Conclusion

Neuroticism was the only personality trait that significantly distinguishes professional from semi-professional rugby union players. Other factors not included in the study may explain personality presentation by the rugby players. On a practical level, it would seem that the NEO-FFI is in need of further study as an assessment tool for use with professional athletes, especially in the South African context. Findings for its use may be of incremental value in professional athlete development in combination with physical, tactical, and technical variables.

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CHAPTER 4

Article 3

The effect of expertise on emotional intelligence of professional and semi-professional South African rugby players

THE EFFECT OF EXPERTISE ON EMOTIONAL INTELLIGENCE OF PROFESSIONAL AND SEMI-PROFESSIONAL SOUTH AFRICAN RUGBY PLAYERS

ABSTRACT

Emotional intelligence (EI) is increasingly recognized as an essential component of success in sport. This study sought to investigate whether differences exist in the level of emotional intelligence between professional and semi-professional South African (SA) rugby players. The study involved 79 male SA rugby players. The group was divided into a professional group (n = 55; M_{Age} = 26.16 ± 3.76 years) and a semi-professional group (n = 24; M_{Age} = 22.17 ± 1.31 years). The Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) was used to assess the players' level of EI. An independent t-test indicated no statistically significant difference in total emotional intelligence or the associated subscales. The magnitude-based inference (MBI) method showed that the external emotional capacity (EEC) attained medium worthwhile effect in favour of the professional players. From a practical point of view, it seems that players who are capable of maintaining better interpersonal relations, having better social skills and managing relationships more effectively are those performing at higher levels in rugby. Therefore the EEC subscale of the BRIEF might be used as a screening tool for identifying players that teams would prefer to recruit since these players might contribute to a positive team environment and progress to the top level in their sport.

Keywords: emotions, emotional intelligence, expertise, rugby union

INTRODUCTION

Rugby union (hereafter referred to as rugby) became a professional sport at an elite level in 1996, and the associated changes in the rules led to a significant increase in the speed and pace of the game. Consequently, players have less space to move in, as well as less time for thinking and decision-making during play; thus the psychological challenges inherent in rugby have been emphasised (Hodge *et al.*, 2006). In addition to the psychological factors, various physical, social, environmental and emotional factors have also been found to contribute to rugby performance (Knobel, 2010). In this respect, Dave *et al*. (2017) propose that it is just as essential to work on athletes' emotional regulation as on their cognitive, physical, technical and tactical aspects.

An athlete's (referring to someone who trains for and competes in various sports events) emotional state significantly influences sport performance (Arribas-Galarraga *et al*., 2017; Balk *et al*., 2017). As early as 1995, Hanin stated that detrimental emotions such as anxiety, anger and depression could hinder optimal sports performance. Lane *et al*. (2009) corroborated in this regard by stating that confusion, depression and fatigue correlate with unsuccessful performance. On the other hand, Lane *et al.* (2009) found that optimal emotions such as vigour, happiness and calmness are associated with success in sport. Especially under stressful conditions, it becomes imperative for athletes to control their energy levels in order to perform successfully. Emotions influence sport in both general and specific ways such as affecting athletes' attention (Nieuwenhuys *et al*., 2008) as well as their ability to make effective decisions (Laborde *et al*., 2013; Laborde & Raab, 2013).

While striving to reach high performance in sport, athletes need to continuously motivate themselves to achieve their long-term goals during relentless training and competitions (Laborde *et al*., 2016). Furthermore, athletes need to consistently cope with stress and competitive pressure (Mellalieu *et al*., 2009) which includes an understanding and regulation

of their own emotions as well as understanding and insight into the emotions of others such as teammates, opponents, coaches, umpires and the spectators (Laborde *et al*., 2016). For example, when players understand others' emotions, they can sense their feelings and perspective and consequently be actively interested in their concerns. Also, being able to understand others' perspectives will allow a player to communicate in ways his teammates will understand. Furthermore, by comprehending others' emotions and showing insight into their emotions will allow players to read their teammates' mood and energy which might prohibit them from becoming disengaged, nervous and angry. Also, optimal performance, especially in team sports, depends partially on the group members' ability to communicate effectively and work together to achieve mutual goals. To achieve this goal and to ensure not to disrupt the teams' balance, it is vital to be aware of the emotions of teammates and also to display an appropriate behavioural response to it, which is generally known as emotional intelligence (EI) (Mullen & Cooper, 1994; Abraham, 1999; Laborde *et al*., 2011). For example, when playing rugby, players have to deal with many expectations and demands. Hence it is essential that players control or redirect their emotions so that the outcome of their performance is not affected negatively. About sport, Knobel (2010) conceptualises EI as "the personal and social ability, trait, skill and competency to be aware of and know emotions in oneself and others in order to express, regulate, channel and control them effectively to perform optimally in sport" (p53).

Emotional intelligence was initially popularised by Goleman (1995) in the mid-1990s and defined as an individual's ability to identify and act according to intrapersonal and interpersonal emotional information consisting of the expression, understanding and regulation of one's own and others' emotions (Mayer & Salovey, 1997). Stough and co-workers (2009) propose that EI has the potential of optimally influencing relationships, wellbeing and human performance. Regarding the relationship between EI and performance

in sport, Laborde *et al*. (2016) concluded in their systematic review that athletes who obtain higher scores on EI tests tend to be more successful. Various researchers also found that athletes with a higher level of EI performed better in team sports such as baseball (Zizzi *et al*., 2003), ice hockey (Perlini & Halverson, 2006) and cricket (Crombie *et al*., 2009). EI has been associated with several aspects linked to sports performance among athletes such as the use of psychological skills (imagery and self-talk) (Lane *et al*., 2009), adaptive psychological states (Lane & Wilson, 2011), adaptive coping strategies (Laborde *et al*., 2012), maximal voluntary contraction (Tok *et al*., 2013) and a protective influence on stress when under pressure (Laborde *et al*., 2011). Laborde and colleagues (2014) propose that athletes with high levels of EI perform better in sport due to the manner in which they appraise competitions. These authors contend that high EI athletes tend to appraise competition as a challenge and make use of more effective coping strategies in response to competitive stress. Concerning EI among rugby players, in contrast to the previous findings, Knobel (2010) found no significant difference in terms of total EI and the five domains (Intrapersonal, Interpersonal, Adaptability, Stress management, and General mood) thereof between a school's A-team and B-team rugby players. Knobel (2010) therefore concludes that EI was not a predictor of rugby performance in terms of inclusion into the A-team as a novel player. Knobel's (2010) findings might be ascribed to the fact that at school level, various other factors such as body size, physical skill and ability could explain the difference among players of different playing levels. These margins become smaller at the elite level. Aspects such as EI might thus become more critical. Laborde and co-workers (2014) further support the previous findings by having reported that no significant differences existed between athletes at different levels of sporting expertise, ranging from district level to international level, in terms of their EI scores. Given the positive associations found between EI and sports

performance as discussed above, it is therefore intriguing that athletes competing at a higher level show levels of EI similar to those of athletes competing at lower levels.

PURPOSE OF RESEARCH

The present study sought to investigate whether differences exist in the level of EI between professional and semi-professional rugby players. Drawn from the available literature we expect that the professional South African rugby players would obtain a significantly better score in internal emotional capacity, external emotional capacity, self-concept and total EI than their semi-professional counterparts.

METHODOLOGY

Research design

This study made use of a cross-sectional, quantitative research design with a convenient sample in which the players' level of EI were determined and between-group comparisons were made.

Participants

The study involved 79 male South African rugby players between the ages of 19 and 37 years. The total group was divided into a professional group (n = 55; M_{Age} = 26.16 years; SD = 3.76) and a semi-professional group (n = 24; M_{Age} = 22.17 years; SD = 1.31). The professional group consisted of full-time players who were competing at the highest level in a transnational competition and were remunerated for playing rugby, while the semi-professional players were full-time students at a university and competing in the top tier university competition but therefore not earning a salary for being part of the team.

Instruments

Emotional Intelligence

The Brain Resource Inventory for Emotional Intelligence Factors (BRIEF, Kemp *et al*., 2005) was used to assess the players' level of EI. The BRIEF is a 14-item, self-report

measure on which participants are requested to answer questions on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The 14 items revealed three distinct factors, namely internal emotional capacity (IEC – 6 items), external emotional capacity (EEC – 4 items) and self-concept (SELF – 4 items). It is possible to obtain a total EI score by adding the three factors together. Sample items include "I recognize my emotions through physical changes in my body such as "stomach-churning" when I experience fear or "lightheadedness" when I am highly elated" (IEC); "I usually take the initiative and introduce myself to strangers" (EEC); and "When receiving negative comments about myself, I look for positive things to counter those comments" (SELF). The internal consistency for the IEC, EEC, and SELF range from 0.42 to 0.64, and 0.67 to 0.71 for the total scale (Kemp *et al*., 2005). Test-retest reliability estimates have been reliable at a 4-week interval (r = 0.92), and a strong positive correlation between the BRIEF and the Self-Report Emotional Intelligence Test (SRIET; r = 0.70) supports the convergent validity of the instrument (Kemp *et al*., 2005).

Procedures

The players were requested to complete the evaluation online on laptop and desktop computers at different venues. These laptops and desktops were connected to the internet and set up to ensure that the participants had the necessary privacy and were comfortable with limited distractions. The researcher introduced the players to the WebNeuro Sport and explained the test procedure following on which the players were allowed to ask questions. The players were instructed to start the assessment which took 60-90 minutes to complete.

Statistical analysis

The SPSS (Statistical Package for the Social Sciences) software programme (Version 25) was used for the statistical analysis of the research data. For the reader to secure an overview of the EI scores of both groups, we present descriptive statistics (mean ± SD; 90% confidence

interval [CI]). An independent *t*-test determined the between-group comparison. Also, effect sizes (ES; d) were calculated for the between-group comparison, where the difference between the groups' means was divided by the pooled standard deviation (SD) (Cohen, 1988). In an attempt to confirm or disconfirm the results of the independent *t*-test, irrespective of the *p*-value, the magnitude-based inference method (MBI) was included in this study.

Ethical consideration

Informed consent for this study was obtained from each participant and was approved by the Health Research Ethics Committee (HREC) of [Name of University omitted to allow blind review) (XXX-00026-18-S1).

RESULTS

*Table 1.***DESCRIPTIVE STATISTICS (MEAN ± SD), BETWEEN-GROUP COMPARISON, 90% CONFIDENCE INTERVAL, EFFECT SIZE (COHEN'S D-VALUE)**

EI scale	Professional group (n=55)	Semi-professional group (n=24)	90% CI	*p* value	*d*
Age	26.16 ± 3.76	22.17 ± 1.31			
Internal emotional capacity (IEC)	21.31 ± 2.78	21.29 ± 2.76	-0.47-.049	0.98	0.01
External emotional capacity (EEC)	13.71 ± 2.32	12.63 ± 3.10	0.07-0.90	0.09	0.42#
Self-concept (SELF)	14.11 ± 2.15	14.58 ± 1.50	-0.72-0.25	0.33	-0.24
Total emotional intelligence (TOTAL)	49.13 ± 5.30	48.50 ± 3.78	-0.35-0.61	0.98	0.13

CI = confidence interval; d = effect size; * p < 0.05; # small effect size

The descriptive results (mean and standard deviation), the independent *t*-test, the confidence limits as well as the d-values are presented in Table 1. The independent *t*-test

showed no statistically significant differences in the EI subscales or total EI between the professional and semi-professional players.

The MBI results (Figure 1) indicated that the external emotional capacity (EEC) attained medium worthwhile effect in favour of the professional players. All other EI results are considered unclear due to the confidence interval upper and lower limits exceeding the smallest positive and smallest negative effect of 0.2.

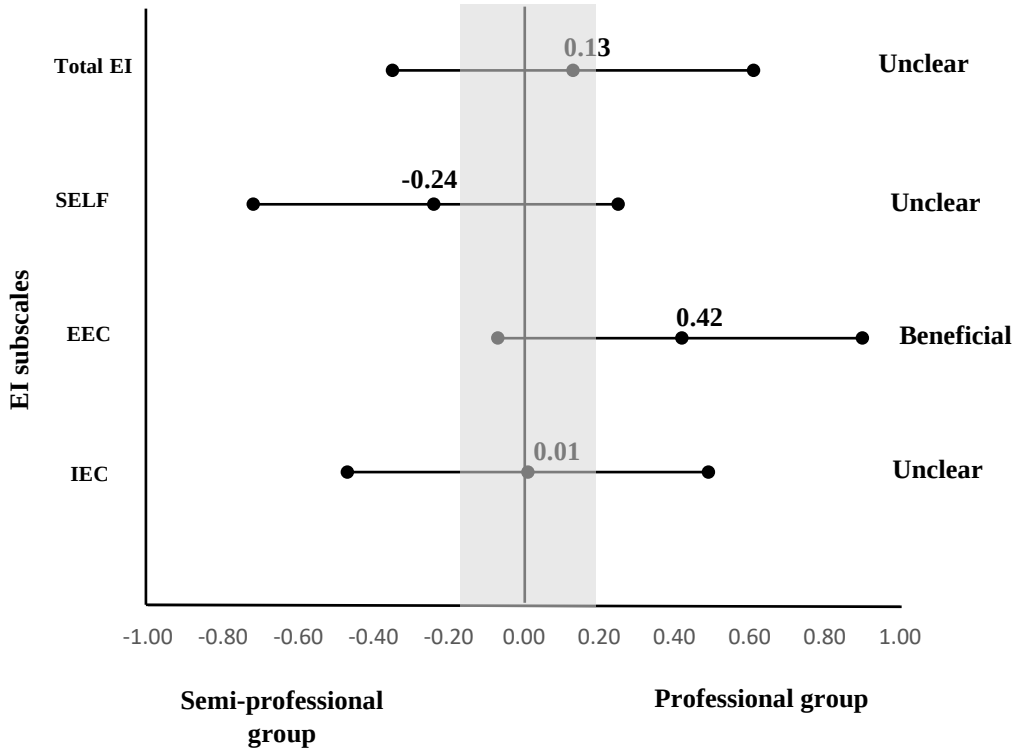

Figure 1. **STANDARDIZED (COHEN'S D) DIFFERENCES BETWEEN THE PROFESSIONAL AND THE SEMI-PROFESSIONAL RUGBY PLAYERS.**

DISCUSSION

This article aimed to investigate whether differences exist in the level of EI between professional and semi-professional rugby players. Despite the seemingly important role of EI in sports performance, our study found no statistical difference in the subscales of EI or total EI between the professional and semi-professional groups of South African rugby players.

Our results are similar to those of Laborde and co-workers (2014) who also found no significant relationship between EI and expertise among a group of 973 individual and team sport participants representing 32 different sports. More recently, Vaughan and Laborde (2018) found similar results with no differences in EI across sport expertise. With particular reference to the sport of rugby, Knobel (2010) also found that EI was not a predictor of rugby performance in terms of inclusion into a schools' A-team as a starting player. Although there are too few comparative studies which directly investigate the differences in EI across sport expertise to draw a meaningful conclusion, it seems that the available research findings to date tended to point towards an expectation that elite rugby players would have a discernibly higher level of EI which enables them to communicate more effectively and, thus, to perform better.

Furthermore, the results of the MBI (Figure 1) indicated that the external emotional capacity (EEC) attained medium worthwhile effect in favour of the professional players. This subscale refers to interpersonal relations, encompassing social skills and the management of relationships. According to Goleman (1998), successful performance and a warm, desirable social environment with a high degree of cooperation might enhance participants' level of emotional and social intelligence. Drawn from Goleman's finding, we speculate that differences in the environments of the professional and semi-professional groups contributed to the better external emotional capacity of the professional rugby players in our study. However, more research is required to establish sound empirical evidence for the link between EI and expertise in sport.

As with any study in the field of psychology, the present study also contains certain limitations that need to be considered. Firstly, the study involved only male players, and it could be interesting to investigate the EI and expertise relationship among female rugby players. We therefore recommend that similar future studies also involve female participants

to address this limitation. Secondly, our participants take part in one sport (rugby) which might have limited the chances of detecting differences in the level of EI between the players competing at different levels. Hence, we recommend that similar studies should in future involve participants from various sports. Our study also involved a relatively small sample size which limited the generalizability of the results to other rugby players. It also only included participants from one country, namely South Africa. Future studies should therefore aim at replicating this study using larger sample sizes and in different countries to obtain more clarity on the relationship between EI and expertise in rugby.

Our study also did not take possible mediating factors such as the players' cognitive abilities, personality and cultural differences into account. Various studies displayed meaningful correlations between EI and measures of general intelligence, signifying that EI might be associated with cognitive abilities such as decision making, problem solving, learning, memory and reasoning (Aminabadi *et al*., 2011; Fox *et al*., 2011; Copestake *et al*., 2013; Iliescu *et al*., 2013). Additionally, Williams *et al*. (2009) found that numerous executive functions play a significant role in stress regulation. Given the role that EI plays in stress and emotional regulation (Laborde *et al*., 2011; 2014) we can speculate that certain executive functions might mediate the relationship between EI and emotional regulation. We therefore urge researchers to consider the interrelationships between these variables in an attempt to understand the relationship between EI and expertise in sport. Since our group consisted of players of different cultures, we also recommend that similar future research takes culture into account to ensure that the measurements used to assess EI are valid and reliable in different cultures. Kemp *et al*. (2005) found that extraversion and openness from the NEO-FFI were the strongest predictors of total EI as determined by the BRIEF EI measurement tool. Also, openness strongly predicted the IEC factor, while extraversion and conscientiousness were the strongest predictors of the IEC and EEC factors respectively. We

thus propose that future researchers take personality into account when exploring the link between EI and expertise in sport.

