The Dark Triad in Male and Female Athletes and Non-Athletes:

Group Differences and Psychometric Properties of the Short Dark Triad (SD3)

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Abstract

Objectives: The Short Dark Triad (SD3) is a popular, brief measure of narcissism, Machiavellianism, and psychopathy, which are known as the Dark Triad. The present study adopted this measure and had two aims. First, to assess the psychometric properties of the SD3 with a focus on measurement invariance across gender, athletic expertise, and sport type. Second, to examine mean differences in Dark Triad scores across these groups.

Design: Cross-sectional.

Method: In total, 1258 participants (625 women; mean age 23.47 years) with a range of athletic experience (non-athletes, N = 408; amateur, N = 557; elite, N = 293) from team (N = 577) and individual (N = 273) sports completed the SD3. Factorial validity was assessed using exploratory structural equation modelling.

Results: Analyses indicated that the three-factor model provided adequate fit, however, a bifactor model incorporating the three specific factors and a general factor, provided superior fit to the data. Moreover, invariance testing suggested some inconsistency in the observed factor structures across groups. In addition, findings indicated group differences with men scoring higher than women, athletes with greater expertise scoring higher than those with less expertise, and individual athletes scoring higher than team athletes across all factors.

Conclusions: We suggest that researchers continue to use the SD3 using both composite and subscale scores, but recommend caution when interpreting subscale scores among women and team athletes until further psychometric work has been conducted within these populations. Our findings also suggest that the Dark Triad may be worth examining in future studies in sport.

Keywords: Gender; Machiavellianism; Narcissism; Psychopathy; Psychometrics.

1. Introduction

Personality has been studied extensively in sport. Among athletes, specific traits have been shown to predict numerous cognitive, affective, and behavioural outcomes (e.g., Laborde, Guillén, Watson, & Allen, 2017). For example, a large body of work attests to the relevance of perfectionism for athletes (see Hill, Mallinson-Howard, & Jowett, 2018). Several other personality facets have also been associated with sport performance (e.g., Allen & Laborde, 2014). Moreover, researchers have consistently reported population-based differences among certain personality traits. For example, athletes show higher extraversion than non-athletes, team sport athletes show higher extraversion (and lower conscientiousness) than individual sport athletes, and female athletes show higher neuroticism than male athletes (see Allen, Greenlees, & Jones, 2013). However, one personality constellation that little is known about among athletes is the Dark Triad.

1.2. The Dark Triad

The Dark Triad are the three distinct, but interrelated traits of narcissism, Machiavellianism, and psychopathy. Narcissism reflects grandiosity, entitlement, and superiority, Machiavellianism is defined by manipulation, self-service, behavioural flexibility, and deceit, and psychopathy is indicative of an impulsive, unempathetic, and anxious individual (Paulhus & Williams, 2002). Together, the Dark Triad describes a disagreeable, callous, and antagonistic character (Furnham, Richards, Rangel, & Jones, 2014). As a consequence, these traits are typically considered maladaptive. However, high levels of the Dark Triad may confer some advantages. For example, they may enable individuals to get ahead and achieve personal goals by disregarding others’ priorities and emotions. They may also be beneficial in scenarios where personal or professional gains are possible through deceit and/or self-interest (e.g., competition in mating; Carter, Montenaro, Linney, & Campbell, 2015; Furnham, Richards, & Paulhus, 2013).

Empirical research has revealed that the Dark Triad predicts and precedes numerous key outcomes. For example, researchers have found that the Dark Triad was associated with lower life expectancy, maladaptive attachment, and depression (Jonason, Baughman, Carter, & Parker, 2015). Marcus and Zeigler-Hill (2015) also argued that the Dark Triad is likely to be problematic across several domains, even when present at only moderate levels. Preliminary evidence supports this assertion in the domains of sport (Nicholls, Madigan, Backhouse, & Levy, 2017), work (O'Boyle, Forsyth, Banks, & McDaniel, 2012), and health (Jonason et al., 2015). Here, however, it is important to be aware that correctly identifying relationships that exist across domains is contingent on accurate and reliable measurement among the specified population.

1.3. Measurement of the Dark Triad

Several measures have been developed to assess individuals' levels of the Dark Triad (see Furnham et al., 2013). Initially, researchers used separate scales for each trait. This approach, however, results in a taxing process for participants (Maples, Lamkin, & Miller, 2014). For example, completing individual scales for narcissism (Narcissistic Personality Inventory [40 items]; Raskin & Hall, 1979), Machiavellianism (Mach-IV [20 items]; Christie & Geis, 1970), and psychopathy (Self-Report Psychopathy Scale [64 items]; Williams, Paulhus, & Hare, 2007) requires participants to respond to upwards of 120 items (Maples et al., 2014). Subsequently, researchers developed short-form scales, of which two dominate the literature. The first is the Dirty Dozen (Jonason & Webster, 2010), a 12-item measure that emphasises brevity. Although the Dirty Dozen has been widely used, researchers have been critical of its utility and lack of psychometric consistency. Essentially it is "too brief" to capture the full complexity of these traits (Carter, Campbell, Muncer, & Carter, 2015; Jones & Paulhus, 2014). The second is the Short Dark Triad (SD3; Jones & Paulhus, 2014), a 27-item scale which captures aspects of the longer scales (e.g., the grandiose concept of the

Narcissistic Personality Inventory; Raskin & Hall, 1979). When compared, the SD3 has shown better predictive validity than the Dirty Dozen (e.g., stronger convergent and incremental validity by capturing more variance of the longer scales; see Maples et al., 2014).

1.4. Psychometric Properties of the SD3

The SD3 was originally developed by Jones and Paulhus (2014), who provided initial evidence that a three-factor model representing the Dark Triad provided a good fit to the data. Nonetheless, subsequent research has failed to replicate this original factor structure. For example, Persson, Kajonius, and Garcia (2017) examined the structure of the SD3 in three large samples (*N* = 19,723). These authors concluded that the SD3 did not effectively differentiate Machiavellianism and psychopathy. For example, intended items cross loaded and model fit improved significantly when both factors were modelled as one specific factor. Persson et al. (2017) suggest that one reason for this discrepancy may have been the analytic techniques that were employed. Specifically, Persson and colleagues used somewhat restrictive analyses (i.e., exploratory [EFA] and confirmatory factor analysis [CFA]). Persson and colleagues themselves concluded that future research should adopt less restrictive analytic techniques to re-examine the factor structure of the SD3.

Exploratory structural equation modelling (ESEM) is a relatively new methodological approach that combines the strengths of both CFA and EFA. ESEM avoids the strict requirements of CFA (e.g., that only certain items can load onto certain factors) by allowing cross-loadings of items on non-intended factors like in EFA. It also provides robust indicators of model fit (e.g., goodness-of-fit statistics) that are available with CFA procedures. Recent research has advocated the use and benefits of ESEM over CFA (Marsh et al., 2011; 2013). Psychometric researchers have also extended this analysis to incorporate bifactor-ESEM models (Morin, Arens, & Marsh, 2016). These models provide an estimation of both the hierarchical nature of the constructs being assessed (the co-existence of global and specific components within the same measurement model), and the degree of accuracy associated with the constructs' indicators (how well items load on their target construct and the degree of overlap with non-target constructs). Moreover, a bifactor model is non-hierarchical and specifies unique and common variance associated with the factors (Stenling, Ivarsson, Hassmén, & Lindwall, 2015). In context of the SD3, this suggests the coexistence of the original three-factor model proposed by Jones and Paulhus (2014) and a general Dark Triad factor (see Figure 1 for bifactor ESEM framework of the SD3).

