Performance Enhancement & Health 14 (2026) 100418

Contents lists available at ScienceDirect

Performance Enhancement & Health

journal homepage: www.elsevier.com/locate/peh

Research Paper

(Re-thinking) values and virtues: A network approach to mapping athletes' personal values and the spirit of sport

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ARTICLE INFO

Keywords:
Athletes
Value priority
WADA
Best-worst scaling
Network analysis

ABSTRACT

Promoting the values of sport in anti-doping education requires understanding the relations among athletes' personal values and societal sport values. However, the interplay between these value systems and their impact on doping prevention remains unclear. This study mapped these relations via network analysis among 833 (53% male, 59% competitive) European athletes, assessing Schwartz's personal values and WADA's Spirit of Sport Values (SSV) using Likert scales and Best-Worst Scaling. Hedonism and universalism as general values, and fun, joy, and respect as sport values were the most important for athletes. Tradition and power among general values, and courage and excellence in performance among sport values were ranked as least important. Network analysis revealed interconnectedness without distinct clusters, highlighting paradoxical centrality: SSV principles like excellence and fair play — though less endorsed individually — emerged as critical or "central" hubs (high strength, closeness, betweenness), bridging personal values (risk-taking, leadership) and SSV priorities. Only two cross-system links existed: personal achievement ↔ SSV dedication and personal enjoyment ↔ SSV fun. Despite moderate correlation ($r = 0.58$) between aggregated values, SSV principles showed limited resonance as internalized personal values. This apparent disconnect presents a significant challenge for values-based anti-doping education, as the Spirit of Sport principles may not resonate with athletes' personal value priorities. Further research into the cultural and contextual dynamics between personal and societal value adoption is warranted to enhance value-aligned intervention and the promotion of sport values as a doping prevention strategy.

1. Introduction

In public and media discourse, the words "Spirit of Sport" tend to evoke high ideals, principles, ethics or values guiding sport competition in all its forms and manifestations. At its core, the Spirit of Sport also profoundly embeds the socially shared notion that sport is one of the highest human experiences, insofar as it allows humankind to express skills, emotions, and performances at their highest levels. These initial considerations tend to also resonate and matter for sport institutions' policies. In fact, the Spirit of Sport is at the center of sport's public policy. Since the first publication of World Anti-Doping Code in 2003, the World Anti-Doping Agency (WADA 2021) pursued its mandate of a doping-free sports environment, calling upon sport integrity and, more importantly, a set of principles encoded in WADA's endorsement of the

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https://doi.org/10.1016/j.peh.2026.100418
Received 15 July 2025; Received in revised form 5 December 2025; Accepted 3 February 2026

Spirit of Sport – which are also identified as the intrinsic values of sport (*WADA-CODE,* p.13).[1] Over several years, the WADA Code has consistently offered three basic criteria for justifying prohibition of specific substances and methods in competitive sports. The first two criteria broadly refer to means that may, respectively, enhance sport performance and cause potential health risks for athletes. The third criterion instead explicitly refers to the Spirit of Sport (i.e., "WADA's determination that the use of the substance or method violates the Spirit of Sport described in the introduction to the Code*", WADA-CODE, 2021*, p. 22). Over the years, the WADA Code consistently referred to eleven Spirit of Sport principles evoked by the words *health; ethics and fair play; excellence; character; fun and joy; teamwork; dedication; respect for rules; respect for self and others; courage; and solidarity*. In 2021, the WADA Code included *athletes' rights* as a twelfth Spirit of Sport principle (ibid, p.13). Resulting from the latest consultation and Code revision process, the 2027 Code expands and cluster the list of the 'Spirit of Sport' principles for their functions as values found (e.g., community, equality, fun and joy, respect, solidarity), demonstrated (e.g., accomplishment, commitment, courage, discipline, excellence in performance, fair play, honesty, personal responsibility) and taught (athletes' rights and responsibilities as set out in the Code, cooperation with others, education and knowledge, fairness, health, respect for human rights, respect for rules, laws and justice) through sport (WADA Code 2027, pp13–14). And yet, whether and how these general views about sport characterize athletes' value systems and guide their decisions and actions in specific sport contexts remains unexplored.