CONCLUSIONS

Despite the limitations mentioned above, when considering the dearth of studies exploring the possible link between EI and sports expertise and more specifically in rugby, the present study provided valuable insights, particularly within the South African context. However, more studies of this nature are warranted before conclusions can be drawn. As this study was exploratory by nature and set out to only indicate what the nature of the relationship is between EI and performance in the sport of rugby, it succeeded in its aim. Given that it was only the second of its kind done on South African rugby players, the results provided another valuable step towards gaining a more in-depth understanding of the association between EI and rugby players competing at different levels of the sport. Currently, it seems that EI does not discriminate between professional and semi-professional rugby players and that other factors such as physical, technical, tactical and psychological aspects play a more critical role in rugby performance.

PRACTICAL IMPLICATIONS

Resulting from our study, it seems that players who are capable of maintaining better interpersonal relations, having better social skills and managing relationships more effectively are those performing at higher levels in rugby. The EEC (external emotional capacity) subscale of the BRIEF might be suggested as a screening tool for identifying players that teams would prefer to recruit since these players will most likely contribute to a positive team environment and progress to the top level in their sport.

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CHAPTER 5

Article 4

Investigating the relationship between personality, cognitive abilities and emotional intelligence among South African rugby union players

INVESTIGATING THE RELATIONSHIP BETWEEN PERSONALITY, COGNITIVE ABILITIES AND EMOTIONAL INTELLIGENCE AMONG SOUTH AFRICAN RUGBY UNION PLAYERS

ABSTRACT

The study aimed to investigate the relationship between personality and EI and cognition and EI among South African rugby players. A convenience sample of 79 male South African rugby players between the ages of 19 and 37 participated in the study. The WebNeuro Sport online assessment which includes amongst others a cognitive functioning domain, the Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) and a Personality inventory (NEO-FFI) was completed. Findings indicate a significant correlation between total EI and extraversion and conscientiousness. Internal emotional capacity significantly correlated with extraversion, openness, agreeableness and conscientiousness. External emotional capacity showed a significant correlation with extraversion and openness. Pertaining to cognition, external emotional capacity significantly correlated with verbal ability. To control for age, level of play and years of education, the hierarchical multiple linear regression analysis was utilised to examine the predictive utility of cognition and personality on EI. The findings of the multiple linear regression analysis revealed that the nuisance variables explained 3% of the variance in EI, personality an additional 31% with the cognitive subscales a further 13%. From a theoretical perspective the results of this study contributed to the mixed-model theory in that EI consists of constructs associated more with personality than with an individual's cognition.

Keywords: cognitive abilities; emotional intelligence, personality, rugby union players

INTRODUCTION

The term 'emotional intelligence (EI)' was originally coined by Daniel Goleman in the mid-1990s (Laborde *et al.*, 2016). Since then it has thrived in many research realms, mainly due to its potential to optimise human performance, relationships, wellbeing, (Stough *et al.*, 2009), academic performance, job performance, leadership, stress and overall health (Keefer *et al.*, 2018). The interest in EI was also fuelled by anecdotal evidence suggesting that cognitive ability alone is not enough for success in life (Cherniss, 2010). Furthermore, a growing body of evidence suggests that EI also plays a vital role in enhancing sport performance (Laborde *et al.*, 2016).

EI is mainly conceptualized from two contrasting perspectives, namely that of EI as an ability which can be learned - the ability model - and that of EI as a constellation of an individuals' cognitive abilities and personality traits, such as optimism, motivation and stress tolerance – the mixed model (Mayer *et al.*, 2008; Webb *et al.*, 2013). Conceptualized from the ability model it is suggested that EI varies from one situation to the next and is trainable (Salovey & Mayer, 1990; Matthews *et al.*, 2007) whereas the mixed model conceptualization of EI views EI as a trait which is relatively stable over time and across different situations and is located at the lower level of personality hierarchies (Petrides, 2009a). Personality can be defined as "psychological qualities that contribute to an individual's enduring and distinctive patterns of feeling, thinking and behaving (Pervin & Cervone, 2010, p. 8) while the term personality hierarchies refers to those personality traits organized hierarchically, with narrow, specific traits combining to define broad, global personality factors (Costa & McCrae, 1995).

Researchers have held lengthy debates on what the best approach would be to conceptualize EI in sport and physical activity contexts. In an attempt to merge the ability- and mixed model conceptualization of EI, a third model, the tripartite model of EI was subsequently introduced for this purpose, which suggests three levels of EI (Mikolajczak, 2009; Nelis *et al.*, 2011). The first level represents knowledge – what an individual knows about emotion; the second level of the

model encompasses ability – the degree to which an individual is capable of performing a particular emotion regulation technique; and the third level of the model entails a trait - what an individual usually does during a particular emotional situation. Both the mixed model and the tripartite model's conceptualization of EI emphasizes the notion that EI does not function in isolation, but that an individual's cognitive abilities and personality might influence the individual's level of EI. An athlete's level of EI can be influenced by various factors such as type of sport, sex (Laborde *et al.*, 2014) age (Sharma, 2017), level of play (Laborde *et al.*, 2016) and academic success (Petrides *et al.*, 2004). For the purpose of the present study, the authors will explore the effects of age, level of play and level of education of the participants. Pertaining to age, Sharma (2017) found a significant impact of age with total EI increasing with age while Laborde and co-workers (2016) reported that athletes performing better in EI tests are more successful in their chosen sports. Based on the findings of Petrides *et al.* (2004) showing a positive correlation between trait EI and academic success, we hypothesize that players with higher levels of education will possess a higher level of total EI.

The relationship between personality factors and EI in an organizational or academic context has been widely investigated, however, the association between personality factors and EI in sport remains limited. One particular study that was however done on the topic by Tok and colleagues (2013) among athletes from various disciplines (including soccer, volleyball, basketball and swimming) found significant positive correlations between the regulation of emotions subscale of the Schutte Emotional Intelligence Scale (SEIS) and the personality traits of Agreeableness ($r = 0.32$, $p < 0.05$) and Conscientiousness ($r = 0.33$, $p < 0.05$). The Schutte Emotional Intelligence Scale is a 33-item, self-report assessment of EI assessing an individual's appraisal and expression of emotions in self and other among four dimensions namely: perception of emotion, managing one's own emotions, managing others' emotions and utilisation of emotions. The data further revealed a significantly negative association with Neuroticism ($r = -0.34$, $p < 0.05$). Also, a

significant positive correlation was found between the utilization of emotions subscale of the SEIS and the personality trait of Openness ($r = 0.34$, $p < 0.05$). Furthermore, the researchers reported a significant negative association between the application of emotion subscale of the SEIS and the personality trait of Neuroticism ($r = -0.42$, $p < 0.01$). Regarding total EI, a significantly positive relationship was found with Agreeableness ($r = 0.31$, $p < 0.05$) and Openness ($r = 0.31$, $p < 0.05$) with a significantly negative association with Neuroticism ($r = -0.37$, $p = 0.05$). In addition to personality, both the mixed model and the tripartite model's conceptualization of EI emphasizes the idea that EI does not function in isolation, but that an individual's cognitive abilities might also influence the individual's level of EI.

Sport is characterized by taking frequent decisions in high-pressure stressful environments (Raab & Johnson, 2007). Additionally, the quality of decision-making and the appraisal of risk are critical elements for successful performance in sport (Raab & Johnson, 2004). According to various researchers, athletes use emotional information to support their decision-making in tasks involving risks (Laborde *et al*., 2013; Panno *et al.*, 2015). In this regard, Raab and Johnson (2004) claim that higher-order personality traits such as trait emotional intelligence (TEI) might influence risky decision-making during a basketball throwing task. Mechanisms outside of sport such as emotion regulation, information processing and search and positive cueing based on somatic markers (Alkozei *et al.*, 2018; Alkozei *et al.*, 2016; Fallon *et al.*, 2014, Panno, 2016; Pilarik & Sarmany-Schuller, 2009) are proposed to provide insight into how TEI may assist athletes in risky decision-making process (Mayer *et al.*, 2008). Fallon and colleagues (2014) further found a positive relationship between higher TEI and the information search component of decision-making. Furthermore, Alkozei *et al.* (2016) observed that individuals with higher TEI use emotional information more effectively in making decisions outside of sport. More recently, Vaughan, Laborde and McConville (2019) investigated the effect of TEI on decision-making among sport participants participating on different levels. Their findings suggest that athletes with

higher levels of TEI make higher quality decisions compared to their counterparts with lower levels of TEI. The latter finding holds merit based on the view of Meyer and Fletcher (2007) who proposed that higher TEI might act as a facilitator for a range of positive abilities such as impulse control, which in turn can enhance decision-making in sport. Research was also conducted outside of sport on 137 healthy individuals between the ages of 18 and 60 from a community using the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) (Mayer *et al.*, 2000) and the Brief Assessment of Cognition in Schizophrenia (BACS) (Keefer *et al.*, 2004) (Pardeller *et al.*, 2017). The MSCEIT is a computer-based test that taps into four domains of EI reflecting an individual's ability to perceive, use, understand and manage emotions (Mayer *et al.*, 2000). The BACS is a fully portable test designed to assess cognitive functions such as verbal memory, working memory, motor speed, attention, executive functions and verbal memory (Keefer *et al.*, 2004). Various relationships between EI and cognitive abilities were found (Pardeller, *et al.*, 2017). In this regard a positive correlation between the MSCEIT subscale of understanding emotions and the BACS subscale of verbal memory ($r = 0.31$, $p < 0.01$), executive functioning ($r = 0.36$, $p < 0.01$) and attention ($r = 0.22$, $p < 0.01$). They also found a positive relationship between both the MSCEIT total score ($r = 0.23$, $p < 0.01$) and the MSCEIT subscale of using emotions ($R = 0.17$, $p < 0.05$) and executive functioning. Research about the relationship between EI and cognitive in sport is scarce. However, the noted correlations between EI and decision-making and EI and cognitive abilities suggest a justification for further exploration of the association between EI and cognitive abilities among rugby union (hereafter referred to as rugby) players.

PURPOSE OF THE RESEARCH

This empirical study article aimed to explore whether a significant relationship exists between personality and emotional intelligence and/or cognition and emotional intelligence among a cohort of South African rugby players. Based on the literature available we hypothesize that a significant

relationship will exists between personality and emotional intelligence and between cognition and emotional intelligence among South African rugby players.

METHODOLOGY

Research design

The present study was exploratory in nature and adopted a quantitative empirical research approach in which a cross-sectional survey design with a convenience sample was used. A cross-sectional survey design was used which entails collection of data by using surveys to make inferences about a population of interest at one point in time (Lavrakas, 2008). As such, it was selected for this study as it was regarded to best fit the research objective.

Participants

The sample consisted of a convenience sample of 79 male South African rugby players between the ages of 19 and 37 years, playing at national, transnational and university level. This sample size was considered to be sufficiently representative of the total population. This is as the total population of male South African rugby players who compete at the afore-mentioned levels at the time when the data was collected amounted to approximately 1500 players in total. Convenience sampling entails a type of non-probability sampling where the particular sample is drawn from a part of the population because they are “convenient” sources of data for the researcher (Lavrakas, 2008). In this instance the sample was obtained from the players of three rugby teams, one national team, one transnational team and one university level team. As standardized procedure, all the players were assessed at the beginning of a competitive season by a Sport Psychologist to determine their level of psychological functioning. Only the results of the players who completed all the sub-tests of the assessment were included for further analysis in this study.

Instruments

The players completed the WebNeuro Sport online assessment (Brain Resource Company: BRC, 2010), which represents a holistic assessment of various factors which might potentially influence an athlete's performance. The assessment consists of a demographic questionnaire (including name, surname, age and gender) and seven assessments namely the Carlstedt Subliminal Attention, Reactivity and Coping Scale-Athlete Version (CSARCS-A); the cognitive functioning domain; the Brain Resource Inventory for Screening Cases (BRISC) which is a screening tool for markers of self-regulation; the Depression Anxiety Stress Scale (DASS); a sleep assessment questionnaire which evaluates the test taker's quality and frequency of sleep; the Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) and a Personality inventory (NEO-FFI) (Costa & McCrae, 1992). For the purpose of this article, only the data of the cognitive functioning domain, the BRIEF and the NEO-FFI were used.

Emotional Intelligence

The Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) is a self-report measure of EI, on which participants are requested to respond using a 5-point scale ranging from 1 (I strongly disagree with this statement) to 5 (I strongly agree with this statement) comprising internal emotional capacity (IEC), external emotional capacity, self-concept and total EI. Test-retest reliability estimates have been reliable at a 4-week interval ($r = 0.92$), and a strong positive correlation between the BRIEF and the Self-Report Emotional Intelligence Test (SRIET; $r = 0.70$) supports the convergent validity of the instrument (Kemp *et al.*, 2005). For a more detailed description of these test see Kemp *et al.* (2005).

Cognitive functioning

The players were administered the WebNeuro Sport online assessment with the cognitive domain comprising tasks tapping into memory, attention and behaviour, sensory-motor functions,

executive functioning, verbal ability and emotional identification ability (Brain Resource Company: BRC, 2010). Correlations between the IntegNeuro, the WebNeuro factors and overall performance scores yielded validity coefficients that ranged between 0.56 to 0.86 (Silverstein *et al.*, 2007). For a more detailed description of these tasks, refer to Silverstein *et al.* (2007).

Personality

The players' personalities were assessed using the NEO-Five Factor Inventory (NEO-FFI). The NEO-FFI is a 60-item self-report measure which assesses five dimensions of personality namely extraversion, neuroticism, openness, agreeableness, and conscientiousness (Costa & McCrae, 1992). Scores from the NEO-FFI have acceptable levels of reliability (0.68 to 0.89) across a range of diverse populations (McCrae & Costa, 2007). The reliability of scores from the NEO-FFI in the present sample varied between 0.66 to 0.79.

Procedure

Data were collected at the venues where the respective teams were based, namely Johannesburg, Potchefstroom and Cape Town. The players completed an online evaluation on a laptop and/or desktop computer which was connected to the internet. The set-up was done to ensure privacy and that the participants encountered limited distractions. The data collection took approximately 90 minutes.

Statistical analysis

The SPSS (Statistical Package for the Social Sciences) software programme (Version 25) was used to analyse the data. Descriptive statistics such as minimum, maximum and mean values, standard deviations and standard errors were used to analyse the research data. To examine the relationship between the players' levels of EI and personality and EI and cognitive abilities, the Pearson's correlation coefficient (also referred to as Pearson *r*) was used. Pearson *r* measures the strength of relatedness or association between two variables. In a general sense this relationship is indicated as a range from -1.0 to 0 through to +1.0. A 0 value implies that no association exists

between the two variables, whereas a -1.0 indicates a perfect negative correlation. This implies as one variable increases; a perfectly predictable decrease will occur in the other variable. A score of +1.0 further implies the opposite, namely a perfect positive relationship. This implies that as the score on one variable increases, the score on the other will predictably also increase in the same strength (Pallant, 2007.). To interpret the results in the present study, Cohen's (1992) table of effect size magnitudes were used where < 0.10 is insignificant, 0.10 – 0.30 is small to medium, 0.30 – 0.50 is medium to large and > 0.50 is large to very large.

In addition to Pearson *r*, hierarchical multiple regression was also used in the present study to assess the ability of personality and cognitive functioning to predict emotional intelligence, after controlling for age and years of education. In simple terms multiple regression is utilised in instances where the aim is to predict the value of a certain variable based on the value of two or more other variables (Pallant, 2007). Hierarchical regression further entails a method through which it is possible to indicate whether certain variables of interest may explain a statistically significant amount of variance in the dependent variable after having accounted for other confounding (Pallant, 2007). In the present study, the dependent variable was EI and the independent variables included both personality and cognitive abilities.

Ethical consideration

The participants granted permission to participate in the study by means of completing an informed consent form. The Health Research Ethics Committee (HREC) of [Name of University omitted to allow blind review] granted permission for the study (XXX-00026-18-A1).

RESULTS

The results for the descriptive statistics for the independent variables (personality and cognitive abilities), the dependent variable (emotional intelligence) and the nuisance variables

(age, years of education) is depicted in Table 1, the Pearson's correlations coefficient in Table 2 and the hierarchical multiple regression analysis in Table 3.

Table 1. **DESCRIPTIVE STATISTICS FOR THE NUISANCE VARIABLES, PERSONALITY, COGNITION AND EMOTIONAL INTELLIGENCE**

Variables	**N**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation (SD)**	**Standard Error (SE)**
Age						
Total group	79	19.00	37.00	24.95	3.70	0.42
Professional players	55	19.00	37.00	26.16	3.76	0.51
Semi-professional players	24	20.00	24.00	22.17	1.31	0.27
Years of education						
Total group	79	12.00	20.00	14.03	2.14	0.24
Professional players	55	12.00	20.00	13.8	2.29	0.31
Semi-professional players	24	12.00	18.00	14.54	1.67	0.34
Personality						
Neuroticism	73[a]	5.00	34.00	17.33	6.31	0.74
Extraversion	73 [a]	15.00	44.00	31.86	5.44	0.64
Openness	73 [a]	8.00	37.00	22.44	5.64	0.66
Agreeableness	73 [a]	18.00	41.00	29.32	5.15	0.60
Conscientiousness	73 [a]	22.00	47.00	34.68	5.65	0.66

Table 1 (cont.). **DESCRIPTIVE STATISTICS FOR THE NUISANCE VARIABLES, PERSONALITY, COGNITION AND EMOTIONAL INTELLIGENCE**

Variables	N	Minimum	Maximum	Mean	Standard Deviation (SD)	Standard Error (SE)
Cognition						
Memory	76[b]	-1.39	1.75	0.18	0.63	0.07
Attention	75[c]	-1.54	1.26	0.01	0.66	0.08
Sensory-Motor	79	-0.81	2.30	0.74	0.70	0.08
Verbal	77[d]	-3.01	1.37	-0.69	0.89	0.10
Executive function	79	-2.33	1.80	-0.05	0.86	0.10
Emotion identification	79	-1.84	2.01	0.43	0.89	0.10
Emotional Intelligence						
Internal emotional capacity	79	15.00	27.00	21.3	2.76	0.31
External emotional capacity	79	5.00	20.00	13.38	2.60	0.29
Self-concept	79	10.00	20.00	14.25	1.98	0.22
Total EI	79	36.00	59.00	48.94	4.87	0.55

Note: a6 players did not complete the NEO-PI; b3 players did not complete the memory domain of the cognitive assessment; c4 players did not complete the attention domain of the cognitive assessment; d2 players did not complete the verbal domain of the cognitive assessment; Professional players were players that were remunerated for playing; Semi-professional players were not remunerated for playing rugby

Pearson Product-moment correlations were used to determine the correlation between personality and EI as shown in Table 2. For the purpose of this discussion, only statistically significant correlations ($p < 0.05$ & $p < 0.01$) with the EI subscales will be considered.