Despite its popularity, an ongoing debate surrounds the optimum conceptualisation and measurement of the Dark Triad. That is, whether it is best represented as three correlated components or as a single general factor (Furnham et al., 2014). In this case, a bifactor model considering general and individual Dark Triad components simultaneously may be particularly relevant. This dual perspective enables researchers to examine the shared and individual variance associated with the Dark Triad providing composite and subscale scores. This is also important given the implications of partialling (i.e., determining independent contributions of each Dark Triad component via multiple regression, SEM, or similar analytic techniques). For example, Vize, Collinson, Miller, and Lynam (2018) recently suggested that the relationships that narcissism showed with a range of variables changed significantly after partialling. Thus, a bifactor-ESEM approach which considers general and specific factors simultaneously may provide the most accurate representation of the SD3 (cf., McLarnon & Tarraf, 2017).

1.5. Measurement Invariance

An implicit assumption underlying previous research using the SD3 is that the items are interpreted the same way across different groups (Chen, 2007). However, as opposed to actual differences between groups, one possible explanation is that SD3 items are interpreted differently by members of different groups. To examine this possibility, invariance testing is required. Measurement invariance ascertains whether instrument items operate equivalently across populations that vary in respect of gender, age, or ability (Byrne, 2012). Researchers are yet to examine the assumption that responses to the SD3 are reasonably invariant across subgroups reporting significantly different levels of the Dark Triad (Furnham et al., 2013; Furnham et al., 2014; Vaughan, Carter, Cockroft, & Maggiorini, 2018). Given Marsh et al.'s (2011) recommendation not to use a scale across various domains before assessing psychometric properties, clarifying these issues will be important to advancing the study of the Dark Triad. In other words, it is important to ascertain that mean differences are attributable to theoretical rather than methodological reasons (Marsh et al., 2013).

Nonetheless, to date, research subjecting the SD3 to tests of measurement invariance is scarce, despite calls in the literature (e.g., determine equivalence in DT scores for men and woman; Dowgwillo & Pincus, 2016). Pechorro et al. (2018) reported measurement invariance between male and females in a Portuguese translation of the SD3 with at-risk youths. However, two items from each subscale had to be removed in order to achieve model fit. The authors called for further research examining the psychometric properties of the SD3, such as measurement invariance, primarily due to the exclusivity of their sample. Despite not being tested in sport, it is possible that there may be variation in item interpretation between athlete and non-athletes. For example, many of the SD3 items make reference to leader behaviours, competition, and self-directed focus, all of which are common in sport settings (Cruickshank & Collins, 2015; Nicholls et al., 2017; Vaughan et al., 2018).

One particularly important grouping factor that scholars have found differences in the Dark Triad is gender. Indeed, men reported higher levels of the Dark Triad than women (Furnham et al., 2013). There are several reasons for why this may be the case. First, it is possible that overt anti-social behaviours as conceptualised by the Dark Triad are more common in men than women. Second, there could also be sex-based differences such as higher levels of testosterone in men. Finally, differences could also be due to social reasons such as stereotypical gender roles (Jonason & Davis, 2018; Muris, Merckelbach, Otgaar, & Meijer, 2017). It appears then that gender may be an important factor to consider for research examining the Dark Triad.

A second grouping factor that research suggests show differences in the Dark Triad is athletic expertise. In this regard, research suggests that athletes report higher levels of the Dark Triad than non-athletes (Ueno, Shimotskasa, Suyama, & Oshio, 2017; Vaughan et al., 2018). Specifically, Ueno et al. (2017) found that student athletes competing at higher levels (e.g., international) reported higher levels of Machiavellianism in comparison with those competing at lower levels (e.g., regional). Three-way interaction effects also revealed differences on all three DT components across gender, event type, and competition level. It also appears that athletes with greater expertise report higher levels of the Dark Triad than athletes with less expertise (Vaughan et al., 2018). It is possible that the Dark Triad facilitate successful sport performance by increasing competitiveness, potentially facilitating ruthlessness in the pursuit of goals, and engaging in unacceptable behaviours to gain a competitive advantage (Furnham et al., 2013; 2014). Indeed, recent research attests to this possibility. For example, all dimensions of the Dark Triad are positively correlated with favourable attitudes towards doping in athletes (Nicholls et al., 2017).

Researchers have demonstrated considerable variability on the individual components of the Dark Triad in sport. For example, narcissism mediates sports performance under pressure and manifests as a driver to self-enhance, a requisite of successful and elite sport performance (Geukes, Mesagno, Hanrahan, & Kellmann, 2012; Roberts, Woodman, Lofthouse, & Williams, 2014; Roberts, Woodman, & Sedikides, 2018). Cruickshank and Collins (2015) reported that Machiavellianism may be related to leader effectiveness in elite sport. Therefore, sport may be an important domain for future research examining the implications of the Dark Triad.

Previous research consistently shows that athletes from team and individual sport differ in personality traits (Allen, Greenlees, & Jones, 2013; Allen & Laborde, 2014; Laborde, Guillén, Watson, & Allen, 2017). However, no research has compared levels of the Dark Triad between individual and team athletes. Indeed, there is reason to expect that individual athletes may score higher than team athletes. The Dark Triad represent a highly individualistic, agentic social style (Jonason, Li, & Teicher, 2010). Highly psychopathic individuals typically have indifferent views of others, whereas Narcissism and Machiavellianism are associated with being dismissive of others' positive communal qualities. Moreover, highly Machiavellian and highly psychopathic individuals are themselves viewed negatively by others, and are liked less (Rauthmann, 2012). In addition, highly Machiavellian individuals are undesirable as partners for social or cooperative endeavours (Wilson, Near, & Miller, 1998), psychopathy is associated with impulsive behaviours and low empathy, typically making them poor teammates (Jonason & Krause, 2013), and narcissism is related to less effortful performance where identifiability is low (i.e., social loafing; Woodman, Roberts, Hardy, Callor, & Rogers, 2013), and moral disengagement and antisocial behaviour in sport (Jones, Woodman, Barlow, & Roberts, 2017). In sum, individuals with high levels of the Dark Triad traits are better-suited, and appear to prefer, an approach to life that has the potential to maximise individual gains, rather than to contribute to cooperative team efforts. Thus, whether of their own volition, or in response to rejection by (potential) teammates, they may be more likely to "go it alone" as an individual athlete, seeking personal success and glory.