At first glance, the WADA Code's Spirit of Sport clause may appear quite reasonable and in line with WADA mandate and stated ethical position (WADA Code, 2027, p13). However, it has spawned a complex debate in the academic community. Some scholars (e.g., Geeraets, 2018) questioned the two fundamental arguments of the WADA Code and antidoping policy and concluded that the goal of protecting the Spirit of Sport and the WADA claim that athletes endorse the Code *voluntarily* are ideological, at their core. On a quite different account, Obasa and Borry in their 2019 review of scientific contributions on Spirit of Sport Values (SSV), concluded that the WADA Spirit of Sport clause had supporters or opponents depending upon a host of factors, ranging from SSV's adherence to the Olympic tradition or, rather, their inherent instrumentality, as well as from the supposed SSV's conceptual clarity or, rather, their weak operational applicability. On yet another level of analysis, Loland and McNamee (2019) looked at the philosophical and ethical implications of the WADA Code and argued that the Code's third Spirit of Sport criterion might be interpreted either as a sign of institutional support for a *liberal view of human enhancement* (i.e., the "*permissive*" account) or as a manifesto for the development of *human excellence* (i.e., the "*restrictive*" view). The central premise of this latter view is that competitive sport is a sphere of ethically admirable human excellence, and that an athlete can rely on personal virtues and qualities, a.k.a. the Spirit of Sport, to enhance and develop performance.

Aside from these debates on the institutional, jurisdictional or ethical implications of WADA's Spirit of Sport clause, existing scientific literature seems to show some uncertainty or lack of consensus on whether the SSV are in fact part of athletes' value systems. Petróczi, Martinelli and colleagues (2024) recently conducted a qualitative study in which elite athletes participating in focus groups were prompted to recall whether and how their values helped them in dealing with the challenges encountered during their sport careers. The investigation, designed to provide insights into the development of value-based education programs, led authors to point out several, only partly unexpected, findings. For one thing, the SSVs do not seem to represent a key component of elite athletes' idiosyncratic value systems. On the contrary, a variety of other (personal) values, not necessarily sport-bounded, seem to guide athletes' behavioral choices. Thirdly, values influence athletes' decision-making or behavioral choices, but this influence seems to work indirectly by shaping athletes' personal goals, motivation and reasons. Fourthly, elite athletes seem to lack, at least partly, consciousness or clarity on what their values are and on their influence on human motivation and action (Petróczi, Martinelli et al., 2024).

Other existing studies are consistent with these general views. For instance, some scholars have investigated whether sport values are related to morality and clean sport (Lee et al., 2000, 2008), and sought to derive specific sport values from Schwartz's seminal work (Schwartz, 1992) on universal personal values. In these studies, authors identified specific moral (e.g., fairness, obedience), competence (e.g., achievement, self-direction), and status (e.g., public image, leadership) values as three important components of athletes' sport values, and found evidence for the general hypothesis that moral values tend to promote clean sport and protect athletes from cheating, gamesmanship, and doping use. Similarly, other studies found that the practice of clean sport at least partly depends upon a combination of personal values and sport values (Mortimer et al., 2021; Ring et al., 2022, 2023).

The above considerations possibly highlight conceptual tensions concerning sport values. While WADA frames its Spirit of Sport principles as intrinsic to sport, critics (Loland & McNamee, 2019) argue that they are better understood as institutional articulations of existing universal values, such as those identified in Schwartz's cross-cultural model (Schwartz & Sagiv, 1995). This conflation risks blurring the line between moral norms (externally enforced standards) adopted as specific to sport and internalized personal values, which are psychologically distinct universal drivers of behavior. If athletes perceive WADA's principles as externally imposed norms rather than values they personally endorse, this misalignment could undermine their motivational force in guiding ethical decision-making. Furthermore, the values embedded in the Spirit of Sport clause are, or should be, according to WADA, a key factor in regulating athletes' sport integrity and their adherence to the WADA Code. And yet, findings from scientific inquiry seem at odds with these basic premises (Lee et al., 2000, 2008; (Lee et al., 2000, 2008; Mazanov et al., 2019; Petróczi, Martinelli et al., 2024). It is not clear whether SSV principles indeed matter at all when athletes must face critical situations and decisions, and it appears that athletes instead may draw upon personal values stemming from broader life experiences and contexts (Petróczi, Martinelli et al., 2024). Values elicited by, or bound specifically to, athletes' sport experiences do exist, but they too seem to be the expression of athletes' psychological and mental capacity to integrate the demands of sport situations with their personal life values (Lee et al., 2000, 2008). Furthermore, athletes may draw upon personal or sport values differentially, depending upon the varying constraints of culturally or morally relevant situations, ranging from expressing their attitudes towards clean sport to self-reporting their doping use (Lee et al., 2000, 2008; Mazanov et al., 2019).