Table 2. **PEARSON'S CORRELATIONS FOR THE INDEPENDENT VARIABLES (PERSONALITY AND COGNITION) AND THE DEPENDENT VARIABLES (EMOTIONAL INTELLIGENCE)**

Variables	**Internal emotional capacity**	**External emotional capacity**	**Self-concepts**	**Total EI**	**Neuroticism**	**Extraversion**	**Openness**	**Agreeableness**	**Conscientiousness**	**Memory**	**Attention**	**Sensory-Motor**	**Verbal**	**Executive function**	**Emotion identification**
Internal emotional capacity	1	0.21	0.15	0.74**	-0.07	0.32**	0.32**	0.26*	0.42*	0.04	-0.06	-0.14	0.05	-0.08	0.05
External emotional capacity	0.21	1	0.08	0.68**	-0.05	0.53**	0.26*	0.22	0.14	0.04	-0.08	-0.14	0.32**	-0.06	0.10
Self-concept	0.15	0.08	1	0.53**	0.06	0.16	-0.18	-0.14	0.22	0.12	-0.15	-0.12	-0.07	0.04	-0.06
Total EI	0.74**	0.68**	0.53**	1	-0.04	0.50**	0.23	0.19	0.39**	0.09	-0.14	-0.20	0.17	-0.06	0.06
Neuroticism	-0.07	-0.05	0.06	-0.04	1	-0.30**	0.08	-0.37**	-0.36**	0.01	-0.22	0.04	-0.24*	-0.05	-0.12
Extraversion	0.32**	0.53**	0.16	0.50**	-0.30**	1	0.21	0.32**	0.41**	0.10	0.12	-0.09	0.13	0.06	0.01
Openness	0.32**	0.26*	-0.18	0.23	0.08	0.21	1	0.21	0.07	0.09	-0.10	-0.26*	-0.01	-0.09	-0.08
Agreeableness	0.26*	0.22	-0.14	0.19	-0.37**	0.32**	0.21	1	0.33**	-0.07	0.17	0.02	0.11	-0.03	0.18

Table 2 (cont). **PEARSON'S CORRELATIONS FOR THE INDEPENDENT VARIABLES (PERSONALITY AND COGNITION) AND THE DEPENDENT VARIABLES (EMOTIONAL INTELLIGENCE)**

Variables	**Internal emotional capacity**	**External emotional capacity**	**Self-concepts**	**Total EI**	**Neuroticism**	**Extraversion**	**Openness**	**Agreeableness**	**Conscientiousness**	**Memory**	**Attention**	**Sensory-Motor**	**Verbal**	**Executive function**	**Emotion identification**
Conscientiousness	0.42**	0.14	0.22	0.39**	-0.36**	0.41**	0.07	0.33**	1	-0.01	-0.09	-0.13	-0.15	-0.07	-0.08
Memory	0.04	0.04	0.12	0.09	0.01	0.10	0.09	-0.07	-0.01	1	-0.04	-0.03	0.18	0.05	0.20
Attention	-0.06	-0.08	-0.15	-0.20	-0.22	0.12	-0.10	0.17	-0.13	-0.04	1	0.29*	0.48**	0.22	0.21
Sensory-Motor	-0.14	-0.14	-0.12	-0.20	0.04	-0.10	-0.26*	0.02	-0.13	-0.03	0.29*	1	0.26*	0.27*	0.01
Verbal	0.05	0.32**	-0.07	0.17	-0.24*	0.13	-0.01	0.11	-0.15	0.18	0.48**	0.26*	1	0.03	0.30**
Executive function	-0.08	-0.06	0.04	-0.06	-0.05	0.06	-0.09	-0.03	-0.07	0.05	0.22	0.27*	0.03	1	0.04
Emotion identification	0.05	0.10	-0.06	0.06	-0.12	0.01	-0.08	0.18	-0.08	0.20	0.21	0.01	0.30**	0.04	1

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed

Total EI demonstrated a statistically significant correlation with a large effect size with the personality scales of Extraversion (r = 0.50; p < 0.01) and a medium effect size with Conscientiousness (r = 0.39; p < 0.01). The EI subscale of Internal emotional capacity (IEC) showed a statically significant correlation with a small to medium effect size with Extraversion (r = 0.32; p < 0.01), Openness (r = 0.32; p < 0.01), Agreeableness (r = 0.26; p < 0.05) and Conscientiousness (r = 0.42; p < 0.01). External emotional capacity (EEC) obtained a statistically significant correlation with a small to large effect size with Extraversion (r = 0.53; p < 0.01) and Openness (r = 0.26; p < 0.05).

Statistically significant results were obtained for one of the EI subscales used to determine whether a statistically significant relationship exists between EI and cognition as shown in Table 2, namely EEC. This subscale showed a statistically significant relationship with a medium effect size with the verbal subscale (r = 0.32; p < 0.01) of cognition.

Hierarchical multiple regression analysis, with age and years of education (nuisance variables) entered as step 1 followed by personality (step 2) and cognition (step 3) was used to determine the extent of the relationship between personality and EI and cognition and EI while controlling for the effect of the nuisance variables. The Brain Resource Inventory for Emotional Intelligence Factors (BRIEF, Kemp *et al.*, 2005) showed a derived integrated score of total EI based on the three distinct scales, namely internal emotional capacity (IEC), external emotional capacity (EEC) and self-concept (SELF). The derived total EI score of the BRIEF was used as the dependent variable with personality and cognition as the independent variables. The total EI was regressed on personality and cognition respectively to explore the multivariate relationship between these constructs.

Three models were used for the analysis. The first model demonstrated the regression of total EI on the nuisance variables to determine the overall effect size of these variables with EI. As a second step, personality was entered to demonstrate the effect size of personality with EI after

controlling for the nuisance variables. Thirdly, cognition was entered to demonstrate the effect size of the cognitive subscales with EI after the nuisance variables were taken into account.

Table 3. **HIERARCHICAL MULTIPLE REGRESSION ANALYSES**

Variable	**Step 1**	**Step 2**	**Step 3**
	Age, level of play, years of education	**Personality**	**Cognition**
Total EI	$\Delta R^2 = 0.01$, $F(3, 75) = 0.78$ Age β = 0.07, LoP β = -0.12, YoE β= 0.18	$\Delta R^2 = 0.26$, $F(5, 64) = 5.99$ Neu β = 0.22, Ext β = 0.42*, Open β = 0.10, Agree β= 0,12, Con β = 0.25*	$\Delta R^2 = 0.03$ $F(6, 63) = 1.55$ Mem β = 0.04, Att β= -0.25, Sen β= -0.22, Ver β = 0.32*, Exe β = 0.03, Emo β = -0.04

LoP – level of play, YoE = years of education; Neu = neuroticism, Ext = extraversion, Open = openness, Agree = agreeableness, Con = conscientiousness; Mem = memory, Att = attention & behavioural, Sen = sensory-motor, Ver = verbal, Exe = executive functions, Emo = Emotion identification; * Statistically significant at the 0.05 level

To further explore the relationship between personality and EI and cognition and EI, a series of hierarchical multiple regression analyses were performed. The nuisance variables explained 1% of the variance in EI. After entry of the personality subscales at Step 2 an additional 26% of the variance in EI was explained with the cognitive subscales explaining a further 3% of the variance in EI after taking the nuisance variables into account. None of the nuisance variables showed any significant predictive utility for EI. Pertaining to personality, EI was positively predicted by extraversion ($\beta= 0.42^*$, $p < 0.05$) as well as conscientiousness ($\beta= 0.25^*$, $p < 0.05$). Lastly, only the verbal function ($\beta= 0.32^*$, $p < 0.05$) of cognitive ability positively predicted total EI in the group of rugby players

DISCUSSION

This study aimed to explore the relationship between personality and EI, as well as cognition and EI, among a cohort of South African rugby players competing at national, transnational and university levels. Consistent with the literature, this study found a number of significant correlations between personality and EI. In this regard, extraversion correlated with three of the four EI scales; conscientiousness with two of the EI scales; openness to experience with two of the EI scales while agreeableness correlated with one EI scale (Costa & McCrae, 1997). Pertaining to the relationship between EI and cognition, only the verbal task of cognition showed a significant correlation. This finding adds credence to the work of Fernández-Berrocal and Checa (2016) which suggests a link between cognitive ability and EI.

The results indicate that individuals with high total EI are likely to score high on the personality factors of extraversion and conscientiousness. This finding is in line with those of Dhani and Sharma (2017) and Athota *et al.* (2009) who reported a significant positive correlation between EI and extraversion which suggests that individuals with high levels of total EI are likely to portray sociable, outgoing and active characteristics. The positive association between EI and conscientiousness could be justified by the findings of various other researchers (McCrae, 2000; Day & Caroll, 2004; Zadel, 2004; Shulman & Hemenover, 2006) who suggested that individuals with a high level of EI will most likely display greater self-control, responsibility, self-discipline and high regard for achievement.

Under stressful conditions in sport, athletes need to regulate their energy levels to achieve optimal performance (Zizzi *et al.*, 2010). Athletes must therefore learn to recognize their own individualized zones of optimal functioning (IZOF) (Hanin, 1995) by developing the skills to effectively regulate their own emotions. Athletes with high levels of EI may therefore be better at recognizing and utilizing their IZOF in certain situations compared to athletes with low levels of EI. Results from the present study found significant positive correlations to exist between the

internal emotional capacity (IEC) of EI and extraversion, openness, agreeableness and conscientiousness. These results accord with a study by Kemp and co-workers (2005) suggesting that the personality traits of openness, extraversion and agreeableness are predictors of IEC. Therefore, individuals with higher scores on the personality traits of extraversion, openness, agreeableness and conscientiousness might be associated with higher scores of the IEC factor of EI, involving a better perception of emotions in oneself and in others, better intuition as well as empathy (Kemp *et al.*, 2005). The results from the present study also suggest a positive association between the external emotional capacity (EEC) of EI and extraversion and openness. Kemp *et al.* (2005) found similar results with extraversion and openness as significant predictors of EEC. Thus, individuals who are sociable, outgoing, active, curious, creative and imaginative might have better social skills and be better at managing relationships. Players who score high on these traits will therefore in all likelihood become valuable team members who can drive the team culture.

When considering the relationship between EI and cognition, only one dimension of cognitive functioning, namely verbal abilities, showed a positive correlation with the EEC domain of EI. Kemp and co-workers (2005) found extraversion to explain to most variance in EEC, suggesting that an increased score on the personality trait of extraversion were associated with an increased score in the EEC factor. One the other hand, Sutin *et al.* (2011) stated that performance on verbal abilities may be moderated by demographic and individual differences. For example, an individual's personality traits may contribute to the ability to retrieve specific words. These researchers furthermore suggested that seeing that extraverted individuals tend to have exceptional language skills; such individuals should perform superiorly on verbal tasks. Extraversion's relationship with the EEC domain of EI as well as with an individual's verbal abilities might explain the positive correlation we found between EEC and verbal abilities. In addition, this finding adds credence to the work of previous researchers suggesting that self-report EI is more associated with personality that with IQ (Brackett & Mayer, 2003; Dawda & Hart, 2000;

Newsome *et al.*, 2000). This might be indicative that individuals with higher EI would be more likely to have a better ability to recognize words, access words and to remember what has been heard. This can make these players more effective communicators, both on and off the field.

The results of the hierarchical multiple regression analyses emphasized the previous findings by identifying extraversion, conscientiousness and verbal functioning as significant predictors of EI. Therefore, based on these results it may be concluded that people who possess higher levels of EI might be the individuals displaying higher levels of energy, who actively seek out attention from others, who are controlled, organized and hardworking. In addition, individuals scoring higher on verbal functioning will also most likely have a better capacity to recognize and utilize emotional states in order to change intentions and behaviours. From a theoretical perspective the results of this study contributed to the mixed-model theory in that EI consists of constructs associated more with personality (Bar-On, 1997; Goleman, 1995; Joseph & Newman, 2010, Stough *et al.*, 2009) than with an individual's cognition. Finally, based on the results obtained from the present study, it was considered that the research hypothesis was ultimately proven to be correct, namely that a significant relationship does exist between personality and emotional intelligence and between cognition and emotional intelligence.

RECOMMENDATIONS

As is the case with all studies conducted in the social sciences field, the present study also contained some limitations. Firstly, only men were involved in our study. This was purely as a result of the data that had been obtained while the 3rd author was delivering services to these teams. As such, they only consisted of male teams. It could therefore be interesting to investigate the relationship between EI and personality and between EI and cognition among female South African rugby players. Secondly, our participants were only from one sport, namely rugby union, and it would be of interest to see the effect of different types of sports (both team and individual

sports) on similar research studies. In this study EI was further determined by the BRIEF. In the development of the BRIEF measure Kemp and colleagues (2005) found that the SELF (self-concept) subscale showed a low internal consistency. As such we suggest future researchers to consider other instruments measuring EI. Lastly, in order to obtain more clarity on EI as a non-cognitive ability, we propose that future studies also include an intelligence (IQ) test so as to be able to distinguish whether EI is in fact a form of intelligence or not. From an applied perspective we suggest that future research focus on exploring if a significant correlation exists between EI and a player's on-field performance. The results of such research might assist team management in the recruitment of players.

CONCLUSION

Despite its limitations, this study provides interesting insights into the association between EI and personality and between EI and cognitive abilities in the sport context. This is as it brings additional evidence to the notion that EI is more associated with an individual's emotional, personal and social aspects of intelligence and to a lesser degree to an individual's cognitive intelligence. EI is identified as a predictor of significant outcomes in various real-world domains (Mayer *et al.*, 2008) and our results indicated that EI showed a positive correlation with certain personality traits such as conscientiousness, openness, agreeableness and extraversion.

PRACTICAL IMPLICATIONS

From an applied point of view, if we assume that all physical characteristics of players are equal, coaches, selectors and others involved in rugby union might be interested in recruiting players with higher levels of conscientiousness, openness, agreeableness and extraversion based on the findings of this investigation as they will most likely have higher levels of EI. In addition to recruiting players with these favourable personality traits, the verbal function of a cognitive

measure might also be indicative of a rugby player with a higher level of EI. Finally, from a theoretical point of view, it is hoped that this study will have assisted to shed more light on the findings of other studies dealing with the relationship between EI and personality and EI and cognition.

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CHAPTER 6

Conclusions, limitations and recommendations

- **Introduction**
- **Chapter 1**
- **Chapter 2 / Article 1 summary**
- **Chapter 3 / Article 2 summary**
- **Chapter 4 / Article 3 summary**
- **Chapter 5 / Article 4 summary**
- **Conclusions**
  - **Thesis statement 1**
  - **Thesis statement 2**
  - **Thesis statement 3**
  - **Thesis statement 4**
- **Limitations and recommendations**
- **Contribution of the study**
- **Researcher's experience**
- **Conclusion**

Introduction

This concluding chapter presents a general overview of the complete study. The extent to which the aims have been addressed will also be highlighted. Possible limitations of the study are noted and recommendations for future research are also proposed. To conclude this chapter, the contribution of this study will be highlighted.

The objectives of this study were fourfold. The first objective was to investigate differences in the neurocognitive profiles of professional and semi-professional South African rugby union players. The second objective was to investigate whether a difference exists in the personality profiles of professional and semi-professional South African rugby union players. Thirdly, the objective was to investigate whether differences exist in the level of emotional intelligence between professional and semi-professional South African rugby union players. The final objective was to investigate the relationship between personality, cognitive abilities and emotional intelligence in South African rugby union players. The overall sample for the study included a total of 79 players. Unfortunately, 6 players did not complete the NEO-FFI personality assessment and, therefore, their data could not be included. This led to a deviation from the entire sample size of 79 in the second article (Chapter 3).

Chapter 1

Chapter 1 consists of a brief literature overview to contextualize the study which focused on the history of rugby union as a sport followed by a brief discussion of rugby in the context of the Southern Hemisphere and, more specifically, in South Africa. This section was followed by a brief discussion of the measuring instrument, the WebNeuro Sport, which was used in the study to give the reader an overview of the development, content and aim thereof. The literature review also reported on neurocognitive functioning, personality, and emotional intelligence, how it was measured in the current study as well as its relationship with sport

performance. The interrelationship between cognition, personality and emotional intelligence was also discussed. The chapter further contained the research questions and objectives, the research statement (hypotheses), the delineations and limitations, the assumptions and significance of the study. Lastly, a chapter overview of the thesis was presented.

The next section will be devoted to the findings and conclusions of each article followed by a brief discussion of the limitations of the study. Lastly, recommendations for future research will be proposed.