1.6. The Present Study

Against this background, the aim of the present study was to further assess the psychometric properties of the SD3. First, we examined whether the original (Jones & Paulhus, 2014) or a bifactor-ESEM model would provide best fit to the data. Second, we sought to determine if the SD3 was invariant across gender, athletic expertise, and sport type. Third, we tested group differences in the Dark Triad scores. Research suggests that a bifactor model may provide the most robust estimation of the SD3 factor structure over single and three factor models. We also hypothesised that the SD3 would be invariant across gender, athletic expertise, and sport type. Finally, we hypothesised that the Dark Triad would differ across these groups with elite, male, individual athletes scoring higher than their non-elite, female, team athlete counterparts.

2. Methods

2.1. Participants

A sample of 1,258 participants (633 males; 625 females) aged 18 to 52 years (M^{AGE} = 23.47; *SD* = 6.83) was recruited for the present study. Participants were elite (*n* = 293; 23.29%), amateur (*n* = 557; 44.28%) and non-athletes (*n* = 408; 32.43%) from various team (*n* = 577; 45.87%) and individual (*n* = 273; 21.70%) sports (e.g., athletics, boxing, golf, hockey, karate, rugby, soccer, tennis, and volleyball). Classification of athlete status was based on Swann, Moran and Piggott's (2015) criteria. Specifically, the highest level of competition played (regional–international level), success at the athletes highest level (some success at regional – sustained success at international competition), time spent at current level (fewer than two–more than eight years), and global representation (non-Olympic/Olympic). These metrics were used to code and then determine groups (see Swann et al., 2015 for overview)[1]. We collapsed these groupings to ensure that analyses were

[1]According to Swann et al. (2015) athletic expertise is computed as: [(A + B + C / 2)/3] x [(D + E)/2], where A is the athlete's highest standard of performance, B is success at the

sufficiently powered (Vaughan, Carter et al., 2018; Vaughan, Hanna, & Breslin, 2018). Non-athletes were predominantly university students. Additionally, non-athletes were those who did not compete in any sport and failed to score on Swann and colleagues predetermined criteria such as do not participate in any level of competition.

2.2 Procedure

Ethical approval was granted from a university ethics committee. Participants were recruited using purposive sampling. For example, gatekeepers of sports clubs were contacted and asked for permission to contact athletes. Data were collected at designated laboratories at the first author's institution or data was collected during training. Participants were briefed prior to data collection and informed of their ethical rights, and provided informed consent to participate. Participants were required to state whether they participated in sport or not (and if so which sport), how long, what level of competition, and highest level of success. Participants then completed the SD3 along with demographic information age and sex.

2.3. Measures

To measure the Dark Triad, we used the 27-item Short Dark Triad (SD3; Jones & Paulhus, 2014), comprising nine items each capturing narcissism (e.g., "People see me as a

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athlete's highest level, C is experience at the athlete's highest level, D is competitiveness of sport in athlete's country, and E is global competitiveness of sport. Samples are coded as semi elite (a score of 1-4), competitive elite (a score of 4-8), successful elite (a score of 8-12) or world-class elite (a score of 12-16). Thus, the current sample is composed of semi-elite (those in talent-identification programs or competing at the second tier standard; 24.18%), competitive-elite (those who regularly compete at the highest level but have not had success at this level; 21.37%), successful-elite (those who compete at the highest level and have experienced infrequent success at this level; 11.35%), and world-class elite athletes (those who have had sustained success at the highest level; 10.20%).

natural leader"), Machiavellianism (e.g., "I like to use clever manipulation to get my way"), and psychopathy (e.g., "It's true that I can be mean to others"). Participants responded to all items on a Likert-type scale from 1 = '*strongly disagree*' to 5 = '*strongly agree*.' Total and subscale scores were calculated (Persson et al., 2017).

2.4. Data Screening

Upon inspection, a small amount of data was missing (2.1%). Following recommendations (Tabachnick & Fiddell, 2007), we used ipstatized estimation of relevant cases. Multivariate skewness (21.44, $p > .05$) and kurtosis (64.28, $p > .05$) coefficients (Muthén & Muthén, 2014) indicated no departure from normality.

2.5. Analytic Strategy

First, using SPSS (version 23), we calculated means, standard deviations, measures of effect and internal consistency (omega; Dunn, Baguley, & Brunsden, 2014) for all variables (Table 1). Next, we tested one- and three-factor models using ESEM and bifactor-ESEM with latent means analysis (for an overview see Gucciardi & Zyphur, 2016). Then, we assessed measurement invariance across gender, athletic expertise, and sport type on the best fitting model (Muthen & Muthen, 2014). Measurement invariance was tested between the configural model (i.e., the same pattern of factors and loadings across groups), metric model (i.e., invariant loadings), and scalar model (i.e., invariant factor loadings and intercepts). For these analyses, we used the robust maximum likelihood estimator in Mplus 7.4 (Muthen & Muthen, 2014).The robust maximum likelihood estimator can handle instances of missing data, non-normality, categorical variables when there are at least five response categories, and is particularly suited to bifactor interpretations compared to other estimators (see e.g., Stenling, et al., 2015).

Myers, Ntoumanis, Gunnell, Gucciardi, and Seungmin (2017) recommend the use of Monte Carlo simulation for estimation of sample size in structural equation modelling, however, no guidelines exist for parameter estimation in ESEM. Using Monte Carlo simulation, applying CFA estimations with no missing data, standard error biases that do not exceed 10%, and coverage of confidence intervals set at 95% indicated that sufficient power (80%) could be achieved with a sample size of 630 (see Muthén and Muthén (2009) for an overview of this analysis). Additionally, general "rules of thumb" regarding minimum sample size for factor analysis were used to guide recruitment for measurement invariance testing. For example, a minimum of 10 cases per item is considered to provide for an 'excellent' factor analysis (MacCallum, Widaman, Preacher, & Hong, 2001).

As a hypothesised model exists regarding the factor structure of the SD3, an oblique target and oblique-bifactor target rotation were used to estimate how the a priori 27-items and latent factors of the SD3 were interrelated for the ESEM and bifactor-ESEM. An epsilon value of .50 was adopted to enable as many items as possible to be optimally identified within one component while minimising the potential number of doublets (Comrey & Lee, 1992). To evaluate model fit, we examined incremental and absolute fit indices, including the $\chi 2$ statistic, comparative fit index (CFI), Tucker–Lewis Index (TLI [or non-normed fit index]), root mean square error of approximation (RMSEA), and standardised root mean square residual (SRMR). The following criteria were indicative of acceptable model fit: $CFI > 0.90$, $TLI > 0.90$, $RMSEA < 0.06$, $SRMR < 0.06$ (Marsh, Hau, & Wen, 2004). Acceptable fit was achieved if the model met all of these criteria.