These points, taken together, depicts a complex picture in which athletes' value systems may draw upon and, at the same time, reflect personal guiding principles, one's own idiosyncratic ways to evaluate and to deal with what situational demands or constraints require, and typical behavioral repertoires (Petróczi, Blank et al., 2024, 2024). These views are consistent with a well-established conceptual framework in personality science (Caprara & Cervone, 2000. At an individual level, athletes are quite likely to mentally organize their lives by integrating dynamically their life experiences, the personal values guiding their choices and behaviors, and the demands or challenges of their social and interpersonal environments (Cervone, 2005; Mischel & Shoda, 1995). To put it differently, individuals' value systems, rather than having a positive or negative valence per se, represent criteria or principles that people use to assess and evaluate their own actions and those of other

[1] The Spirit of Sport principles as set forth in the WADA Code is widely referred to as the intrinsic values of sport. In this paper, we follow this labelling to align with the language used in pertinent documents and scientific publication but note that by definition, not all constituents of the Spirit of Sport are values.

individuals depending upon the situations at hand (Caprara & Cervone, 2000). Furthermore, in line with these views, individuals' values are both expressions of societal or cultural endowment, as well as part of the personal beliefs and standards which are at the core of one's own self (Schwartz, 2012; Schwartz & Sagiv, 1995). Along these lines, personal values may also strongly influence behavior across different contexts (Sagiv & Roccas, 2021; Sagiv & Schwartz, 2022). For instance, people who value self-transcendence and self-direction are more likely to engage in environmentally friendly actions (Büchs, 2017). Furthermore, one's value priorities can change across situations, and these changes partly depend upon the level or strength of value endorsement (Howes & Gifford, 2009). In business, for instance, when personal and organizational values align, ethical behavior increases, and vice versa (Gopinath et al., 2018). Similarly, in religious settings, values congruence (alignment) with one's church is linked to stronger commitment, especially in smaller or more conservative churches (Dunaetz et al., 2022). Finally, pro-social personal values lead to more altruistic behavior such as registering as organ donor, giving blood, time or money (e.g., Massey et al., 2011; Merz et al., 2017; Sneddon et al., 2020; van Dijk et al., 2019).

1.1. Aims

The overarching picture emerging from the above examples is clear: personal value priorities underpin endorsements of organizational and/or societal values, and value congruence or incongruence impacts the degree of adopting these values and acting upon them. Applying this logic to anti-doping education in sports, promoting the values encapsulated in the Spirit of Sport concept requires understanding how these normative societal principles align with personal values. These arguments call upon the possibility that any further understanding of athletes' decision-making and behavioral choices during their sport careers might benefit from a scientific effort "*to map*" athletes' mental value representations including, with no a priori preference, both personal life values and sport-specific values. In the present investigation, we attempted to "*draw*" this map by focusing on personal values and Spirit of Sport dimensions and by examining the possible interconnected structure linking them.