Chapter 2 / Article 1 summary

This article titled "Differences in the neurocognitive profiles of professional and semi-professional male South African rugby union players" has been published in the *Journal of Psychology of Africa* (see Addendum 1). The article sought to investigate the differences in the neurocognitive profiles of professional and semi-professional male South African rugby union players. It presents the results of the differences in cognitive functioning among a group of South African rugby union players. A convenience sample of 79 male rugby union players aged 19-37 years was utilised. The players were further divided into a professional (n = 55) and semi-professional group (n = 24) based on receiving remuneration for participation, with professional group members being remunerated for participation. The players completed the WebNeuro Sport which tapped into memory, attention, and behaviour, sensory-motor, executive functioning, verbal and emotion identification tasks. Sadly, we were unable to determine the reliability of the neurocognitive assessment for our population as we did not have access to the compilation of the assessment. As such, we did not know which variables contributed to which component of cognition as defined by Carlstedt (2007).

The investigation made use of a quantitative approach. As such, basic statistics, an independent t-test and magnitude-based inference methods were used where the effect sizes were examined according to Cohen's guidelines to describe and analyse the data. No

significant differences in the cognitive tasks were found between the two groups. However, a small effect for memory in favour of the semi-professional group was detected. The conclusion drawn from these results was that a certain sport (in this case rugby) might lead to more efficient brain networks which results in a certain cognitive skill profile among participants of the same sport. This study makes a valuable contribution to the current literature on neurocognition in sport. To the authors' knowledge, this is the first study of its kind among South African rugby players; therefore the study paves the way for future similar research. Lastly, according to the results of our study, cognitive functioning does not discriminate between rugby players playing at different levels and should therefore not be used in team selection.

Chapter 3 / Article 2 summary

This article titled "Personality profiling of South African rugby union players" has been published in the *Journal of Psychology of Africa* (see Addendum 1). This article aimed to investigate whether differences exist in the personality profiles of professional and semi-professional rugby union players. A convenience sample of 73 male rugby union players aged 19-37 years was included. The players were further divided into a professional (n = 52) and semi-professional group (n = 21) based on receiving remuneration for participation, with professional group members being remunerated for participation. All participants completed the NEO Five-Factor Personality Inventory (NEO-FFI) as part of the WebNeuro Sport online assessment. Scores from the NEO-FFI was found to have acceptable levels of reliability (ranging from 0.68 to 0.89) across a range of diverse populations (Costa & McCrae, 1992).

The study utilised a quantitative approach, and an independent t-test showed a statistically significant difference in the neuroticism domain between the professional and semi-professional players, with the semi-professional group obtaining a higher result for this personality domain. The magnitude-based inference method confirmed the results of the

independent t-test with a moderate effect. It was thus concluded from the findings that professional rugby players appear to be emotionally more stable with a generally better ability to be coached, possessing more self-control and an ability to overcome detrimental tendencies, desires, and behaviours. Also, professional players seem to be able to resist short-term temptations to achieve their long-term goals. The potential value of these findings is that the Big Five personality dimension of neuroticism can be used as a screening tool for indicating which players a team would want to recruit and invest time and money in, since these players will most likely be capable of progressing to the top level in their sport.

Chapter 4 / Article 3 summary

Chapter 4 was also presented in article format titled: "The effect of expertise on emotional intelligence of professional and semi-professional South African rugby players" which is currently under review at the *South African Journal for Research in Sport, Physical Education and Recreation* for possible publication (see Addendum 2). This study sought to investigate whether differences exist in the level of emotional intelligence between professional and semi-professional South African rugby players. The study also involved 79 male South African rugby players with the group being divided into a professional group (n = 55) and a semi-professional group (n = 24), aged 19-37 years. The professional players were remunerated for participation. As part of the WebNeuro Sport, The Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) was used to assess the players' level of EI. The internal consistency for the IEC, EEC, and SELF range from 0.42 to 0.64, and 0.67 to 0.71 for the total scale (Kemp et al., 2005). Test-retest reliability estimates have been reliable at a 4-week interval (r = 0.92), and a strong positive correlation between the BRIEF and the Self-Report Emotional Intelligence Test (SRIET; r = 0.70) supports the convergent validity of the instrument (Kemp et al., 2005). As with the previous studies, this study also adopted a quantitative approach. An independent t-test indicated no statistically significant difference in

total emotional intelligence or the associated subscales. However, the magnitude-based inference (MBI) method indicated that the external emotional capacity (EEC) attained medium worthwhile effect in favour of the professional players. We thus concluded that the players who are capable of maintaining better interpersonal relations, most likely possess better social skills and can manage relationships more effectively and are the players performing at higher levels in rugby. These findings add value to the existing literature in that the EEC subscale of the BRIEF might be used as a screening tool for identifying players which teams would prefer to recruit since these players might contribute to a positive team environment and progress to the top level in their sport.

Chapter 5 / Article 4 summary

Chapter 5 is also presented in article format titled: “Investigating the relationship between personality, cognitive abilities and emotional intelligence in South African rugby union players”. This article was also prepared in accordance with the guidelines of the *South African Journal for Research in Sport, Physical Education and Recreation* and is currently under review for possible publication (see Addendum 2). This article aimed to explore whether a relationship exists between personality and emotional intelligence and cognition and emotional intelligence among a cohort of South African rugby union players. A convenience sample consisting of 79 male South African rugby union players between the ages of 19 and 37 years, playing at national, transnational and university level was also included in this study which also followed a quantitative approach. The results of the cognitive domain, NEO-FFI personality assessment, and The Brain Resource Inventory for Emotional Intelligence Factors (BRIEF) were used to address the aim. Basic statistics, Pearson’s correlation coefficient, and hierarchical multiple regression analysis were used. To interpret the results, Cohen’s (1992) table of effect size magnitudes was used where a total of < 0.10 is insignificant, 0.10 – 0.30 is small to medium, 0.30 – 0.50 is medium to large and >

0.50 is considered to be large to very large. We controlled for age, years of education as well as the level of play. Total EI demonstrated a statistically significant correlation with a large effect size with the personality scales of Extraversion (r = 0.50; p < 0.01) and a medium effect size with Conscientiousness (r = 0.39; p < 0.01). The EI subscale of Internal emotional capacity (IEC) showed a statically significant correlation with a small to medium effect size with Extraversion (r = 0.32; p < 0.01), Openness (r = 0.32; p < 0.01), Agreeableness (r = 0.26; p < 0.05) and Conscientiousness (r = 0.42; p < 0.01). External emotional capacity (EEC) obtained a statistically significant correlation with a small to large effect size with Extraversion (r = 0.53; p < 0.01) and Openness (r = 0.26; p < 0.05). On cognition, EEC showed a statistically significant relationship with a medium effect size with the verbal subscale (r = 0.32; p < 0.01) of cognition. The results of the Hierarchical multiple regression analysis indicated that the nuisance variables (age and years of education) explained 1% of the variance in EI with personality explaining an additional 26% of the variance in EI, and cognition an additional 3% of the variance in EI after taking the nuisance variables into account. None of the nuisance variables showed any significant predictive utility for EI. Pertaining to personality, EI was positively predicted by extraversion ($\beta = 0.42^{*}$, p < 0.05) as well as conscientiousness ($\beta = 0.25^{*}$, p < 0.05). Lastly, only the verbal function ($\beta = 0.32^{*}$, p < 0.05) of cognitive ability positively predicted total EI in the group of rugby players. The conclusions drawn from these results are that people who are full of energy, who actively seek attention from others, who are controlled, organized and hardworking will likely demonstrate higher levels of EI. Also, individuals scoring higher on verbal functioning will have a better capacity to recognize and utilize emotional states to change intentions and behaviours. We furthermore agree to previous research stating that EI is a construct associated with personality and to a lesser extent with cognition. To the authors' knowledge, this was the first study of its kind among a cohort of South African rugby players. The results

of this study indicated that EI consists of constructs which are associated more with personality than with an individual's cognition, and therefore contributes more to the mixed-model theory of EI.

Conclusions

The results of this study were used to test the thesis statements (research hypotheses) and to draw the following conclusions:

Thesis statement 1:

Hypothesis 1 stated that memory capacity, attention and behavioural tasks, sensory-motor functioning, verbal tasks, executive functioning, and emotion identification would differ significantly between professional and semi-professional South African rugby union players.

The null hypothesis stated that memory capacity, attention and behavioural tasks, sensory-motor functioning, verbal tasks, executive functioning, and emotion identification would not differ significantly between professional and semi-professional South African rugby union players

The results indicated no significant differences in the cognitive tasks between professional and semi-professional South African rugby union players. However, a small effect was detected for memory in favour of the semi-professional group.

Based on these findings, the research hypothesis was therefore rejected for attention and behavioural tasks, sensory-motor functioning, verbal tasks, executive functioning, and emotion identification and the null hypotheses accepted as there were no statistically significant differences. However, for memory capacity, the research hypothesis was accepted, and the null hypothesis rejected based on the small practical effect in favour of the semi-professional group. These results differed from what was initially anticipated, and the implications thereof are that, especially in the South African context, further research is necessary to get clarity on the neurocognitive functioning among rugby players playing at

different levels. Based on the results of the present it seems that cognitive functioning is not a discriminator between rugby players who compete at different levels in the sport.

Thesis statement 2:

Hypothesis 2 stated that extraversion, openness, agreeableness, conscientiousness, and neuroticism would significantly differ between professional and semi-professional South African rugby union players.

The null hypothesis stated that extraversion, openness, agreeableness, conscientiousness, and neuroticism would not differ significantly between professional and semi-professional South African rugby union players.

The results of the second article indicated a statistically significant difference in neuroticism between the professional and semi-professional players with the semi-professional group obtaining a higher result for this personality domain. The magnitude-based inference method confirmed the results of the independent t-test with a moderate effect.

Based on these findings, this research hypothesis was thus accepted for the personality domain of neuroticism based on the statistically and practically significant differences between the professional and semi-professional South African rugby union players. However, for extraversion, openness, agreeableness, and conscientiousness the set hypothesis was rejected, and the null hypotheses accepted. This finding implied that the Neuroticism scale of the Big Five personality dimensions can be used as a screening tool for indicating which players a team would want to recruit and invest time and money in, since these players will most likely be capable of progressing to the top level in their sport. However, more research in this regard is suggested.

Thesis statement 3:

The *third research hypothesis* stated that internal emotional capacity (empathy/intuition), external emotional capacity (social relationships), self-concept and total emotional

intelligence would significantly differ between professional and semi-professional South African rugby union players.

The null hypothesis stated that internal emotional capacity (empathy/intuition), external emotional capacity (social relationships), self-concept and total emotional intelligence would not differ significantly between professional and semi-professional South African rugby union players.

The results of the third article revealed no statistically significant differences in total emotional intelligence or the associated subscales. However, the magnitude-based inference (MBI) method showed that the external emotional capacity (EEC) attained medium worthwhile effect in favour of the professional players.

Based on these findings, the research hypothesis was therefore accepted for external emotional capacity (EEC) based on the medium practically significant difference between the professional and semi-professional South African rugby union players while the null hypothesis was accepted for total emotional intelligence, internal emotional capacity and self-concept, seeing that no significant differences were found between the two groups of players. These findings imply that players who are capable of maintaining better interpersonal relations, having better social skills and managing relationships more effectively are the players who tend to perform at higher levels in rugby. The external emotional capacity subscale of the BRIEF might be proposed as a screening tool for identifying players that teams might prefer to recruit, since these players will most likely contribute to a positive team environment and progress to the top level in their sport.

Thesis statement 4

The *fourth research hypothesis* stated that a significant relationship will exist between total emotional intelligence and its associated subscales and personality (neuroticism, agreeableness, conscientiousness, extraversion and openness) and between emotional

intelligence and its associated subscales and cognitive functioning (memory capacity, attention and behavioural tasks, sensory-motor functioning, verbal tasks, executive functioning and emotion identification) among professional and semi-professional South African rugby union players.

The *null hypothesis stated* that no significant relationship will exist between total emotional intelligence and its associated subscales and personality (neuroticism, agreeableness, conscientiousness, extraversion and openness) and between emotional intelligence and its associated subscales and cognitive functioning (memory capacity, attention and behavioural tasks, sensory-motor functioning, verbal tasks, executive functioning and emotion identification) among professional and semi-professional South African rugby union players.

The results of the fourth article showed a statistically significant correlation with a large effect size between total EI and the personality scales of Extraversion and Conscientiousness. The EI subscale of Internal emotional capacity (IEC) showed a statically significant correlation with a small to medium effect size with Extraversion, Openness, Agreeableness, and Conscientiousness. External emotional capacity (EEC) obtained a statistically significant correlation with a small to large effect size with Extraversion and Openness. On cognition, EEC showed a statistically significant relationship with a medium effect size with the verbal subscale of cognition. Furthermore, total EI was positively predicted by extraversion as well as conscientiousness. Lastly, only the verbal function of cognitive ability positively predicted total EI in the group of rugby players.

Based on these findings, this research hypothesis was therefore accepted for total emotional intelligence, IEC, EEC, the personality traits of agreeableness, conscientiousness, extraversion, openness and for the verbal function of the cognitive domain. However, the null hypothesis is accepted for the emotional intelligence subscale of self-concept, the personality

trait of neuroticism and the cognitive domains of memory capacity, attention and behavioural tasks, sensory-motor functioning, executive functioning and emotion identification since no significant relationships were found between these variables. The results of this study imply that the constructs of emotional intelligence are more associated with one's personality than with one's cognitive ability and therefore contribute to the mixed-model conceptualization of emotional intelligence.

Limitations and recommendations

Before proposing the contribution of the research, it was considered essential to reflect on the possible limitations of this study and to propose recommendations for future research. A potential limitation includes the fact that the participants in this study belong to only one sport, namely rugby, which might have limited the chance to detect differences between the participants' cognitive functioning due to the effect of the cognitive component skills approach. For future research we recommend researchers to involve participants from other sports to explore the notion that a specific sport might lead to the development of a specific cognitive profile among its participants. Another possible limiting factor joins the previously mentioned limitation in that our sample consisted of only sport participating individuals which might have limited the chances to detect differences among our participants. We therefore recommend that future research also include non-active control groups to obtain a clearer picture of the cognitive differences between groups. In this study we further used the WebNeuro Sport online assessment, developed by the Brain Resource Company (BRC), to measure the players' cognitive functioning, personality and emotional intelligence. The BRC is a United States and Australian-based company. Hence the question arises as to whether this measuring tool is applicable in a South African context with its diverse multicultural and multilingual population. Another possible limitation of this study was the self-report nature of WebNeuro Sport. With self-report measures, the possibility exists that results can be

produced related to those of the Hawthorne Effect as the participants may try to portray themselves in a way they think will impress the researchers, a coach, selector or any other related stakeholder (Chiesa & Hobbs, 2008). We therefore suggest that researchers ensure that participants are aware of the fact that the results of such a measure will not be used for selection purposes. In the present study, we attempted to control for this limitation by assuring the participants of this principle but acknowledge that it still may have occurred. Another potential limitation included the relatively small sample size that was included in the study consisting of players from one region in South Africa and therefore generalization of the results to the broader South African rugby community should be made with caution. Therefore we suggest including more participants who are representative of a specific population from different regions to compare with the findings of the present study. Lastly, we did not take possible mediating factors such as the player's age, playing history, level of education, cognitive abilities, personality, and cultural differences into account. We therefore suggest that future studies take these mediating factors into account in their studies.

Contribution of the study

To the authors' knowledge, this is the first study of its kind in the South African context that made some significant and unique contributions to the field of Applied Sports Psychology. This is so since the study provides a theoretical point of departure by discussing literature on the positive association between cognitive functioning, personality, emotional intelligence and performance in sport. The results of the study highlighted the notion that a certain type of sport might lead to the development of a particular cognitive profile and that in the South African context, rugby relies more on physical attributes to distinguish players playing on different levels than on cognitive abilities. Concerning personality traits, it would seem that neuroticism is the only personality trait that significantly distinguishes professional from semi-professional players. On a practical level, we suggest that a player's score in the

neuroticism domain of personality can be used by decision-makers for recruiting players most likely to participate at the top level in rugby in combination with physical, tactical and technical variables. Based on the results of this study, another significant contribution to the broader rugby community is that the external emotional capacity subscale of the BRIEF assessment can be used as a screening tool for identifying players that teams would want to recruit, since these players might contribute to a positive team environment and most likely progress to the top level in their sport. Additionally, coaches, selectors and other stakeholders involved in rugby might recruit players with higher levels of conscientiousness, openness, agreeableness, and extraversion, as they will most likely display higher levels of EI contributing to optimal performance in rugby. In addition to recruiting players with these favourable personality traits, the verbal function of a cognitive measure might also be indicative of a rugby player with a higher level of EI.

In general, the results of the study, as a first of its kind in the South African context, paved the way for similar future studies.

Researcher's experience

Being involved in an academic environment and being a "curios" researcher, I have experienced writing this thesis as an exciting and fulfilling process. In general, I enjoy conducting research and applying statistical analysis to see the outcomes. Although the results of this thesis were mostly contradictory to the research findings of the majority of scientific literature I read, I still perceive it as contributing to the scientific literature. Usually, most researchers tend to feel disappointed or discouraged because we did not find "significant" results, but my view on research is that even no results also means something.

Conclusion

In contrast to the majority of literature, the quantitative findings indicated that cognitive functioning does not discriminate between rugby players playing on different

levels. It therefore seems that other factors such as technical, tactical and physical aspects might play a more significant role in ruby performance. On personality, the study found that only neuroticism discriminates between the two groups of rugby players. In the same line, only one subscale of emotional intelligence, namely external emotional capacity, differs between professional and semi-professional rugby players. Lastly, the findings showed that emotional intelligence is more associated with a rugby player's personality than with his cognitive functioning. We recommend that future similar studies take account of our suggestions for future research to get more clarity on the personality, cognitive functioning and levels of emotional intelligence among South African rugby players. Lastly, this study is unique to South Africa and will hopefully pave the way for future similar studies.