In order to select the most parsimonious model, the Bayes information criterion (BIC) and Akaike's information criterion (AIC) were used to compare nested models. The AIC and BIC assign a greater penalty to model complexity and therefore have a better propensity to select more efficient models. Therefore, models with superior incremental and absolute fit are indicative of a better fitting model and used as the structure for invariance testing (Byrne, 2012; Putnick & Bornstein, 2016). In addition, a change of less than .01 in the CFI and .015

in the RMSEA support an invariant model in relation to the previous model (Chen, 2007). Additionally, if imposing successive equivalent restraints result in a loss of fit, noninvariance may be assumed (Kline, 2015; Putnick & Bornstein, 2016). Due to the exploratory nature of ESEM, standardised solutions were examined to evaluate the significance and strength of parameter estimates. The following criteria were used to evaluate the standardised factor loadings (> .71 = excellent, > .63 = very good, > .55 = good, > .45 = fair, > .32 = poor; Comrey & Lee, 1992).

3. Results

3.1. Factor Structure

Descriptive statistics were calculated for total and subscale scores (Table 1). All Omega values were satisfactory (Table 1). Data indicated significant differences between groups, with males scoring higher than their female counterparts, athletes with higher expertise scoring higher than those with lower expertise, and individual athletes scoring higher than team athletes on composite and subscale Dark Triad scores. The one-factor ESEM model did not provide an adequate fit to the data (Table 2). Moreover, the three-factor ESEM model provided only marginal fit (i.e., TLI < .90). However, the bifactor-ESEM model provided an acceptable fit to the data. Model comparisons suggested the bifactor-ESEM model provided a better fit to the data than both ESEM models (i.e., lowest AIC and BIC values were found in the bifactor-ESEM; see again Table 2).

The standardised factor loadings of the bifactor-ESEM model are presented in Table 3. In most instances, higher factor loadings were found for the general factor than for the specific factors, substantiating improved fit associated with the bifactor ESEM (Marsh et al., 2004). For each factor, seven of the highest loadings were found on the general factor whereas only two loadings were highest on the specific factors (i.e., Machiavellianism items 1 and 4, narcissism items 10 and 15, and psychopathy items 20 and 23). Importantly, several cross-loading items were found (e.g., items 3, 4, 10, 13, 15, and 23). However, all cross-loadings were considered small and only three (e.g., items 3, 10, and 13) were significant based on Comrey and Lee's (1992) cut-offs. Moreover, all target factor loadings were higher than the cross-loadings. Small significant correlations were found between latent factors (see Supplementary Material). Narcissism was negatively correlated with Machiavellianism and psychopathy. Machiavellianism was positively correlated with psychopathy.

3.2. Invariance Testing

To test measurement invariance across gender, the configural model was compared with the metric model (see Table 2). The configural model provided significantly better fit ($\Delta\chi^2$ [92] = 436.983, $p < .001$; ΔRMSEA = .007; ΔCFI = .024). Next, the metric model was compared against the scalar model. The scalar model provided significantly better fit ($\Delta\chi^2$ [23] = 209.412, $p < .001$; ΔRMSEA = .002; ΔCFI = .031). AIC and BIC were lowest for the configural model. Whilst changes in the *CFI* and *RMSEA* were within range of invariance, values were above the critical cut-off for each invariance model using the conservative estimates suggested (Chen, 2007). These analyses suggest that while invariance remained relatively stable with each subsequent parameter restraint, the model may differ across men and women due to the loss of model fit (i.e., imposing restraints caused a decrease in model fit from baseline; Kline, 2015; Putnick & Bornstein, 2016).

To test measurement invariance across athletic expertise, the configural model was compared with the metric model (see Table 2). The configural model provided significantly better fit ($\Delta\chi^2$ [184] = 1455.848, $p < .001$; ΔRMSEA = .013; ΔCFI = .062). Next, the metric model was compared against the scalar model. The scalar model provided significantly better fit ($\Delta\chi^2$ [46] = 325.023, $p < .001$; ΔRMSEA = .015; ΔCFI = .109). *AIC* and *BIC* were lowest for the configural model. Whilst changes in the *CFI* and *RMSEA* were within range of invariance, values were above the critical cut-offs for each invariance model, except for the configural suggesting that the SD3 items (the same pattern of free of fixed loadings) were only equivalent when the same pattern of free of fixed loadings were analysed across athletic expertise using the conservative estimates suggested (Chen, 2007). These analyses suggest that while invariance remained relatively stable with each subsequent parameter restraint, the model may differ across elite, amateur, and non-athletes due to a loss of fit at the metric and scalar level (Kline, 2015; Putnick & Bornstein, 2016).

To test measurement invariance across sport type (team and individual athletes), the configural model was compared with the metric model (see Table 2). The configural model provided significantly better fit ($\Delta\chi 2$ [86] = 449.254, $p < .001$; ΔRMSEA = .004; ΔCFI = .003). Next, the metric model was compared against the scalar model. The scalar model provided significantly better fit ($\Delta\chi 2$ [32] = 143.676, $p < .001$; ΔRMSEA = .002; ΔCFI = .015). AIC and BIC were lowest for the configural model. Whilst changes in the *CFI* and *RMSEA* were within range of invariance, values were above the critical cut-off for each invariance model using the conservative estimates suggested in the literature (Chen, 2007). These analyses suggest that while invariance remained relatively stable with each subsequent parameter restraint, the model may differ across team and individual athletes due to the loss of model fit (i.e., imposing restraints caused a decrease in model fit from baseline; Kline, 2015; Putnick & Bornstein, 2016).

3.3. Parameter Estimates for Invariance Measurement Models

Comparison of factor matrixes between gender, athletic expertise, and type of sport indicated a partial representation of Jones and Paulhus' (2014) conceptualisation. For gender, inspection of the factor loadings and residual variances indicated strong representations of their latent factors, with loadings ranging from excellent to poor on their intended subscale (Comrey & Lee, 1992). However, degrees of misspecification existed (i.e., at least two misloading and three cross-loading items outside of their target factor). The least misspecification was noted for men. Similar to gender, the factor loadings across athletic expertise differed indicating moderate levels of misspecification (i.e., at least three misloading and four cross-loading items outside of their target factor). The least amount of misspecification was found for non-athletes. Furthermore, similar to estimates in the whole sample, loadings were higher in the general factor as opposed to their specific components. This pattern continued for team and individual athletes (i.e., higher loadings on the general factor and at least two misloading and two cross-loading items outside of their target factor) with less misspecification found in individual athletes. The latent factor correlations indicated similar patterns across groups, with narcissism negatively correlated with Machiavellianism and psychopathy and a positive relationship between the latter components (see Supplementary Material).

4. Discussion

The aim of the present study was to assess the psychometric properties of the SD3. We explored whether a one factor, three factor ESEM or a bifactor ESEM model provided an adequate fit to the data. We also explored measurement invariance of the SD3 across gender, athletic expertise, and sport type. The results provided mixed support for our expectations. Whereas the findings indicated that a bifactor-ESEM framework provided the best fit to the data, measurement invariance across groups was not fully supported due to the overall loss of fit. In this regard, there were instances of misspecification across all groups, suggesting that the SD3 items may be interpreted differently by men and women, elite, amateur, and non-athletes, and team and individual athletes.