In doing so, the study specifically focused on Schwartz' universal personal values. Schwartz' work undoubtedly provides the most well-known system of values guiding people's lives (Schwartz, 2012). His multinational survey studies have offered clear scientific evidence of a small yet comprehensive set of (ten) values that has fidelity across individuals and across cultures. Multidimensional scaling techniques have also clearly indicated that these ten distinct values (or categorical types of values) can well represent individuals' psychological space or mental representations of values (Schwartz, 2012). The ten values include the valuing of power, security, achievement, conformity, tradition, benevolence towards socially significant others, universalism (i.e., concerns towards others who are outside of one's own social circles), self-direction, stimulation and hedonism. These distinct values are well represented within a two-dimensional space including "openness to change" (versus conservation of the status quo) and "self-enhancement" (versus self-transcendence) and capturing very well the dynamic relations among values (Schwartz, 2012). Thus, for someone it might be relatively easy to pursue or be guided by values that lie closely in the two-dimensional space (e.g., power and achievement, both expression of self-enhancement values) and, conversely, he or she may have difficulty in pursuing values that are positioned as bipolar opposites (e.g., stimulation and conformity).

Schwartz' set of ten personal values and the WADA set of eleven Spirit of Sport principles represent two, quite distinct, models of value systems. The first stems from decades of well-grounded scientific inquiry, whereas the second stems from WADA's top-down discretionary vision of sport integrity in professional sports. As anticipated earlier, the present work pursued the specific empirical goal of "mapping" the network of possibly complex relations linking these two value systems in a relatively large sample of European athletes. In doing so, we hypothesized that systematic individual differences exist in this network of multivariate relations. In this study, we aimed to empirically investigate the relative position or prominence that personal values or, rather, Spirit of Sport principles may have in this multivariate network of relations. To the best of our knowledge, no study that pursued this specific goal exists, despite its important practical implications for anti-doping, and potential for making theoretical contribution to understanding value-priorities.

2. Methods

2.1. Research context

This study is part of the broader "Sense-Making in Anti-doping Reasoning Training" (SMART) project, a three-year international initiative aimed at developing case-based anti-doping educational materials to strengthen athletes' sense-making and decision-making abilities in complex ethical contexts. The SMART project was a collaborative effort among anti-doping researchers from Germany, Greece, Italy, Russia, and the UK, and consisted of both quantitative (Woolway et al., 2021) and qualitative phases (Petróczi et al., 2021; Veltmaat et al., 2023). A portion of the survey data collected within the SMART project, analyzed using Best-Worst Scaling (i.e., BWS), was previously published (Woolway et al., 2021). This study presents a secondary analysis, re-examining this dataset alongside additional, unpublished data collected concurrently using a Likert-scale approach. By applying a novel analytical perspective, this study aims to provide fresh insights into athletes' value systems.

2.2. Participants

Following the receipt of institutional ethical approval (ER21157484), the study relied on the recruitment of athletes from five European countries (i.e., Germany, Greece, Italy, Russia, and the UK). Athletes were contacted through personal contact networks of the researchers and through university networks, online recruitment platforms (i.e., Prolific), sport clubs, and relevant sport organizations/charities (see Woolway et al., 2021).

A total of 921 participants provided complete data on the key variables. Participants were either active local competitive athletes (N = 286), active national/international competitive athletes (N = 210), recreational exercisers (N = 337), former athletes (N = 62), or individuals who declared no sport involvement (N = 26). The last two subgroups (for a total of 88 cases) were excluded from any further analysis, resulting in a final sample of 833 athletes. Athletes' average age was 22.5 (SD = 6.20). As to gender, 446 were male athletes (53.5 %), 368 were female athletes (44.2 %) and 8 cases preferred to give no gender information. The remaining cases (11) had missing data. Athletes' sport practice was distributed across a total of 38 different teams and individual sports.

2.3. Methodology, instruments and data collection

The study relied on two measurement approaches to value assessment, namely, traditional (Likert) rating scaling and forced-choice scaling. The two methods stem from two alternative ways to conceptualize values. A value may be thought as a standard, principle or concept a person considers important in and of itself (i.e., a sort of "absolute" rating). There however also is the possibility that a person may deem a value important when he or she mentally compares it to other value alternatives (i.e., a sort of "relative" rating). Methodologically, the latter view has led to the so called "*forced choice*" assessments, which typically ask survey participants to select an option from a given set of choices, thus increasing the chances of recording participants' concrete or real