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APPENDICES

Addendum 1: Author guidelines for the Journal of Psychology in Africa

- **Addendum 1: Author guidelines for the Journal of Psychology in Africa**
- **Addendum 2: Author guidelines for the South African Journal for Research in Sport, Physical Education and Recreation.**
- **Addendum 3: An example report for the WebNeuro Sport**
- **Addendum 4: Informed consent forms used in this study**
- **Addendum 5: Proof of ethical permission for the study**
- **Addendum 6: Proof of acceptance / submissions of articles**

Journal of Psychology in Africa

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Journal article

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Book

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Edited book

Galley. K. E. (Ed.). (2004). Global climate change and wildlife in North America. Bethesda, MD: Wildlife Society.

Chapter in a book

Cook, D. A., & Wiley, C. Y. (2000). Psychotherapy with members of the African American churches and spiritual traditions. In P. S. Richards & A. E. Bergin (Ed.), Handbook of psychotherapy and religiosity diversity (pp 369–396). Washington, DC: American Psychological Association.

Magazine article

Begley, S., & Murr, A. (2007, July 2). Which of these is not causing global warming? A. Sport utility vehicles; B. Rice fields; C. Increased solar output. Newsweek, 150 (2), 48–50.

Newspaper article (signed)

Landler, M. (2007, June 2). Bush's Greenhouse Gas Plan Throws Europe Off Guard. New York Times, p. A7.

Unpublished thesis

Appoh, L. (1995). The effects of parental attitudes, beliefs and values on the nutritional status of their children in two communities in Ghana (Unpublished master's thesis). University of Trondheim, Norway.

Conference paper

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Manuscripts should be typed with ***SINGLE spacing*** in 10-point Times New Roman letter size for the text. All the text in *tables* and *figures* should be in 10-point Times New Roman font size and single spacing. Please do not use *Calibri*. The original manuscript can be submitted by Email. The length may not exceed 20 pages (tables, figures, references, etc. included). The **page setup** (cm) must be in the following format:

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Top:	3.56 cm	*Width*:	17.5 cm
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Right:	2.11 cm		
Gutter:	0.00 cm		
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Footer:	0.89 cm		

Original manuscripts may be submitted in English and should be sent to:

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Physical Activity, Sport and Recreation E-mail:sajrsper@nwu.ac.za

Research Unit

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Republic of South Africa

CONDITIONS

Each manuscript must be accompanied by a ***covering letter*** in which the following is declared: (1) that the manuscript contains original research; (2) that the manuscript or parts of the manuscript has not been published elsewhere previously; (3) that the manuscript is not currently being presented elsewhere for publication; and (4) that all the authors have read and approved the manuscript. This signed declaration regarding the originality must accompany each manuscript.

Authors are also requested to name three/3 potential referees, of which one/1 must be an *international* referee (the Journal is not bound to use these referees). Complete information regarding the referees (name, surname, e-mail address and telephone numbers) must be provided in the cover letter.

We discourage the practice of parts of the same study submitted for other issues of this Journal. Authors who submit a manuscript from a study of which some data have been or will be published elsewhere, must provide a strong justification in the accompanying letter to the Editor. The justification for not publishing all the data together in one paper must also be motivated in the covering letter.

The author should also ensure that the ***language*** of the manuscript has been ***edited*** thoroughly (English [UK]) by the time of submission. The name, address and telephone

number of the person who did the language editing must be provided. Any expenses incurred by the Journal dealing with language editing will be added to the author's page fees.

The manuscript must have an ***ethical clearance number*** that was supplied by the authentic ethical committee of a specific institution. The process that was followed to obtain ethical clearance must be described in the manuscript under the heading, 'Ethical clearance'. No manuscript can be published without this declaration. Review, theoretic or philosophical articles do not require ethical clearance.

Any uncertainty regarding the ***statistical procedures*** that arise during the assessment of the manuscript will be referred to a local statistician. Any expenses incurred by the Journal dealing with statistical procedures will be added to the author's page fees.

PREPARATION OF MANUSCRIPT

Manuscripts must be presented in a format that is compatible with *Microsoft Word for Windows* (PC). Tables, all figures (illustrations, diagrams, etc.) and graphs are regarded as text and must be presented in a format that is compatible with ***Word*** and figures should be ***accessible*** to make any text corrections. Photographs must be presented in *jpg* format.

Original manuscripts must contain the following sections in the following sequence: Title page, Abstract, Introduction, Purpose of Research, Methodology, Results, Discussion, Practical application/Recommendations, Conclusions, Acknowledgements (if applicable) and References (not all applicable to review/theoretical/philosophical articles). Appendices are acceptable but must be succinct.

Title page

The first page of each manuscript should indicate the *title* in English and Afrikaans (will be translated for foreign authors), the *names* (title, first name in full and other initials, surname) of the author(s), the *telephone* numbers (work & home [& *mobile* for local authors]), *facsimile* number, *Email* address and the *field of study*. The ***complete mailing***

address and ***telephone numbers*** of the corresponding author and the institution (department, faculty, university, city, country) where the work was conducted should be provided in full. When more than one author and/or authors from various departments and institutions are involved, the **[1]*author*(s)** must be numbered according to their **[1]*department*(s)**. If any of the above-mentioned information should change during the review process, please inform the Subject Editor. A ***short title*** of not more than ***45 characters*** (including spaces), should be provided for use as a running heading.

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Each manuscript must be accompanied by an abstract of approximately 150-200 words in *English* and should be set on a *separate page* as a SINGLE paragraph (single spacing). A list of three to seven ***keywords*** in *English* is required for indexing purposes and should be typed below the abstract in alphabetical order.

Text

Start the text on a new page with the title of the article (centred and *without* the names of the authors). Follow the style of the most recent issue of the Journal regarding the use of headings and subheadings. Use only ***one-line space*** after a paragraph. Only make use of ***section breaks*** and not ***page breaks***. The text, as well as the tables and figures, may not be in any other format than ***normal***. Thus, ***no style sheets*** may be used, also in the case of the list of references.

Tables and figures

Tables and figures should be numbered with *Arabic* numerals (1, 2, etc.). Tables require the heading at the *top,* while figures have the legend *below* and both must **not** be included in the cells of the table/figure. ***Note:*** Use the decimal POINT (**not** the decimal comma). The site where the table or figure should be placed in the text must be indicated clearly in the manuscript. All tables and figures are to be placed *after the reference list* with

each on a ***separate page***, always ending with a ***section break***. Any preference for the use of *colour* in the case of figures or photographs must be noted and will be at an *additional cost* to the page tariff.

It is essential that tables/figures should be *contained/fit within the page setup* described earlier for this Journal. Portrait layout is preferred for all tables/figures. Tables must use separate rows/columns (do not merge cells) for each item. Figures must be in ***Word*** and *accessible to make corrections* or changes within the figure where deemed necessary. Please ensure that especially the figures are of high quality for printing purposes. Any preference for the use of *colour* in the case of figures or photographs must be noted and will be at an *additional cost* to the page tariff.

References

In the *text*, the Harvard method must be adopted by providing the author's surname and the date placed in parentheses. *For example:* Daly (1970); King and Loathes (1985); (Botha & Sonn, 2002); McGuines *et al.* (1986) or (Daly, 1970:80) where Daly is not part of the sentence and page number is added for a direct quotation. More than one reference must be arranged ***chronologically*** (Daly, 1970; King & Loathes, 1985). Note that *et al.* (italics) is used in the body of the text from the beginning when there are ***more than two authors***, but never in the list of references, where all authors must be provided.

List of references

Only the references cited in the text should be listed alphabetically according to surname (last name) of authors (uppercase) after the body of text under the heading, **REFERENCES** (uppercase) starting on a new page. In the case where the TITLE of an article, book, etc., is in any other language than English, the author must also provide an ***English translation*** of the title in parentheses (this applies to Afrikaans titles as well).

In the case of articles published in ***JOURNALS***, references listed should include the

surnames and initials (upper case and with full-stop and without spaces between initials) of ***all*** authors, the date of the publication in parentheses, the full title of the article, the full title of the journal (italics and no abbreviations), the volume number, the series/issue number in parentheses (if the said journal does not use issue numbers, the month of publication should be used), followed by a colon and a space with the first and last page numbers separated by a hyphen. In the case of online journals, use "online" if page numbers are not provided. The use of the correct punctuation is of importance.

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For a ***CHAPTER*** in a book, the page numbers of the chapter cited must be provided in parentheses (not italics) after the title of the book (pp. 20-29). For further details, authors should consult the most recent publication of this Journal for other examples.

If the reference is a ***THESIS*** (master's level) or ***DISSERTATION*** (doctoral level), italics is **not** used in the title as it is an unpublished work. Provide the name of the city, state/country, colon, university and department/faculty.

For ***ELECTRONIC SOURCES,*** all references start with the same information that would be provided for a printed source (if available). The web page information follows the reference style. It will usually contain the name of the author(s) (if known), year of publication or last revision, title of complete work in *inverted commas*, title of web page, Uniform Resource Locater (URL) or access path in square text brackets (do not end the path statement with a full stop), full stop after the closing bracket and date of access (Retrieved on

10 December 2015]. See "How to cite information from the Internet and the Worldwide Web" at [http://www.apa.org/journals/webref.html] for specific examples. When citing a Web site in the text, merely give the author and date. When reference is made to a specific statement (quotation) in the article/document and no page number can be provided, the word 'online' is used for citing in the text (Van der Merwe, 2010:online).

When referencing an article in a ***NEWSPAPER,*** the key word of the newspaper is typed in capitals, as this is how it will appear in the ***alphabetical listing*** of references, namely ~~*The*~~ *CAPE ARGUS* (*The*) will appear under "C" or *BURGER* (*Die*) will appear under "B".

In the case of a paper presented in conference ***PROCEEDINGS***, the editors and the title of the proceedings, the page numbers of the article being referred to and the details of the congress (when and where it was held) and by whom (city, state, publisher) the proceedings was published should be provided.

Examples of style of formulations for different references

Journal

ZHENG, N.; BARRENTINE, S.W.; FLEISIG, G.S. & ANDREWS, J.R. (2008). Kinematic analysis of swing in pro and amateur golfer. *International Journal of Sports Medicine*, 29(6): 487-493.

Book

WEINBERG, R.S. & GOULD, D. (2011). *Foundations of sport and exercise psychology* (5th ed.). Champaign, IL: Human Kinetics.

Chapter in book

SCHNECK, C.M. (2010). Visual perception. In J. Case-Smith & J.C. O'Brian (Eds.), *Occupational therapy for children* (6th ed.) (pp. 373-403). Maryland Heights, MO: Mosby.

Thesis/Dissertation

SURUJLAL, J. (2004). Human resources management of professional sports coaches in South Africa. Unpublished doctoral dissertation. Johannesburg, South Africa: Rand Afrikaans University.

Proceedings of a conference

HARDMAN, K. & MARSHALL, J. (2001). Worldwide survey on the state and status of physical education in schools. In G. Doll-Tepper & D. Scoretz (Eds.), *World summit on physical education* (pp. 15-37). Proceedings of the "World Summit on Physical Education", 3-5 November 1999. Berlin, Germany: International Council of Sport Science and Physical Education (ICSSPE).

Personal communication/correspondence/interview

BOUKES, P.B. (2015). Personal communication from the Acting Director of Sport at the Nelson Mandela Metropolitan University, Port Elizabeth on 27 February 2015.

JACOBS, L. (2015). Personal interview with the Spokesperson of UNICEF, 25 August, Pretoria.

Newspaper

CAPE ARGUS (*The*) (1997). 25 March, p. 5.

Electronic source

DINOFFER, J. (2011). "Activities to build balance". *Prevent child obesity 101*. Hyperlink: [http:// www.preventchildobesity101.com/Activities/BalanceActivities.php]. Retrieved on 20 November 2012.

ADMINISTRATION

If authors honour the rules and specifications for the submission of manuscripts, unnecessary delays would be avoided. Requesting 'copy right', concerning figures or photographs, is the responsibility of the authors and should be indicated. A manuscript that

does not meet the requirements, as set out above, will be returned to the author without being evaluated. A subject specialist Editor administers and coordinates the assessment of the referees and provides the final recommendation.

The corresponding author will receive a complimentary copy of the Journal and five reprints of the article that could be shared with the co-authors. The original manuscripts and illustrations will be discarded one month after publication unless a request is received to return the original to the corresponding author. A page fee of South African **R300** per page is payable on receipt of a statement issued by the Editor.

Brain Resource®

WebNeuro Sport

CSARCS-A, Cognition, BRISC, DASS, Sleep, BRIEF, Personality.

Client: NWUN-00026 (birth date 23 Mar 1988; age 25 years; male)

Test	Level	Function Measured	Functional Significance
Carlstedt Subliminal Attention, Reactivity and Coping Scale-Athlete Version (CSARCS-A)			
	Medium Medium Medium	Subliminal Attention Subliminal Reactivity Subliminal Coping	Ability to attain peak performance during critical moments
Cognition			
Memory	Borderline	Working memory recall and recognition	Ability to attend to, learn, remember, store, retrieve and manipulate new information. It includes long and short term memory
Attention, Behavioral	Superior	Sustained attention Focussed attention Impulsivity Cognitive flexibility	Ability to selectively concentrate during cognitive tasks, detect and respond to change in the environment, sustain attention over time and control impulses
Sensory-Motor/Spatial	Average	Hand/eye coordination Accuracy of selecting an appropriate response	Ability to perform motor skills and respond to information in a timely fashion. It includes reaction time
Verbal	Average	Word comprehension Verbal memory	Ability to recognize words, access words and remember what has been heard
Executive Function	Average	Planning Abstraction Error correction	Ability to plan, strategize, execute complex tasks, abstract thinking, rule acquisition, inhibiting inappropriate actions and ignoring irrelevant sensory information
Emotion Identification	Superior	Emotional expressions	Ability to recognize interpersonal emotions through facial expression

Deficit	<-2 standard deviation	Average	>-1 and <1 standard deviation
Borderline	>-2 and ≤-1 standard deviation	Superior	≥1 standard deviation

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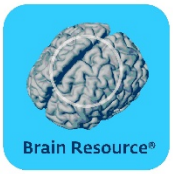


WebNeuro Sport

Test	Level	Function Measured	Functional Significance
Brain Resource Inventory for Screening Cases (BRISC)			
Negativity Bias	Average	Sensitivity to negative emotion and unpleasant experiences	The tendency to see yourself and your world as negative (lower scores) versus positive (higher scores). Associated with sensitivity versus hardiness to daily stresses
Emotional Resilience	Average	Self control and the ability to regulate emotions	Capacity for coping and feeling confident, with self-esteem and self-efficacy
Social Skills	Average	Empathy, extraversion and capacity for social relationship building and social skills	Capacity for building and keeping relationships, associated with extraversion and empathy
Depression Anxiety Stress Scales (DASS)			
	Normal Normal Normal	Depression Anxiety Stress	Screening for Depression and Anxiety
Sleep			
	No	Probable Sleep Apnea	Screening for Sleep Apnea
Brain Resource Inventory for Emotional Intelligence Factors (BRIEF)			
	Borderline Average Average	Empathy/intuition Social relationships Self esteem	Control of emotions in self and in dealing with others
Personality			
	Very Low Average Average High Low	Neuroticism Extraversion Openness Agreeableness Conscientiousness	Used to understand basic emotional, interpersonal, experiential, attitudinal and motivational style

Deficit	≤-2 standard deviation	Average	>-1 and <1 standard deviation
Borderline	>-2 and ≤-1 standard deviation	Superior	≥1 standard deviation

CSARCS-A

Carlstedt Subliminal Attention, Reactivity and Coping Scale

Client: NWUN-00026

The Carlstedt Subliminal Attention, Reactivity and Coping Scale-Athlete Version (CSARCS-A) contains measures that reflect the following neuropsychophysiological processes (Mind-Body processes):

I. ***Subliminal Attention (SA)***: this measure reflects an athlete's subliminal or unconscious focusing or concentration tendencies. It can be viewed as the "Zone" facilitator in athletes who score high on this dimension (23-35). They possess an enhanced ability to focus intensely on task-relevant activities (sport-specific action/movement, etc). Paradoxically, low SA can also be performance facilitating.

II. ***Subliminal Reactivity (SR)***: this measure reflects an athletes subliminal autonomic nervous system or "fight" or "flight" tendencies. It can be viewed as the "Great Disrupter" of peak performance in athletes who are high on this dimension (16-25). They are likely to exhibit increased psychophysiological reactivity (nervousness; muscle tension) that is mediated by catastrophic and negative intrusive thoughts, especially during critical moments of competition.

III. ***Subliminal Coping (SC)***: this measure reflects an athletes subliminal or unconscious ability to fend off negative intrusive thoughts associated with high Subliminal Reactivity. It can be viewed as the "Great Facilitator" of "Zone" states and peak performance in athletes who are high in this measure (22-34).

Measure	Client Score	Range
Subliminal Attention	19	Medium
Subliminal Reactivity	10	Medium
Subliminal Coping	15	Medium

This client has a "**Neutral**" profile as measured by the CSARCS-A.