Additionally, we reported that individuals Dark Triad score differs on a function of gender, athletic expertise and sport type. Specifically, we found that males score higher than females, expert athletes scored higher than non-athletes, and individual athletes scored higher than team athletes, on narcissism, Machiavellianism, psychopathy and a composite Dark

Triad score. Although the first to directly examine differences in the Dark Triad these findings align with previous research suggesting differences across these groupings (Furnham et al., 2013; Jonason et al., 2010; Vaughan et al., 2018).

4.1. Psychometric Properties of the SD3

Overall, our findings provide support for the psychometric properties of the SD3. Our results indicated high internal consistency at the total and subscale level. In addition, a bifactor-ESEM model provided a better fit to the data than did a one or three factor ESEM model. Note, that while the three-factor ESEM model provided largely adequate fit to the data based on conservative estimates – the bifactor ESEM provided better fit meeting all pre-specified criteria therefore offering a more parsimonious model (Byrne, 2012). Thus, findings support the three specific factors and a composite SD3 factor existing concurrently in the same data. As to candidate explanations as to why this was the case, the general factor not captured by ESEM is likely key. In line with the work of others (McLarnon & Tarraf, 2017; Persson et al., 2017), SD3 items showed higher loadings on the general factor than the individual Dark Triad factors. Moreover, the lack of fit associated with the one-factor ESEM indicates that the specific factors capture variance not associated with the general factor. Nonetheless, the marginal fit reported and item misspecification in the three-factor ESEM suggests that SD3 items are not pure measures of each factor. It is possible that in any instance the conceptual similarity between narcissism, Machiavellianism and psychopathy is unavoidable. This is a common finding across many aggregate scales whereby in an attempt to increase internal consistency high inter-item correction is a by-product (Asparouhov & Muthen, 2009; Vaughan et al., 2018). As such, this higher-order model may provide the most accurate representation of the structure of the SD3.

This finding aligns with current theory regarding the Dark Triad suggesting the existence of a unifying “dark factor” of personality (Moshagen, Hilbig, & Zettler, 2018). The dark factor of personality describes a framework of negatively connoted traits which account for instances of ruthless, selfish, and unscrupulous behaviour. Critically, the dark factor describes a general dispositional tendency – some dark traits may arise as specific manifestations. Specifically, Moshagen et al. (2018) suggest that individuals high in the dark factor generally aim to maximise their individual utility at the cost of others, disregard, accept, or malevolently provoke disutility for others, and endorse beliefs that serve as justification for such behavior. Indeed, a general factor located within the SD3 factor space coincides with the proposed existence of the dark factor. Moreover, research has attested the facilitative aspects of dark personality traits such as narcissism in athletes (Roberts et al., 2014; 2018). It is perhaps the conceptual blending of the SD3 factors which manifest in a sport context. For example, only some facets of psychopathy, Machiavellianism and narcissism manifest in sport whilst the remaining residual variance is captured by this general factor.

The SD3 was developed as a measure of the three separate traits of the Dark Triad. As such, the present findings are somewhat at odds with Jones and Paulhus' (2014) original work. The strong factor loadings found in the general factor may indicate that narcissism, Machiavellianism, and psychopathy share some underlying variance (e.g., malevolence). Importantly, this may enable researchers to test whether other constructs can contribute to the prediction of meaningful outcomes over and above this general factor (e.g., sadism; Meere & Egan, 2017). Moreover, a bifactor structure augments the SD3 model incorporating recommendations proposed by Johnson et al. (2012) and Johnson, Rosen and Chang (2011) regarding the use of higher-order multidimensional constructs. For example, this bifactor structure retains the conceptual uniqueness and original work of Jones and Paulhus (2014) whilst providing an empirically testable model, moving forward, with greater parsimony and bandwidth in sport.

Regarding the factor loadings of the specific factors, some misspecification existed in the factor structure for Machiavellianism, narcissism, and psychopathy, suggesting some items may be problematic. Specifically, Item 4 of Machiavellianism cross-loaded onto narcissism (i.e, “Avoid direct conflict with others because they may be useful in the future”), Item 13 of narcissism cross-loaded onto Machiavellianism (i.e., “I know that I am special because everyone keeps telling me so”) and Item 10 cross-loaded onto psychopathy (i.e., “People see me as a natural leader”). Interestingly, all three cross-loading items share a common theme of leadership and team dynamics, suggesting that this may be a complex factor in a sport context (Cruickshank & Collins, 2015; Jonason et al., 2010; Jones et al., 2013). Future research should test this association. Furthermore, the identification of non-target rotations, although advantageous in ESEM, may indicate redundancy in the item set in shortened scales such as the SD3 (Jones & Paulhus, 2014; Marsh et al., 2011; 2013; Morin et al., 2016). For example, the narcissism subscale of the SD3 comprises grandiose rather than vulnerable narcissism; this overlaps with other aspects of the Dark Triad (e.g., hostility). However, it may also support research postulating the unique role of narcissism in the Dark Triad (Nicholls et al., 2017; Vaughan et al., 2018).

Vize and colleagues (2018) recently highlighted the issues surrounding partialling in context of the Dark Triad. It is possible that the bifactor approach may negate some of these issues. Nonetheless, adopting a bifactor framework may only shift the issues associated with interpretation to the global factor. For example, although recent research suggests a common core to dark personality traits (Moshagen et al., 2018), debate surrounds what exactly a global factor represents (Furnham et al., 2013; 2014; Marcus & Zeigler-Hill, 2015; McLarnon & Tarraf, 2017). These limitations are similar to those reported for a general factor of psychopathy such as an over simplification of the constructs conceptual theory in favour of increased model fit (see Bonifay, Lane, & Reise, 2016 for review). Although bifactor models are robust from a psychometric point of view, it is currently unclear if they introduce conceptual difficulties when examining and explaining empirical associations with other variables (Vize et al., 2018). This is a clear avenue for future research.

4.2. Measurement Invariance

The present findings have important implications for previous and future research examining how the Dark Triad differs between groups. To enable comparisons across groups, the SD3 needs to be invariant. Psychometric evaluation should be based on theoretical and empirical evidence by confirming and falsifying results (Hopwood & Donnellan, 2010). We were particularly interested in the differences between three groups: gender, athletic expertise, and type of sport. However, invariance models did not meet predetermined fit criteria and decreases in fit were observed in each successive equivalence constraint (Chen, 2007; Kline, 2015; Putnick & Bornstein, 2016). Therefore, we cannot ascertain whether the SD3 remains invariant across groupings.

As regards to gender, we found that the factor structure in the male group indicated fewer instances of misspecification compared with the female group. However, both provided discrepancy with Jones and Paulhus’s (2014) conceptualisation, whereas the general Dark Triad factor remained relatively stable. Similarly, the factor structures across athletic expertise provided little support for the hypothesised structure of the SD3, with the least misspecification found in non-athletes. Previous research has reported higher Dark Triad scores for athletes (Ueno et al., 2017; Vaughan et al., 2018), suggesting a lack of congruence between theory and measurement. Although no previous work has investigated differences between team and individual athletes, our analyses showed the least misspecification in the individual athletes. These findings align with previous research suggesting that individuals high in Dark Triad traits will favour individual activities (Jonason et al., 2010; Jones et al., 2013; Rauthmann, 2012; Woodman et al., 2013). The findings also underscore the necessity of research examining measurement invariance across other important groups (e.g., youth or adult athletes).

Overall, it is possible that due to the nature of competitive sport some items contain content that is more common (and relevant) and athletes with more expertise may interpret them differently in comparison to those less involved in elite athletic settings. For example, items from each subscale reflect self-gain (e.g., “Make sure your plans benefit yourself, not others”, “I insist on getting the respect I deserve”, “People who mess with me always regret it”) which are congruent with the goal orientated sport environment. Although the present research is interested in athletes, personality researchers should be cautious regarding generalizability of findings with samples from Western, Educated, Industrialized, Rich, and Democratic samples (see Henrich, Heine, & Norenzayan, 2010 for a review). Research suggests that the characteristics of such samples, like that of the current data, may only provide a partial representation of the population thus any conclusions regarding non-equivalence may not be totally reflective of the groupings used but may be a byproduct of these larger demographics (Henrich et al., 2010).

Whilst determining complete invariance was not possible due to the overall loss of model it should be noted that the cut-offs adopted originated from CFA techniques (Marsh et al., 2004; 2011; 2013). Therefore, considering the flexibility offered in an ESEM framework, the cut-offs adopted may be too restrictive. Indeed this has been contested regarding the utility of CFA with many scales failing to meet strict cut-offs (Marsh et al., 2011; 2013; Myers et al., 2017). Moreover, recent research has attested that some misspecification is to be expected in an ESEM framework due to the rotational procedures adopted (Perry, Nicholls, Clough & Crust, 2015; Vaughan et al., 2018). Similarly, in scale development, high inter-item correlation is sought to increase internal consistency but this may be compounded in an ESEM framework which allows covariance between non-intended items and factors resulting in some overlap between subscales (Asparouhov & Muthen, 2009; Russell, 2002). Coupled with the lack of research examining the invariance of the SD3 outside of sport, the current work provides insight regarding examining equivalence of the Dark Triad framework across different populations.

4.3. Limitations and Future Research

The present findings should be considered in relation to some limitations. As mentioned, cut-offs adopted for the ESEM fit indices were recommended for CFA procedures with no ESEM specific indicators developed. Second, the data was not collected from intact teams and therefore it was not possible for us to account for any nesting in the data. Future research should collect data from such samples and use multilevel analytic techniques to better account for this nesting. Nonetheless, our findings have important implications for research using the SD3. Despite acceptable model fit, they suggest that the current composition of the SD3 should be used with caution among women, elite athletes, and those from team sports, particularly in research that seeks to explore similarities and differences across these and other groups in relation to the Dark Triad traits. That is, until invariance can be established via future research. Note, considering the number of studies, adequate definitions, and theoretical development we do not claim that the SD3 is non-invariant (i.e., unequivocal across groups). Rather, we could not conclude that the scale is invariant and as such further work is needed.

We think, however, there are some relatively easy solutions that can be the focus of future research. Studies should aim to refine the items for use in specific populations comparing data from the original and revised item sets. This could entail adding or removing specific items, or examining the proposed bifactor structure before other hypothesis testing. Another possible solution to this problem is to contextualise SD3 items for use in specific domains (e.g., sport). This has been successfully implemented with other complex personality traits such as perfectionism (Stoeber & Madigan, 2016). Research is needed to determine if domain-specific conceptualisations provide greater explanatory value than non-specific approaches. It is possible that without contextualisation, some nuances associated with the Dark Triad are masked by the large degree of shared variance between the traits (Furnham et al., 2013; 2014; Viz et al., 2018). Moving forward, researchers interested in examining dark personality in sport may wish to provide both subscale and total SD3 scores.

4.4. Conclusion

We suggest that researchers continue to use the SD3 using both composite and subscale scores, but recommend caution when interpreting subscale scores among women and team athletes until further psychometric work has been conducted within these populations. Our findings also suggest that the Dark Triad may be worth examining in future studies in sport.

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Table 1

Descriptive Statistics for Total and Subscale Scores across Gender, Athletic Expertise, and Sport Type.

	Overall	Gender			Athletic Expertise				Sport Type			
		Male	Female		Non-Athlete	Amateur	Elite		Team	Individual		
Scale		*M* (*SD*)		ηp^2	*M* (*SD*)			ηp^2	*M* (*SD*)		ηp^2	Ω
Total score	69.31 (15.62)	72.20 (17.78)	66.39 (12.41)	.04**	65.84 (13.46)	68.66 (13.26)	75.41 (20.19)	.05**	68.98 (15.13)	74.39 (18.56)	.04**	.85
Narcissism	24.02 (5.67)	24.41 (5.99)	23.62 (5.29)	.03*	22.28 (5.20)	23.94 (5.27)	26.59 (6.06)	.12**	24.41 (5.56)	25.78 (5.87)	.10**	.71
Machiavellianism	26.04 (6.22)	26.76 (6.56)	25.31 (5.76)	.04**	26.27 (5.90)	25.33 (5.78)	27.07 (7.22)	.03**	25.33 (6.04)	27.18 (6.84)	.04**	.76
Psychopathy	19.32 (6.80)	21.13 (7.61)	17.49 (5.15)	.10**	17.48 (5.29)	19.39 (6.09)	21.74 (8.73)	.09**	19.42 (6.69)	21.85 (7.93)	.08**	.79

Note. N = 1,258. * $p < .05$; ** $p < .01$.

Table 2

Fit Indices of One Factor ESEM, Three Factor ESEM, and Bifactor-ESEM Models with Tests of Invariance.

Model	X^2	*df*	RMSEA (90% CI)	SRMR	TLI	CFI	AIC	BIC
ESEM (one factor)	2000.552	273	.064 (.061-.067)	.054	.839	.875	95545.457	96223.578
ESEM (three factor)	1756.33	253	.060 (.058-.063)	.052	.891	.910	95345.851	96101.608
Bifactor-ESEM	1493.499	249	.053 (.050-.056)	.046	.909	.948	95086.404	95887.820
Gender Configural	2001.465	498	.062 (.059-.065)	.051	.867	.891	94176.237	95779.068
Gender Metric	2438.448	590	.069 (.069-.072)	.053	.832	.867	94429.220	95559.421
Gender Scalar	2647.860	613	.071 (.068-.073)	.055	.805	.836	94592.632	95604.675
Expertise Configural	2600.695	747	.060 (.057-.063)	.052	.887	.916	92815.464	95219.710
Expertise Metric	4056.543	931	.073 (.070-.076)	.065	.804	.854	93903.311	95362.298
Expertise Scalar	4381.566	977	.088 (.086-.092)	.081	.731	.745	93923.310	95404.251
Type Configural	2098.358	502	.064 (.061-.064)	.053	.854	.882	94212.530	95995.604
Type Metric	2547.612	588	.068 (.066-.070)	.054	.841	.879	94368.087	95845.156
Type Scalar	2691.288	620	.070 (.063-.072)	.056	.828	.864	94455.429	96122.291

Note. N = 1,258. .X^2 = Chi-Square, RMSEA = Root Mean Square Error of Approximation, CI = Confidence Interval, SRMR = Standardised Root Mean Residual, Tucker Lewis Index, CFI = Comparative Fit Index, AIC = Akaike Information Criteria, BIC = Bayes Information Criterion.