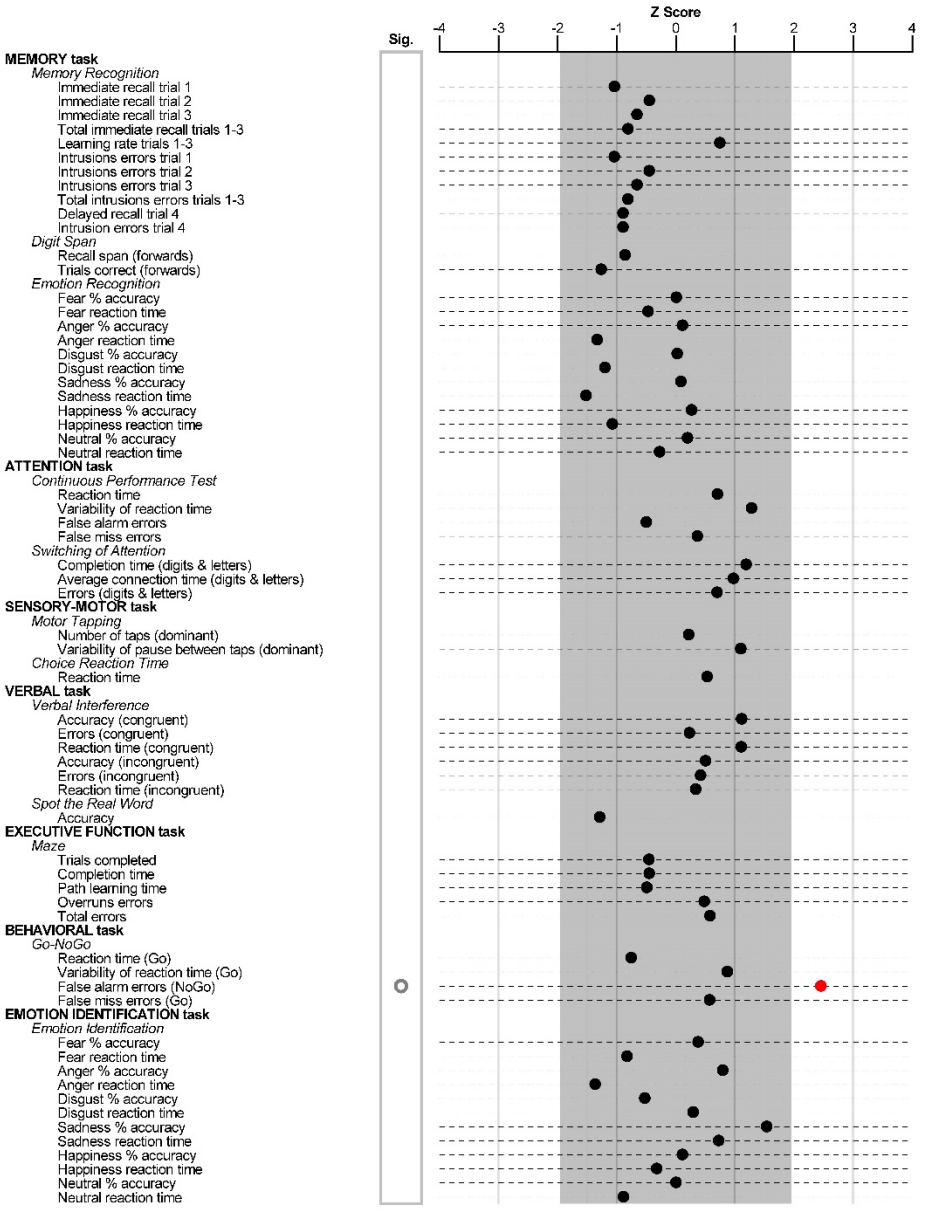
It should be noted that the above measures interact to affect performance as a function of the criticality of a competitive moment. In other words the more critical the moment as established by the Carlstedt Critical Moment Analysis System (CCMAS) the greater the probability that an athlete's combination of the above measures will influence performance either positively or negatively. In isolation and outside the context of critical moments or competitive stress singular measures are expected to exert their positive effects. Their negative influences will remain relatively dormant until actual or perceived critical moments or competitive stress are encountered (see Critical Moments During Competition: A Mind-Body Model of Sport Performance When it Counts the Most; Carlstedt [2004] Psychology Press for a complete analysis of the dynamics of the above constructs).

Follow-up Report Service: It is recommended that athletes, coaches and practitioners who use this test battery consult with Dr. Roland A. Carlstedt to further inform the interpretation and implementation. Contact: RCarlstedt@americanboardofsportpsychology.org or DrRCarlstedt@aol.com. See the website: www.americanboardofsportpsychology.org

Brain Resource®

Cognition

Client: NWUN-00026



For convenience, the tasks are organized by broad cognitive groupings. The circles in the Sig. column indicate statistically significant differences compared with the normal control. The Z scores on the right are normalized for age, gender and years of education, which means differences from zero reflect differences from 'average peer'. Positive Z scores indicate strengths, negative Z scores indicate potential deficits. Z scores beyond -2 to +2 are statistically significant. False alarm errors (respond when should not) = false positive; errors of commission. False miss errors (not respond when should) = false negatives; errors of omission. Intrusion = words not on the list. Specialist interpretation is required.

Brain Resource®

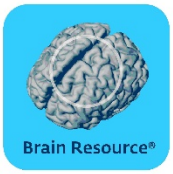
Depression Anxiety Stress Scales

Client: NWUN-00026

Unresolved anxiety and stress are closely coupled with the cycle of decline in depression.

Depression Anxiety Stress Scales provide a screening for Depression and Anxiety.

Measure	Client Score	Severity Rating
Depression	2	Normal
Anxiety	0	Normal
Stress	6	Normal



Sleep

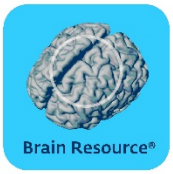
Client: NWUN-00026

This questionnaire provides a screen for a possible sleep difficulty.

Measure	Client Score
Total sleep score	4
Excessive daytime sleepiness symptom	0
Difficulty sleeping symptom	1
Narcolepsy symptom	1
Sleep Apnea symptom	1

Probable Sleep Apnea	No

The total sleep score indicates the likelihood for a sleep difficulty. The score for each symptom is scaled from 0 to 10 such that the higher the score, the more likelihood for that specific symptom. Scores for each symptom are summed from individual questions which range from 0 to 4 (0 = Never; 1 = Rarely, Less than once per week; 2 = 1-2 times per week; 3 = 3-4 times per week; 4 = 5-7 times per week).



Brain Resource Inventory for Emotional Intelligence Factors (BRIEF)

Client: NWUN-00026

Trait	Client Score	Z Score	Range
Empathy/intuition	18	-1.12	Borderline
Social relationships	12	-0.45	Average
Self esteem	14	0.46	Average
Total	44	-0.51	Average

The Z scores on the right are normalized for age and gender, which means differences from zero reflect differences from 'average peer'.

Empathy/intuition:

Client NWUN-00026 is rated as having a good capacity to perceive and understand the emotions in others. He is viewed as having an under developed ability to use the understanding of those emotions when relating to others.

Social relationships:

Client NWUN-00026 is perceived to have a good capacity to initiate and maintain positive relationships with others. He is seen to have a good level of confidence in a social environment.

Self esteem:

Client NWUN-00026 illustrates a highly developed ability to modify self presentation based on understanding the emotions of others. He indicates a good capacity to experience positive emotions when confronted by challenges.

NEO Five-Factor Inventory™

Interpretive Report

Developed By

Paul T. Costa, Jr., PhD,
Robert R. McCrae, PhD,
and PAR Staff

Client Information

Results For :	NWUN-00026
Client ID :	NWUN-00026
Age :	25
Gender :	Male
Test Form :	S (NEO FFI)
Test Date :	06 Feb 2014
Normative Group :	College / Combined Gender

The following report is based on research using adult and adolescent samples and is intended to provide information on the basic dimensions of personality. The interpretive information contained in this report should be viewed as only one source of hypotheses about the individual being evaluated. No decisions should be based solely on the information contained in this report. This material should be integrated with all other sources of information in reaching professional decisions about this individual. This report is confidential and intended for use by qualified professionals only; it should not be released to the individual being evaluated. "Your NEO FFI Summary" provides a report in lay terms that may be appropriate for feedback to the client.

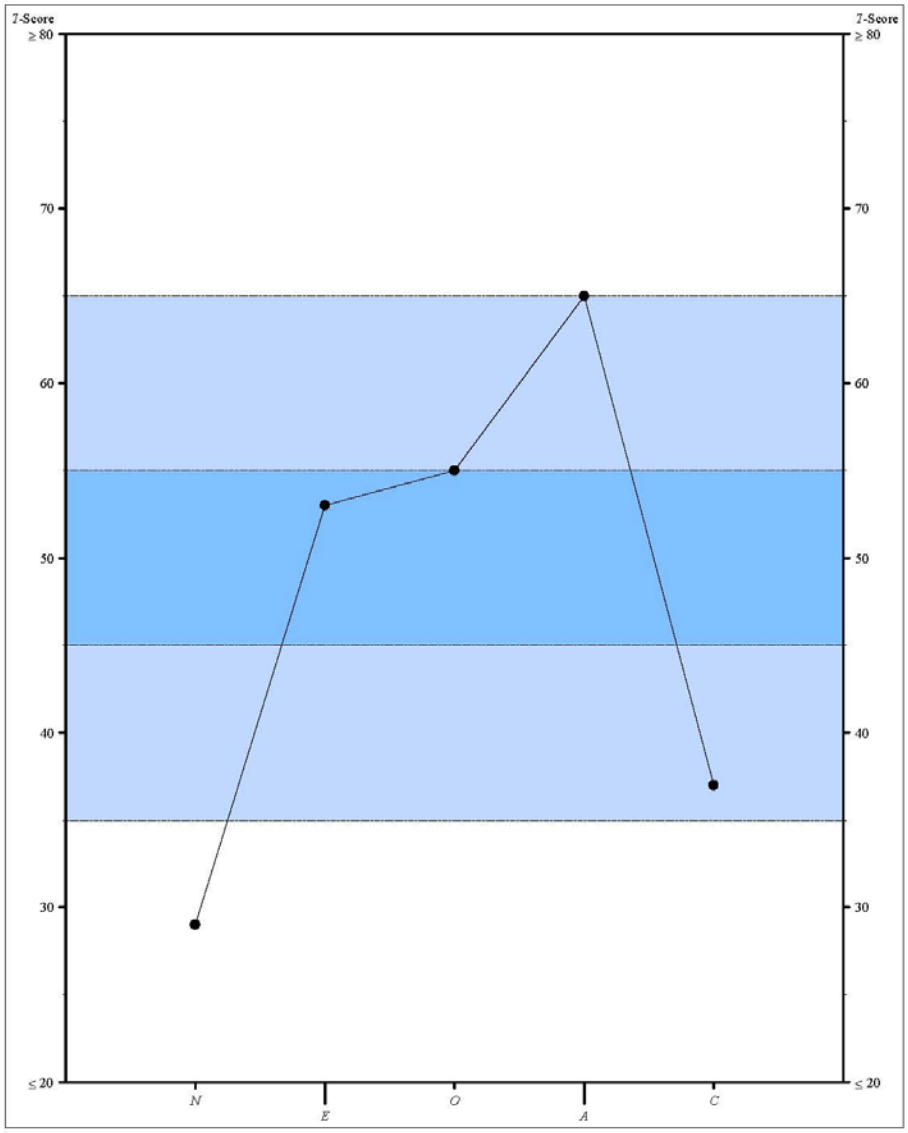
Psychological Assessment Resources (PAR), Inc. / 16204 North Florida Ave. / Lutz, FL 33549 / 1.800.331.8378 / www.parinc.com

Version: 2.00 (3.00.025)

Client: NWUN-00026
Client ID: NWUN-00026

Test Date: 06 Feb 2014
Page 2 of 10

NEO FFI *T*-Score Profile



NEO FFI Data Table

Scale	Raw Score	*T* Score	Range
(N) Neuroticism	8	29	Very Low
(E) Extraversion	32	53	Average
(O) Openness	31	55	Average
(A) Agreeableness	38	65	High
(C) Conscientiousness	22	37	Low

Validity Indices

Validity indices (i.e., B and C questions, and total number of items missing) are within normal limits.

Basis of Interpretation

This report compares the respondent to college age men and women. It is based on self-reports of the respondent.

This report is based on a short version of the Revised NEO Personality Inventory™. It provides information on the five basic personality factors. More precise estimation of the factors and more detailed information about specific traits that define them can be obtained by administering the NEO PI-R.

Global Description of Personality: The Five Factors

The most distinctive feature of this individual's personality is his standing on the factor of Neuroticism. Individuals scoring in this range are typically very well-adjusted emotionally, rarely experiencing psychological distress. They are not sensitive or moody, and have very few complaints about life. They feel quite secure and have a high level of self-esteem. Friends and neighbors of such individuals might characterize them as relaxed, even-tempered, comfortable, and hardy in comparison with the average person.

This person is high in Agreeableness. People who score in this range are typically good-natured and treat people with courtesy and respect. They are sympathetic and tend to be lenient with others. In group interactions, they are more likely to cooperate than to compete. They are trusting and straightforward. People might describe them as helpful and generous.

Next, consider the individual's level of Conscientiousness. Men who score in this range have a fairly low need for achievement and tend not to organize their time well. They usually lack self-discipline and are disposed to put pleasure before business. They have a relaxed attitude toward their responsibilities and obligations. Raters describe such people as relatively unreliable and careless.

This person is average in Openness. Average scorers like him value both the new and the familiar, and have an average degree of sensitivity to inner feelings. They are willing to consider new ideas on occasion, but they do not seek out novelty for its own sake.

Finally, the individual scores in the average range in Extraversion. Such people enjoy other people but also have periods when they prefer to be alone. They are average in level of energy and activity, and experience a normal amount of pleasant and cheerful feelings.

Personality Correlates: Some Possible Implications

Research has shown that the scales of the NEO FFI are related to a wide variety of psychosocial variables. These correlates suggest possible implications of the personality profile, because individuals who score high on a trait are also likely to score high on measures of the trait's correlates.

The following information is intended to give a sense of how this individual might function in a number of areas. It is not, however, a substitute for direct measurement. If, for example, there is a primary interest in medical complaints, an inventory of medical complaints should be administered in addition to the NEO FFI.

Coping and Defenses

In coping with the stresses of everyday life, this individual is unlikely to react with ineffective responses, such as hostile reactions toward others, self-blame, or escapist fantasies. He is likely to use both faith and humor in responding to threats, losses, and challenges. His ability to use positive thinking and direct action in dealing with problems is normal in comparison to most men. He is more likely to be self-sacrificing than to present a defensive facade of superiority. He may use such defense mechanisms as reaction formation and rationalization.

Somatic Complaints

This person may be prone to discount physical problems and minimize the severity of somatic symptoms and medical complaints. In health care situations, it may be important to check for problems even when he reports no difficulties.

Psychological Well-being

Although his mood and satisfaction with various aspects of his life will vary with the circumstances, in the long run this individual is likely to relish positive experiences, minimize problems, and be generally content with life. Because he is high in Agreeableness, his morale and happiness may be increased by strong interpersonal bonds.

Cognitive Processes

This individual is likely to be about average in the complexity and differentiation of his thoughts, values, and moral judgments as compared to others of his level of intelligence and education. He would also probably score in the average range on measures of ego development.

Interpersonal Characteristics

Many theories propose a circular arrangement of interpersonal traits around the axes of Love and Status. Within such systems, this person would likely be described as warm, loving, modest, submissive, and especially frank and trusting. His traits are associated with low standing on the interpersonal dimension of Status and high standing on the dimension of Love.

Stability of Profile

Given the individual's age, some changes in personality are possible over the next few years. However, this profile is likely to be useful as a rough guide to the individual's personality throughout adulthood.

NEO FFI Item Responses

Item Rsp.	Item Rsp.	Item Rsp.	Item Rsp.	Item Rsp.
1. SA	13. D	25. D	37. A	49. SA
2. A	14. SD	26. SD	38. SD	50. N
3. SD	15. SA	27. N	39. D	51. N
4. SA	16. A	28. A	40. A	52. A
5. D	17. A	29. D	41. D	53. SA
6. SD	18. SD	30. N	42. D	54. SD
7. N	19. A	31. SA	43. SD	55. A
8. SA	20. D	32. N	44. A	56. A
9. N	21. SD	33. D	45. D	57. N
10. N	22. SA	34. A	46. SA	58. A
11. SD	23. A	35. A	47. N	59. D
12. D	24. SD	36. D	48. SD	60. A

Validity Items

A. Yes B. Yes C. Yes

Summary of Responses

SD: 20.00% D: 21.67% N: 16.67% A: 26.67% SA: 15.00% ?: 0.00%

Personality Style Graphs

Broad personality factors are pervasive influences on thoughts, feelings, and actions, and combinations of factors provide insight into major aspects of people's lives, defining what can be called *personality styles*. For example, for many years psychologists have known that interpersonal interactions can be conceptualized in terms of a circular ordering or circumplex, defined by the two axes of Dominance and Love, or by the alternative axes of Extraversion and Agreeableness. These two factors define a *Style of Interactions*.

The nine other pairs of factors also define styles, and all ten are represented in NEO Style Graphs. An "X" is placed on each graph to indicate where the respondent falls; the description of that quadrant applies to the respondent. Descriptions are likely to be most accurate if (1) the "X" is far from the center; (2) the "X" is near the diagonal passing through the center of the quadrant; and (3) all the facets in each domain show similar levels. If the "X" is placed in the central circle, then none of the descriptions is especially relevant. If the "X" is located near the horizontal or vertical axis, then both quadrants on that side of the circle may be descriptive. If there is marked scatter among the facets in a domain, then interpretation should focus on these facets rather than the domain and its combinations in Style Graphs.