Table 3.

Parameter Estimates for Total Sample from the Bifactor-ESEM Model.

Item	General Factor	Factor 1	Factor 2	Factor 3
Machiavellianism				
1	.332**	<u>**.350****</u>	.180	.124
2	**.702****	<u>.374**</u>	.099	.101
3	**.723****	<u>.544**</u>	.312**	.184
4	.355**	<u>**.494****</u>	.332*	.038
5	**.750****	<u>.420**</u>	.051	.101
6	**.917****	<u>.368**</u>	.035	.161
7	**.369****	<u>.348**</u>	.204	.024
8	**.543****	<u>.445**</u>	.002	.073
9	**.610****	<u>.377**</u>	.029	.016
Narcissism				
10	.393**	.230	<u>**.469****</u>	.370**
11	**.494****	.258*	<u>.466**</u>	.146
12	**.677****	.297*	<u>.431**</u>	.012
13	**.567****	.354**	<u>.510**</u>	.024
14	**.619****	.202	<u>.436**</u>	.006
15	.375**	.215	<u>**.437****</u>	.309*
16	**.539****	.232	<u>.332**</u>	.107
17	**.392****	.287*	<u>.352**</u>	.019
18	**.379****	.008	<u>.315*</u>	.204
Psychopathy				
19	**.737****	.047	.298*	<u>.443**</u>

20	.412**	.220	.047	**.465****
21	**.483****	.136	.208	.453**
22	**.787****	.057	.129	.466**
23	.445**	.310*	.183	**.554****
24	**.758****	.028	.185	.311*
25	**.628****	.216	.219	.386**
26	**.625****	.263*	.038	.454**
27	**.850****	.014	.084	.354**

Note. N = 1,258. Values in bold indicate highest loading on that factor. Values underlined are interpreted as a factor. Factor 1 = Machiavellianism, Factor 2 = Narcissism, Factor 3 = Psychopathy. * $p < .05$; ** $p < .01$.

Supplementary Material

Table 4.

Parameter Estimates for Bifactor-ESEM Gender Invariance SD3 Models

Item	Male					Female				
	1	2	3	4	r^2	1	2	3	4	r^2
SD3 1	.258**	.153*	.373**	.006	.862**	.296**	.192**	.253**	.020	.857**
SD3 2	.802**	.384**	.025	.054	.619**	.626**	.170**	.222**	.045	.863**
SD3 3	.836**	.350**	.308**	.077	.541**	.579**	.015	.393**	.030	.579**
SD3 4	.174**	.280**	.019	.030	.938**	.420**	.011	.387**	.084	.837**
SD3 5	.692**	.570**	.113*	.051	.456**	.755**	.075	.160*	.250**	.554**
SD3 6	.986**	.582**	.065	.015	.528**	.743**	.013	.094	.174*	.633**
SD3 7	.177*	.634**	.294**	.105	.700**	.444**	.904**	.180*	.136*	.886**
SD3 8	.651**	.192**	.215**	.005	.934**	.399**	.058	.011	.048	.870**
SD3 9	.660**	.338**	.019	.174**	.710**	.518**	.080	.067	.006	.873**
SD3 10	.442**	.155*	.372**	.132*	.868**	.178*	.218**	.080	.459**	.896**

SD3 11	.699**	.122*	.263**	.297**	.930**	.115	.700**	.097	.034	.720**
SD3 12	.859**	.117*	.297**	.019	.778**	.356**	.085	.102	.425**	.531**
SD3 13	.721**	.345**	.224**	.109	.835**	.354**	.016	.033	.573**	.481**
SD3 14	.737**	.064	.161*	.349**	.673**	.462**	.176*	.320**	.206*	.653**
SD3 15	.046	.006	.488**	.019	.886**	.010	.713**	.039	.011	.765**
SD3 16	.596**	.041	.308**	.213**	.893**	.338**	.023	.048	.435**	.870**
SD3 17	.206**	.254**	.355**	.263**	913**	.081	.511**	.011	.071	.851**
SD3 18	.431**	.214**	.350**	.064	.907**	.328**	.064	.041	.166*	.931**
SD3 19	.902**	.077	.054	.461**	.463**	.477**	.022	.206**	.029	.447**
SD3 20	.569**	.011	.113	.237**	.954**	.231*	.203*	.259**	.056*	.934**
SD3 21	.465**	.008	.058	.314**	.686**	.489**	.012	.244**	.066	.368**
SD3 22	.980**	.123*	.328**	.198*	.713**	.496**	.087	.341**	.061	.498**
SD3 23	.554**	.411**	.087	.277**	.862**	.608**	.193*	.157*	.050	.903**
SD3 24	.848**	.027	.100	.236**	.479**	.622**	.078	.159*	.149*	.504**
SD3 25	.850**	.020	.318**	.153*	.596**	.204*	.191*	.248**	.053	404**
SD3 26	.834**	.371**	.295**	.161*	.679**	.253*	.230**	.161*	.063	.827**

SD3 27	765**	.002	.156*	.150*	.574**	.631**	.076	.097	.067	.557**

Note. Values underlined indicate intended factor. 1 = General DT Factor, 2 = Machiavellianism; 3 = Narcissism; 4 = Psychopathy. N = 1258.

* significant at $p < .05$; ** significant at $p < .01$.

Table 5.

Parameter Estimates for Bifactor-ESEM Athletic Expertise Invariance SD3 Models

Item	Non-Athletes					Amateur Athletes					Elite Athletes				
	1	2	3	4	r^2	1	2	3	4	r^2	1	2	3	4	r^2
SD3 1	.305**	.310**	.009	.207*	.672**	.266**	.288**	.044	.131	.897**	.349**	.064	.193*	.049	.746**
SD3 2	.668**	.035	.364**	.289**	.743**	.742**	.042	.075	.105	.733**	.867**	.043	.383**	.260**	.430**
SD3 3	.848**	.173*	.066	.155	.484**	.541**	.132	.047	.218**	.770**	.965**	.597**	.19	.361**	.625**
SD3 4	.350**	.061	.159*	.033	.634**	.306**	.076	.002	.244**	.802**	.146**	.434**	.267**	.016	.650**
SD3 5	.748**	.163*	.003	.280**	.576**	.671**	.391**	.092	.001	.638**	.923**	.228**	.543**	.028	.254*
SD3 6	.848**	.012	.031	.394**	.614**	.668**	.336**	.015	.021	.760**	.825**	.032	.346**	.036	.373**
SD37	.120*	.208*	.137	.092	.663**	.439**	.265*	.057	.247**	.854**	.476**	.098	.193*	.153*	.689**
SD3 8	.587**	.170*	.326	.019	.703**	.427**	.049	.032	.064	.954**	.608**	.274**	.353**	.050	.937**

SD3 9	.495**	.004	.502*	.471**	.610**	.537**	.240*	.038	.134	.880**	.798**	.148*	.058	.023	.580**
SD3 10	.160*	.405**	.162*	.131	.849**	.295*	.303*	.131*	.224*	.899**	.511**	.083	.325**	.425**	.796**
SD3 11	.544**	.438**	.266*	.122	.776**	.074	.114	.544**	.123	.852**	.737**	.016	.134	.110	.913**
SD3 12	.420**	.270*	.052	.043	.452**	.487**	.381**	.138*	.005	.701**	.724**	.037	.132	.144*	.895**
SD3 13	.501**	.362**	.124	.184*	.571**	.486**	.574**	.188*	.039	.571**	.662**	.358**	.347**	.037	.604**
SD3 14	.679**	.029	.087	.322**	.536**	.445**	.119	.197*	.414**	.674**	.872**	.278**	.006	.095	.587**
SD3 15	.180*	.685**	.017	.040	.654**	.081	.024	.621**	.016	.951**	.515**	.046	.222**	.167**	.776**
SD3 16	.220**	.489**	.044	.176*	.621**	.517**	.323**	.190*	.104	.913**	.715**	.139*	.063	.141*	.858**
SD3 17	.261**	.194*	.552**	.027	.666**	.068	.049	.612**	.031	.832**	.721**	.529**	.067	.089	.833**
SD3 18	.120*	.466**	.012	.516**	.890**	.370**	.172*	.600**	.219	.940**	.525**	.087	.238**	.079	.613**
SD3 19	.509**	.130*	.077	.220*	.510**	.632**	.023	.068	.436**	.549**	.926**	.030	.072	.329**	.422**
SD3 20	.376**	.001	.629**	.129	.801**	.099	.134*	.396**	.176*	.963**	.780**	.282**	.028	.207**	.694**
SD3 21	.512**	.003	.041	.222*	.387**	.574**	.127*	.002	.389**	.536**	.323**	.260*	.003	.512**	.244*
SD3 22	.629**	.359**	.189*	.004	.660**	.568**	.120	.006	.396**	.598**	.532**	.317**	.445**	.058	.331**
SD3 23	.223*	.093	.261*	.598**	.786**	.651**	.158*	.019	.386**	.952**	.819**	.447**	.089	.024	.632**
SD3 24	.571**	.125	.073	.282**	.459**	.604**	.004	.053	.254*	.596**	.966**	.047	.006	.452**	.339**

SD3 25	.225*	.106	.103	.169*	.899**	.352**	.018	.312**	.400**	.577**	.888**	.464**	.002	.141	.639**
SD3 26	.449**	.151	.360**	.156*	.339**	.528**	.125	.051	.378**	.824**	.816**	.040	.572**	.016	.697**
SD3 27	.743**	.006	.008	241*	.447**	.622**	.018	.011	.197*	.726**	.538**	.057	.227*	.069	.352**

Note. Values underlined indicate intended factor. 1 = General DT Factor, 2 = Machiavellianism; 3 = Narcissism; 4 = Psychopathy. N = 1258.

* significant at $p < .05$; ** significant at $p < .01$.

Table 6.

Parameter Estimates for Bifactor-ESEM Sport Type Invariance SD3 Models

Item	Team					Individual				
	1	2	3	4	r^2	1	2	3	4	r^2
SD3 1	.351**	.173*	.218**	.010	.851**	.307**	.202**	.157*	.074	.861**
SD3 2	.813**	.390**	.002	.041	.624**	.604**	.191**	.204*	.041	.824**
SD3 3	.802**	.387**	.261**	.082	.551**	.587**	.054	.374**	.062	.584**
SD3 4	.201**	.292**	.031	.047	.922**	.416**	.068	.361**	.028	.863**
SD3 5	.690**	.545**	.108	.062	.469**	.746**	.097	.138*	.201**	.524**
SD3 6	.912**	.571**	.052	.025	.534**	.727**	.022	.044	.141*	.612**

SD3 7	.166*	.608**	.243**	.095	.687**	.489**	.812**	.101*	.145*	.808**
SD3 8	.671**	.209**	.193*	.014	.901**	.428**	.071	.081	.002	.931**
SD3 9	.628**	.367**	.003	.112*	.746**	.535**	.089	.006	.047	.782**
SD3 10	.430**	.181*	.385**	.107*	.828**	.184*	.264**	.063	.462**	.881**
SD3 11	.708**	.162*	.297**	.241**	.908**	.192*	.684**	.087	.028	.841**
SD3 12	.804**	.104*	.321**	.031	.745**	.367**	.098	.094	.417**	.624**
SD3 13	.734**	.262**	.239**	.094	.811**	.383**	.067	.085	.562**	.499**
SD3 14	.758**	.023	.181*	.258**	.697**	.481**	.155*	.312**	.273**	.663**
SD3 15	.111*	.014	.469**	.034	.862**	.101	.724**	.141*	.005	.771**
SD3 16	.614**	.036	.325**	.192**	.855**	.302**	.061	.134*	.396**	.893**
SD3 17	.228**	.198**	.333**	.264**	874**	.107	.547**	.107*	.007	.872**
SD3 18	.443**	.143*	.341**	.087	.894**	.341**	.032	.082	.174*	.903**
SD3 19	.841**	.051	.040	.480**	.561**	.482**	.081	.154*	.063	.464**
SD3 20	.541**	.032	.101	.261**	.909**	.201*	.257*	.174**	.041	.907**
SD3 21	.478**	.010	.081	.338**	.678**	.463**	.062	.207*	.017	.383**
SD3 22	.853**	.136*	.261**	.229*	.735**	.483**	.062	.228**	.012	.432**

SD3 23	.518**	.219**	.001	.314**	.847**	.601**	.148*	.163*	.073	.822**
SD3 24	.784**	.003	.106	.276**	.468**	.607**	.062	.101	.084	.533**
SD3 25	.790**	.031	.221**	.215**	.599**	.199*	.213**	.236**	.063	425**
SD3 26	.861**	.250**	.247**	.187*	.643**	.268*	.206**	.011	.052	.811**
SD3 27	748**	.005	.117*	.192*	.542**	.611**	.007	.028	.061	.563**

Note. Values underlined indicate intended factor. 1 = General DT Factor, 2 = Machiavellianism; 3 = Narcissism; 4 = Psychopathy. N = 1258.

* significant at p < .05; ** significant at p < .01.

Table 7.

Latent Factor Correlations for Bifactor ESEM Models

Factor	Total		Male		Female		Non		Amateur		Elite		Team		Individual	
1.Machiavellianism	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
2.Narcissism	-.186*		-.142*		-.163*		-.141*		-.264*		-.218*		-.210*		-.289**	
3.Psychopathy	.174*	-.129*	.133*	-.143*	.390**	-.131*	.140*	-.169	.151*	-.186*	.153*	-.136*	.188*	-.163*	197*	-177*

N = 1258. * significant at p < .05; ** significant at p < .01.

Figure 1. Conceptual diagram of bifactor ESEM Framework of the SD3 (M = Machiavellianism, N = narcissism, P = psychopathy)