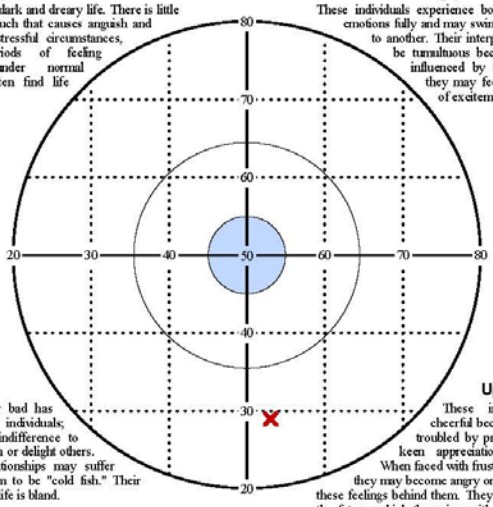
Client: NWUN-00026
Client ID: NWUN-00026

NEO Style Graphs

Test Date: 06 Feb 2014
Page 6 of 10

Style of Well-Being

Vertical Axis: Neuroticism (= 29 *T*)
Horizontal Axis: Extraversion (= 53 *T*)



N+E-
Gloomy Pessimists
These individuals face a dark and dreary life. There is little that cheers them and much that causes anguish and distress. Especially in stressful circumstances, they experience periods of feeling depressed. Even under normal circumstances, they often find life hard and joyless.

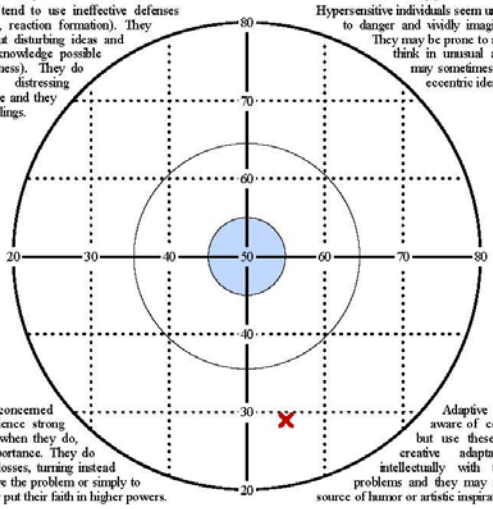
N+E+
Strongly Emotional
These individuals experience both positive and negative emotions fully and may swing rapidly from one mood to another. Their interpersonal interactions may be tumultuous because they are so easily influenced by their feelings. However, they may feel that their lives are full of excitement.

N-E-
Low-keyed
Neither good news nor bad has much effect on these individuals; they maintain a stoic indifference to events that would frighten or delight others. Their interpersonal relationships may suffer because others find them to be "cold fish." Their emotional experience of life is bland.

N-E+
Upbeat Optimists
These individuals are usually cheerful because they are not unduly troubled by problems and they have a keen appreciation for life's pleasures. When faced with frustration or disappointment, they may become angry or sad, but they quickly put these feelings behind them. They prefer to concentrate on the future, which they view with eager anticipation. They enjoy life.

Style of Defense

Vertical Axis: Neuroticism (= 29 *T*)
Horizontal Axis: Openness (= 55 *T*)



N+O-
Maladaptive
Maladaptive individuals tend to use ineffective defenses (e.g., repression, denial, reaction formation). They prefer not to think about disturbing ideas and they may refuse to acknowledge possible dangers (e.g., serious illness). They do not understand the distressing emotions they experience and they cannot verbalize their feelings.

N+O+
Hypersensitive
Hypersensitive individuals seem undefended. They are alert to danger and vividly imagine possible misfortunes. They may be prone to nightmares. Because they think in unusual and creative ways, they may sometimes be troubled by odd and eccentric ideas.

N-O-
Unconcerned
In the face of stress, unconcerned individuals rarely experience strong negative emotions, and when they do, they downplay their importance. They do not dwell on threats or losses, turning instead to concrete action to solve the problem or simply to distract themselves. They put their faith in higher powers.

N-O+
Adaptive
Adaptive individuals are keenly aware of conflict, stress, and threat, but use these situations to stimulate creative adaptations. They grapple intellectually with their own intrapsychic problems and they may react to life stress as a source of humor or artistic inspiration.

Client: NWUN-00026
Client ID: NWUN-00026

NEO Style Graphs

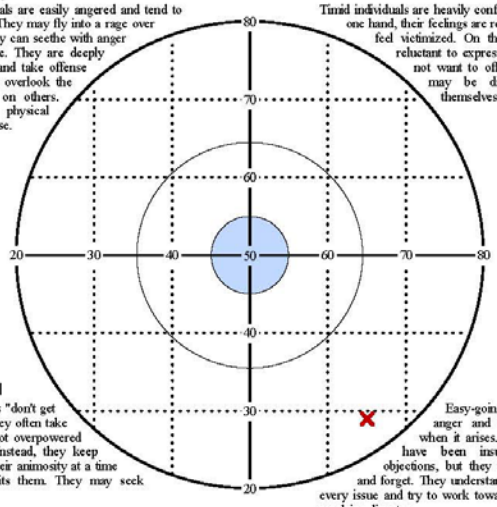
Test Date: 06 Feb 2014
Page 7 of 10

Style of Anger Control

Vertical Axis: Neuroticism (= 29 *T*)
Horizontal Axis: Agreeableness (= 65 *T*)

N+A-
Temperamental
Temperamental individuals are easily angered and tend to express anger directly. They may fly into a rage over a minor irritant, and they can seethe with anger for long periods of time. They are deeply involved in themselves and take offense readily, and they often overlook the effects of their anger on others. They may resort to physical aggression or verbal abuse.

N+A+
Timid
Timid individuals are heavily conflicted over anger. On the one hand, their feelings are readily hurt and they often feel victimized. On the other hand, they are reluctant to express anger because they do not want to offend others. Their anger may be directed inward against themselves.



N-A-
Cold-Blooded
Cold-blooded individuals "don't get mad, they get even." They often take offense, but they are not overpowered by feelings of anger. Instead, they keep accounts and express their animosity at a time and in a way that suits them. They may seek revenge.

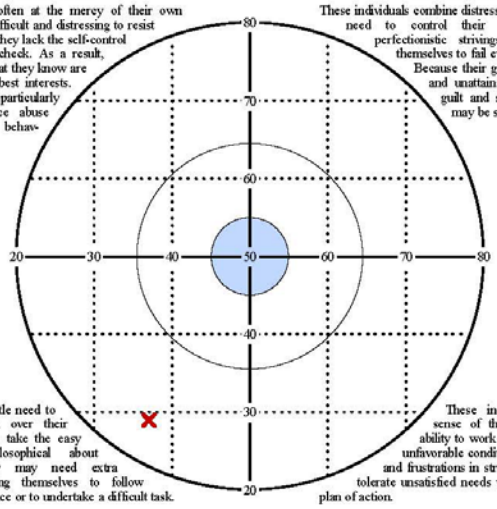
N-A+
Easy-Going
Easy-going individuals are slow to anger and reluctant to express it when it arises. They know when they have been insulted and may raise objections, but they would prefer to forgive and forget. They understand there are two sides to every issue and try to work toward a common ground in resolving disputes.

Style of Impulse Control

Vertical Axis: Neuroticism (= 29 *T*)
Horizontal Axis: Conscientiousness (= 37 *T*)

N+C-
Undercontrolled
These individuals are often at the mercy of their own impulses. They find it difficult and distressing to resist any urge or desire, and they lack the self-control to hold their urges in check. As a result, they may act in ways that they know are not in their long-term best interests. They may be particularly susceptible to substance abuse and other health-risk behaviors.

N+C+
Overcontrolled
These individuals combine distress-proneness with a strong need to control their behavior. They have perfectionistic strivings and will not allow themselves to fail even in the smallest detail. Because their goals are often unrealistic and unattainable, they are prone to guilt and self-recrimination. They may be somewhat compulsive.



N-C-
Relaxed
These individuals see little need to exert rigorous control over their behavior. They tend to take the easy way and are philosophical about disappointments. They may need extra assistance in motivating themselves to follow appropriate medical advice or to undertake a difficult task.

N-C+
Directed
These individuals have a clear sense of their own goals and the ability to work toward them even under unfavorable conditions. They take setbacks and frustrations in stride, and they are able to tolerate unsatisfied needs without abandoning their plan of action.

Client: NWUN-00026
Client ID: NWUN-00026

NEO Style Graphs

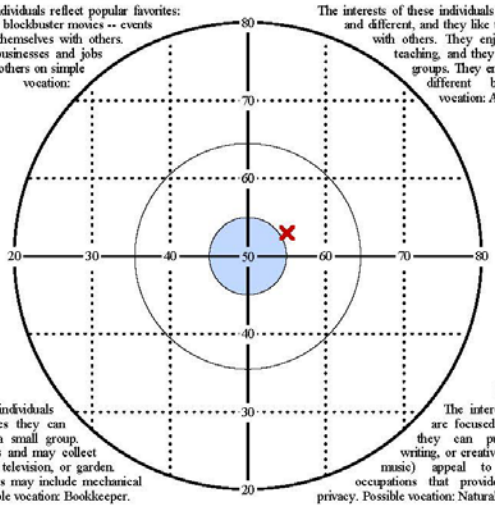
Test Date: 06 Feb 2014
Page 8 of 10

Style of Interests

Vertical Axis: Extraversion (= 53 *T*)
Horizontal Axis: Openness (= 55 *T*)

E+O-
Mainstream Consumers
The interests of these individuals reflect popular favorites: parties, sports, shopping, blockbuster movies -- events where they can enjoy themselves with others. They are attracted to businesses and jobs that let them work with others on simple projects. Possible vocation: Salesperson.

E+O+
Creative Interactors
The interests of these individuals revolve around the new and different, and they like to share their discoveries with others. They enjoy public speaking and teaching, and they fit in well in discussion groups. They enjoy meeting people from different backgrounds. Pos-sible vocation: Anthropologist.



E-O-
Homebodies
The interests of these individuals are focused on activities they can pursue alone or with a small group. They are unadventurous and may collect stamps or coins, watch television, or garden. Their vocational interests may include mechanical or domestic work. Possible vocation: Bookkeeper.

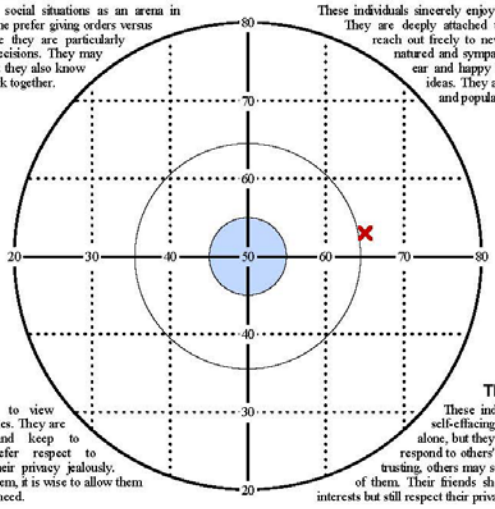
E-O+
Introspectors
The interests of these individuals are focused on ideas and activities they can pursue alone. Reading, writing, or creative hobbies (e.g., painting, music) appeal to them. They prefer occupations that provide both challenge and privacy. Possible vocation: Naturalist.

Style of Interactions

Vertical Axis: Extraversion (= 53 *T*)
Horizontal Axis: Agreeableness (= 65 *T*)

E+A-
Leaders
These individuals enjoy social situations as an arena in which they can shine. The prefer giving orders versus taking them and believe they are particularly well-suited to making decisions. They may be boastful and vain, but they also know how to get people to work together.

E+A+
Welcomers
These individuals sincerely enjoy the company of others. They are deeply attached to their old friends and reach out freely to new ones. They are good-natured and sympathetic, willing to lend an ear and happy to chat about their own ideas. They are easy to get along with and popular.



E-A-
Competitors
These individuals tend to view others as potential enemies. They are wary and distant and keep to themselves. They prefer respect to friendship and guard their privacy jealously. When interacting with them, it is wise to allow them the space they feel they need.

E-A+
The Unassuming
These individuals are modest and self-effacing. They often prefer to be alone, but they are also sympathetic and respond to others' needs. Because they are trusting, others may sometimes take advantage of them. Their friends should watch out for their interests but still respect their privacy.

Client: NWUN-00026
Client ID: NWUN-00026

NEO Style Graphs

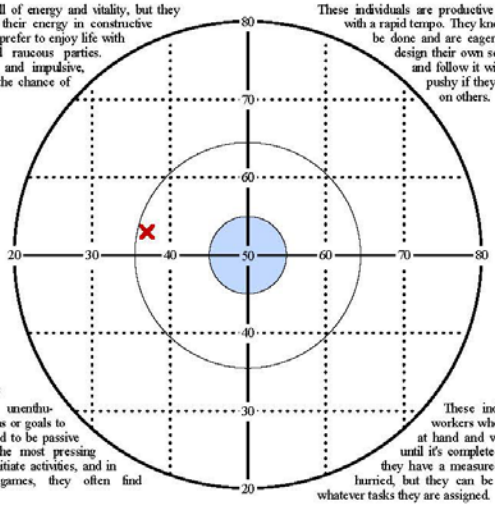
Test Date: 06 Feb 2014
Page 9 of 10

Style of Activity

Vertical Axis: Extraversion (= 53 *T*)
Horizontal Axis: Conscientiousness (= 37 *T*)

E+C-
Funlovers
These individuals are full of energy and vitality, but they find it hard to channel their energy in constructive directions. Instead, they prefer to enjoy life with thrills, adventures, and raucous parties. They are spontaneous and impulsive, ready to drop work for the chance of a good time.

E+C+
Go-Getters
These individuals are productive and efficient and work with a rapid tempo. They know exactly what needs to be done and are eager to pitch in. They might design their own self-improvement program and follow it with zeal. They may seem pushy if they try to impose their style on others.



E-C-
The Lethargic
These individuals are unenthusiastic and have few plans or goals to motivate them. They tend to be passive and respond only to the most pressing demands. They rarely initiate activities, and in group activities and games, they often find themselves left behind.

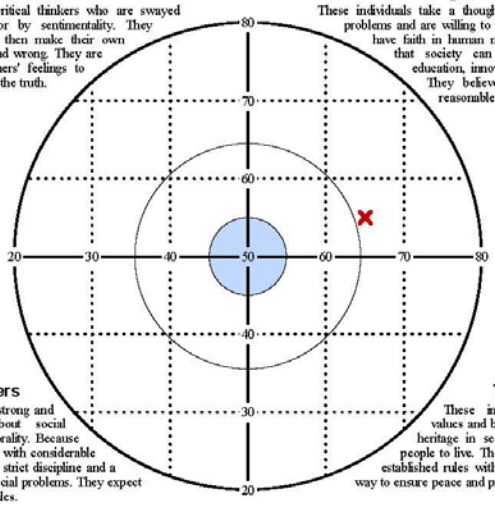
E-C+
Plodders
These individuals are methodical workers who concentrate on the task at hand and work slowly and steadily until it's completed. In leisure as in work, they have a measured pace. They cannot be hurried, but they can be counted upon to finish whatever tasks they are assigned.

Style of Attitudes

Vertical Axis: Openness (= 55 *T*)
Horizontal Axis: Agreeableness (= 65 *T*)

O+A-
Free-Thinkers
These individuals are critical thinkers who are swayed neither by tradition nor by sentimentality. They consider all views, but then make their own judgments about right and wrong. They are willing to disregard others' feelings to pursue their own idea of the truth.

O+A+
Progressives
These individuals take a thoughtful approach to social problems and are willing to try new solutions. They have faith in human nature and are confident that society can be improved through education, innovation, and coopera-tion. They believe in reason and being reasonable.



O-A-
Resolute Believers
These individuals have strong and unchanging beliefs about social policies and personal morality. Because they view human nature with considerable skepticism, they support strict discipline and a get-tough approach to social problems. They expect everyone to follow the rules.

O-A+
Traditionalists
These individuals rely on the values and beliefs of their family and heritage in seeking the best way for people to live. They feel that following the established rules without question is the best way to ensure peace and prosperity for everyone.

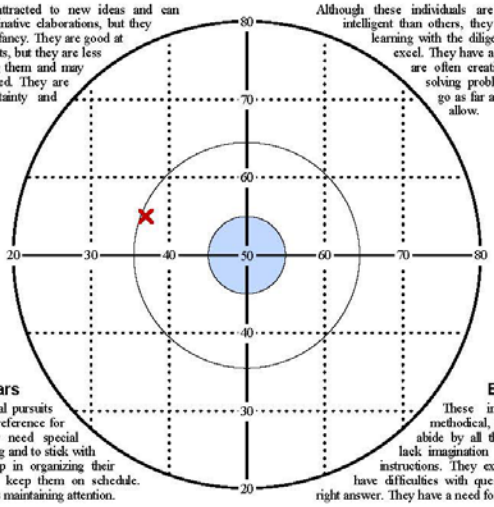
Client: NWUN-00026
Client ID: NWUN-00026

NEO Style Graphs

Test Date: 06 Feb 2014
Page 10 of 10

Style of Learning

Vertical Axis: Openness (= 55 *T*)
Horizontal Axis: Conscientiousness (= 37 *T*)



O+C-
Dreamers
These individuals are attracted to new ideas and can develop them with imaginative elaborations, but they may get lost in flights of fancy. They are good at starting innovative projects, but they are less successful in completing them and may need help staying focused. They are able to tolerate uncertainty and ambiguity.

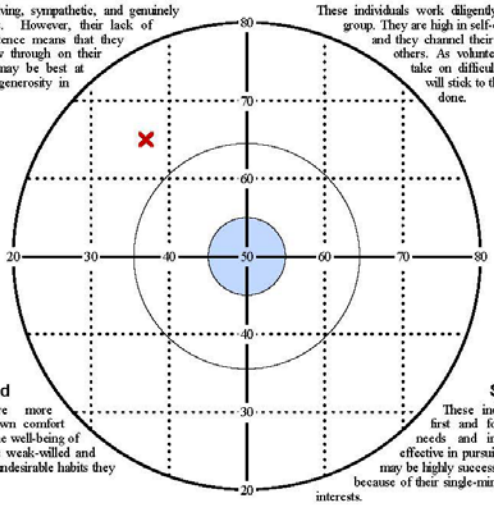
O+C+
Good Students
Although these individuals are not necessarily more intelligent than others, they combine a real love of learning with the diligence and organization to excel. They have a high aspiration level and are often creative in their approach to solving problems. They are likely to go as far academically as their gifts allow.

O-C-
Reluctant Scholars
Academic and intellectual pursuits are not the strength or preference for these individuals. They need special incentives to start learning and to stick with it. They may need help in organizing their work and reminders to keep them on schedule. They may have problems maintaining attention.

O-C+
By-the-Bookers
These individuals are diligent, methodical, and organized, and they abide by all the rules. However, they lack imagination and prefer step-by-step instructions. They excel at rote learning but have difficulties with questions that have no one right answer. They have a need for structure and closure.

Style of Character

Vertical Axis: Agreeableness (= 65 *T*)
Horizontal Axis: Conscientiousness (= 37 *T*)



A+C-
Well-Intentioned
These individuals are giving, sympathetic, and genuinely concerned about others. However, their lack of organization and persistence means that they sometimes fail to follow through on their good intentions. They may be best at inspiring kindness and generosity in others.

A+C+
Effective Altruists
These individuals work diligently for the benefit of the group. They are high in self-discipline and endurance, and they channel their efforts to the service of others. As volunteers, they are willing to take on difficult or thankless tasks and will stick to them until they get the job done.

A-C-
Undistinguished
These individuals are more concerned with their own comfort and pleasure than with the well-being of others. They tend to be weak-willed and are likely to have some undesirable habits they find difficult to correct.

A-C+
Self-Promoters
These individuals are concerned first and foremost with their own needs and interests, and they are effective in pursuing their own ends. They may be highly successful in business or politics because of their single-minded pursuit of their own interests.

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HREC Stamp

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR THE RUGBY PROJECT

TITLE OF THE RESEARCH PROJECT:

Neuropsychological assessment of elite university-level rugby players and the relationship with on-field performance

REFERENCE NUMBERS:

Ethical approval in process

PRINCIPAL INVESTIGATOR:

Dr Kobus Du Plooy

ADDRESS:

Institute for Psychology and Wellness

North-West University, Potchefstroom Campus

Private Bag X6001

Potchefstroom

2520.

CONTACT NUMBER: (018) 2991737

You are being invited to take part in a research project that forms part of larger service delivery project by the Institute for Psychology and Wellbeing as well as post graduate Master's and PhD-studies. Please take some time to read the information presented here, which will explain the details of this project. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you choose not to participate, this will not have any detrimental implications for you in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study will be submitted for approval by the Health Research Ethics Committee of the Faculty of Health Sciences of the North-West University (Ethical approval in process) **and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki and the ethical guidelines of the National Health Research Ethics Council. It might be necessary for the research ethics committee members or relevant authorities to inspect the research records.**

1.1 What is this research study all about?

- *This study will be conducted at the Institute for Psychology and Wellbeing at the North-West University, and will involve the completion of an online Neuropsychological assessment (WebNeuro Sport) and game analysis by means of the Stratus game analysis program. Experienced Clinical Psychologists with extensive experience in sport will conduct the assessments. The aim is to recruit between 35 and 42 male university-level rugby players to participate in this project.*
- *The objectives of this research are to determine:*
  - *The neuropsychological profile of each player to determine strong- and weak points.*
  - *The relationships between the different neuropsychological variables and the on-field key performance indicators over the course of a tournament for each player.*

- *The difference in the neuropsychological profile between forwards and the backline players.*

Why have you been invited to participate? Based on the knowledge available to us:

- *You have been invited to participate because you are an elite male university-level rugby player who has been chosen for the squad for the Varsity Cup Tournament who receive sport psychological assistance from a Clinical Sports Psychologist.*
- *You have also complied with the following inclusion criteria: You provided voluntary consent, while the coaches and management team gave permission for you to participate in the project. You also do not have an injury to your dominant hand that can prevent you from completing the neuropsychological assessment.*
- *Furthermore, you are actively involved and competing as a member of the squad of the Varsity Cup team and you are totally free of any serious injuries and known illnesses. You are also free from any mental illnesses.*
- *Please note that you will be excluded if you become injured or ill at any time during the tournament which will prevent you to play. You will also be excluded if you have an injury to your dominant hand at the time of the neuropsychological assessment. You will furthermore be excluded if you do not complete the online neuropsychological assessment and/or if you do not give written consent to participate in the project.*

1.2 What will your responsibilities be?

- *You will be expected to complete an online neuropsychological assessment in the computer room of the Institute for Psychology and Wellbeing at the North-West University. The assessment will take approximately 60-90 minutes to complete and will be arranged for a time that suits you. You will be expected to complete the assessment only once.*

1.3 Will you benefit from taking part in this research?

- The direct benefits for you as a participant will be that you will be able to gain access to your results as well as a personalized report explaining your results. Your data will also be used by the Clinical Sport Psychologist to tailor your individualized session if necessary in order to prepare you for the demands of the game. Players and the coaches will have the opportunity to talk to the researchers about any advice regarding psychological preparation for a game. Furthermore, the neuropsychological data will allow the researchers to evaluate players' neuropsychological profile and to address any weak points which might be detrimental to their on-field rugby performance.

- The indirect benefit will be an expansion of the existing knowledge in the field of Applied Sport Psychology which can be transferred to the wider sporting community.

1.4 Are there risks involved in your taking part in this research?

- The project should pose no foreseeable risk to you, since the questions in the test batteries are not of a sensitive nature. However, minor negative risks which might occur include amongst others psychological fatigue, boredom, headache, frustration, anxiety and fear; however, precautions are put in place to manage these possible negative consequences should any of them occur. Players will also be given sufficient time to recuperate after completion of each assessment.

1.5 What will happen in the unlikely event of some form of discomfort occurring as a direct result of your taking part in this research study?

- *Should you have the need for further discussions after completion of the neuropsychological assessment an opportunity will be arranged for you to talk to an independent psychologist which will be available on demand. Pending the outcome of such a discussion the most effective approach to manage the need of the player will be provided such as a referral to a professional.*

1.6 Who will have access to the data?

- *Anonymity will be ensured by coding of the data to make sure that no link can be made to a specific player. Confidentiality will be ensured by making sure only the researchers have access to the data. All the researchers involved will have access to the data. Reporting of findings will be anonymous by only authorizing the head researcher to have control over the distribution of the results. Data will be kept safe and secure by locking hard copies in locked cupboards in the researcher's office and for electronic data it will be password protected. Data will be stored for seven years.*

Will you be paid to take part in this study and are there any costs involved?

No, you will not be paid to take part in the study. There will also be no costs involved for you to take part should you agree to do so.

Is there anything else that you should know or do?

- **You can contact Dr Kobus Du Plooy at** (018) 299 1737 / kobus.duplooy@nwu.ac.za **if you have any further queries or encounter any problems.**
- **You can contact the Health Research Ethics Committee via** Mrs Carolien van Zyl **at** 018 299 2094 / carolien.vanzyl@nwu.ac.za **if you have any concerns or complaints that have not been adequately addressed by the researcher.**
- **You will receive a copy of this information and consent form for your own records.**

How will you know about the findings?

- The findings of the research will be shared with you by if you are interested. You are welcome to contact us regarding the findings of the research. We will be sharing the findings with you as soon as it is available.

Declaration by participant

By signing below, I ……..…… agree to take part in a research study entitled: **Neuropsychological assessment of elite university-level rugby players and the relationship with on-field performance**

I declare that:

- I have read this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions to both the person obtaining consent, as well as the researcher and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....…..…….. on (*date*) ……...…….. 2015

....

Signature of participant **Signature of witness**

Declaration by person obtaining consent

I *(name)* ……..…… declare that:

- I explained the information in this document to ……I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter.

Signed at (*place*) .....…..……... on (*date*) ……...…….. 2015

....

Signature of person obtaining consent **Signature of witness**

Declaration by researcher

I *(name)* ……..…… declare that:

- I explained the information in this document to ……I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter.

Signed at (*place*) .....…..……... on (*date*) ……...…….. 2015

....

Signature of researcher **Signature of witness**

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CONSENT FORM

PERFORMANCE UNDER PRESSURE: STRESS, ANXIETY, CRITICAL MOMENT PERFORMANCE AND COGNITIVE FUNCTIONING IN ELITE RUGBY PLAYERS

PARTICIPATION IN THIS ASSESSMENT/ PROJECT IS VOLUNTARY

You are free to decline to be involved in this assessment, or to withdraw at any point before the analysed data is formally reported on even after you have signed the consent form to give without any consequences.

PLEASE READ THE FOLLOWING CAREFULLY

1. **EXPLANATION OF THE TESTING PROCEDURE**

   You will undergo a sport psychological test battery, with the purpose of getting more information that relates to your behaviour in a team environment, psychological tendencies in critical moments, general cognitive functioning and general emotional states. You may stop the tests any time and you are welcome to ask questions if there is something that you do not understand.

2. **RESPONSIBILITY OF THE PARTICIPANT**

   It is very important that you answer all the questions as truthfully as possible.

3. **RESULTS AND CONFEDITIALITY**

   The results of the test battery will reveal some of your psychological strengths, as well as potential areas for improvements. The researchers will not have access to any of the individual questions within the test battery. Your results will be treated confidentially, but after discussing the findings with you as individual, some aspects which will be discussed with you

might be used to formulate individual intervention programmes, as well as be used to improve the performance of the team. Your results will not be discussed with the coach without your permission and informing you how the results will be used.

4. RESULTS FOR RESEARCH

The results might be used for research purposes to form part of a bigger study of performance in elite sport, but all data will be handled anonymously at all times, with no individual data being made available and no identifying particulars being included.

Herewith I declare that:

- The sport psychologist/researcher discussed the test procedure and that I understand all instructions accordingly.
- I give permission that my results may be used for future research.
- I undertake to truthfully complete the inventories.

Should you be willing to participate you are requested to sign below:

I _____ hereby voluntarily consent to participate in the above mentioned project. I am not coerced in any way to participate and I understand that I can withdraw at any time should I feel uncomfortable during the project. I also understand that my name will not be disclosed to anybody who is not part of the project and that the information will be kept confidential and not linked to my name at any stage. I also understand what I might benefit from participation as well as what might be the possible risks and should I need further discussions someone will be available.

_____ _____

Date Signature of the participant

_____ _____

Date Signature of the person obtaining consent

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Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: http://www.nwu.ac.za

Health Sciences Ethics Office for Research, Training and Support

Health Research Ethics Committee (HREC)
Tel: 018-285 2291
Email: Wayne.Towers@nwu.ac.za

Dr JC du Plooy
Psychology
COMPRES

25 June 2018

Dear Dr du Plooy

APPROVAL OF YOUR APPLICATION BY THE HEALTH RESEARCH ETHICS COMMITTEE (HREC) OF THE FACULTY OF HEALTH SCIENCES

Ethics number: NWU-00026-18-S1

Kindly use the ethics reference number provided above in all future correspondence or documents submitted to the administrative assistant of the Health Research Ethics Committee (HREC) secretariat.

Study title: Predicting playing level in South African rugby union players by means of neurocognitive functioning, personality and emotional intelligence as determined by the WebNeuro Sport

Study leader: Dr JC du Plooy

Student: A Kruger-11755350

Application type: Single study

Risk level: Minimal (monitoring report required annually)

Expiry date: 30 June 2019 (monitoring report due at end of June annually until completion)

You are kindly informed that after review by the HREC, Faculty of Health Sciences, North-West University, your ethics approval application has been successful and was determined to fulfil all requirements for approval. Your study is approved for a year and may commence from 25/06/2018. Continuation of the study is dependent on receipt of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation. A monitoring report should be submitted two months prior to the reporting dates as indicated i.e. annually for minimal risk studies, six-monthly for medium risk studies and three-monthly for high risk studies, to ensure timely renewal of the study. A final report must be provided at completion of the study or the HREC, Faculty of Health Sciences must be notified if the study is temporarily suspended or terminated. The monitoring report template is obtainable from the Faculty of Health Sciences Ethics Office for Research, Training and Support at Ethics-HRECMonitoring@nwu.ac.za. Annually, a number of studies may be randomly selected for an internal audit.

The HREC, Faculty of Health Sciences requires immediate reporting of any aspects that warrants a change of ethical approval. Any amendments, extensions or other modifications to the proposal or other associated documentation must be submitted to the HREC, Faculty of Health Sciences prior to implementing these changes. These requests should be submitted to Ethics-HRECApply@nwu.ac.za with a cover letter with a specific subject title indicating, "Amendment request: NWU-XXXXX-XX-XX". The letter should include the title of the approved study, the names of the researchers involved, the nature of the amendment/s being made (indicating what changes have been made as well as where they have been made), which documents have been attached and any further explanation to clarify the amendment request being submitted. The amendments made should be indicated in yellow highlight in the amended documents. The *e-mail*, to which you attach the documents that you send, should have a *specific subject line* indicating that it is an amendment

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request e.g. "Amendment request: NWU-XXXXX-XX-XX". This e-mail should indicate the nature of the amendment. This submission will be handled via the expedited process.

Any adverse/unexpected/unforeseen events or incidents must be reported on either an adverse event report form or incident report form to Ethics-HRECIncident-SAE@nwu.ac.za. The *e-mail*, to which you attach the documents that you send, should have a specific subject line indicating that it is a notification of a serious adverse event or incident in a specific project e.g. "SAE/Incident notification: NWU-XXXXX-XX-XX". Please note that the HREC, Faculty of Health Sciences has the prerogative and authority to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process.

The HREC, Faculty of Health Sciences complies with the South African National Health Act 61 (2003), the Regulations on Research with Human Participants (2014), the Ethics in Health Research: Principles, Structures and Processes (2015), the Belmont Report and the Declaration of Helsinki (2013).

We wish you the best as you conduct your research. If you have any questions or need further assistance, please contact the Faculty of Health Sciences Ethics Office for Research, Training and Support at Ethics-HRECApply@nwu.ac.za.

Yours sincerely

Prof Wayne Towers
HREC Chairperson

Prof Minrie Greeff
Ethics Office Head

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TAX INVOICE # 2019026

January 25, 2019

Prof Ankebé Kruger

North-West University, Potchefstroom, South Africa

Dear Prof Ankebé Kruger

Congratulations on the publication acceptance of your manuscript this **January 2019** as follows:

Differences in the neurocognitive profiles of professional and semi-professional male South African rugby union players.

Your manuscript published in **Volume 29 (2)** of the JPA this **April, 2019**. Your Manuscript Processing Charge is invoiced.

Please pay by **February 25, 2019**

When you wire the money please make sure that your bank places your name, not just the university affiliation, on the wire transfer so that we can match the payment invoice we receive with your wire transfer. Instruct your institution/payor to provide you with confirmation of payment to forward to me as proof of payment.

Thank you,
Professor Elias Mpofu, PhD, DEd Editor

Editor in Chief: Professor Elias Mpofu, College of Health and Public Services, University of North Texas, Denton. TX 76205
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TAX INVOICE # 2019045

June 18, 2019

Ankebé Kruger.
Community Psychosocial Research (COMPRES) and Physical Activity,
Sport and Recreation (PhASRec),
Private Bag X6001, North-West University, Potchefstroom, South Africa.

Dear Ankebé Kruger

Congratulations on the publication acceptance of your co-authored manuscript this June as follows:

Personality profiling of South African rugby union players

Your manuscript is scheduled to publish in **Volume 29 (4)** of the JPA this **August, 2019.** Your Manuscript Processing Charge is invoiced. Please pay by **June 30, 2019**

When you wire the money please make sure that your bank places your name, not just the university affiliation, on the wire transfer so that we can match the payment invoice we receive with your wire transfer. Instruct your institution/payor to provide you with confirmation of payment to forward to me as proof of payment.

Thank you,
Professor Elias Mpofu, PhD, DEd Editor

Ankebe Kruger - Re: Artikel vir oorweging vir publikasie in SAJRSPER

From: SAJRSPER
To: Ankebe Kruger; Santie Peens
Date: 23/08/2019 11:14
Subject: Re: Artikel vir oorweging vir publikasie in SAJRSPER

Dear Ankebe,

Thank you for the submission of the article with the title :
THE EFFECT OF EXPERTISE ON EMOTIONAL INTELLIGENCE OF PROFESSIONAL AND SEMI-PROFESSIONAL SOUTH AFRICAN RUGBY PLAYERS

The article will se sent for review.

SJ (Hanlie) Moss (PhD, MBA)
Professor
Editor: South African Journal for Research in Sport, Physical Education and Recreation
Physical Activity, Sport and Recreation Research Focus Area
North-West University, Potchefstroom
South Africa
Tel: +27182991821
Web: sajrsper.com

obo SAJRSPER Admin officer

>>> Ankebe Kruger 2019/05/31 15:22 >>>
Beste Prof Moss

Vind hierby aangeheg 'n artikel wat ons graag wil aanbied vir oorweging vir moontlike publikasie in die SAJRSPER.

Groete

Ankebé

Ankebe Kruger - Re: Article for publication

From: SAJRSPER
To: Ankebe Kruger
Date: 20/08/2019 11:01
Subject: Re: Article for publication

Dear Ankebé

Thank you for your submission. The article will be sent for review.

Best regards,

SJ (Hanlie) Moss (PhD, MBA)
Professor
Editor: South African Journal for Research in Sport, Physical Education and Recreation
Physical Activity, Sport and Recreation Research Focus Area
North-West University, Potchefstroom
South Africa
Tel: +27182991821
Web: sajrsper.com

>>> Ankebe Kruger 2019/08/20 10:52 >>>
Dear Prof Hanlie Moss

Please find attached an article I wish to submit for consideration for possible publication in the South African Journal for Research in Sport, Physical Education and Recreation (SAJRSPER).

Kind regards

Ankebé Kruger

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