opinions. Scientific attention to forced-choice approaches in psychological assessment has increased over recent years, and this method has now a consolidated position in personality measurement, personnel selection processes, and statistical developments (Goffin & Boyd, 2009; Morrison & Bies, 1991; Mueller-Hanson et al., 2003; Wetzel et al., 2020). Furthermore, this method has been already validly used to assess Schwartz' value system (Lee et al., 2008) and WADA Spirit of Sport Values (Mazanov et al., 2019; Woolway et al., 2021). These latter studies have specifically implemented the method of BWS, which basically ask respondents to choose, upon examining pairs of values included in multiple item sets, the values that, in each set, are perceived by respondents as the *best* (*worst*) values. As Cohen and Markowitz (2002) noted, BWS (which also has been adopted in the present investigation) forces respondents to discriminate the *item pairs that are most distinct*, thus reducing possible response style effects. In choosing to use both traditional ratings and BWS, the present investigation attempted to offer a more rigorous and reliable examination of athletes' structure and interconnectedness of value systems.

Accordingly, athletes provided rating data on two distinct self-report surveys, each of which included measures of Schwartz' ten personal values (Schwartz, 1992) and WADA eleven SSV (WADA-CODE, 2021). Neither survey included the twelfth SSV of "athletes' rights", as it was deemed conceptually quite distant from the "sport integrity" and "Olympism" motives WADA set forth in its prior versions of the Code. On the first survey, athletes' value ratings were collected using a traditional Likert-type scale, whereas the second survey provided athletes' data on value ratings measured via a "Best-Worst" forced-choice method (BWS, Louviere et al., 2013).[2]

As to the first survey, the assessment of Schwartz' personal values relied on a brief version of Schwartz' 2003 Portrait Values Questionnaire that has been introduced and validated by Sandy and colleagues (2017). Athletes reported their ratings answering a set of ten distinct items, each of which was a value dimension. Athletes were prompted by the instruction stem "*Please use the following scale to rate how important each of the following values is to you, as a guiding principle in your life*", and provided their ratings on a 9-point Likert-type scale ranging from "*Opposed to my value*" (initially coded −1) to "*of supreme importance*" (initially coded as 7). Intermediate steps of the scale were prompted by the stems of "*not important*" (0), "*important*" (3) and "*very important*" (6). Personal values' sample items were "*Behaving properly to avoid doing anything wrong*", "*Helping and responding to the needs of others*", and "*Being successful and doing better than others*". The self-report assessment of WADA Spirit of Sport principles relied on a very similar procedure. Athletes reported their ratings for a set of eleven distinct items, each of which was a value dimension. Athletes were prompted by the instruction stem "*Please rate how important each of the following values is to you, as an intrinsic part of the Spirit of Sport*" and used the same 9-point Likert-type scale used for the assessment of athletes' personal values to provide their ratings. Spirit of Sport values' sample items were "excellence in performance is important to me" (SSV value of "excellence"), "*To me, being healthy is important*" (SSV value of "health"), and "*Showing community and solidarity*" (SSV value of "solidarity"). For statistical analyses, all Likert-type ratings were re-scaled on a 0 to 8 score range.

[2] At the time of writing this article, the World Anti-Doping Code is under revision for its 2027 edition. In the second draft of the new Code, the 'Spirit of Sport' section has been changed. The set of values under the 'spirit of sport' umbrella has been expanded to 20 in three groups: values found in and through sport (Community, Equality, Fun and joy, Respect, and Solidarity); values athletes are expected to demonstrate (Accomplishment, Commitment, Courage, Discipline, Excellence in performance, Fair play, Honesty, and Personal responsibility); and values prescribed for anti-doping education (Athletes' rights and responsibilities as set forth in the Code, Compassion, Cooperation with others; Education and knowledge, Fairness, Health, and Respect for rules, laws and justice).

As to the second survey, a series of BWS value sets forced athletes to choose the best/worst items out of a given set of five value alternatives, and this method was separately used for the ten personal values and for the eleven WADA Spirit of Sport dimensions (Louviere et al., 2013). BWS ratings thus provided a measure of the *relative importance* athletes assigned to each value dimension. For Schwartz' personal values, the survey included ten value blocks or sets whereas, for WADA Spirit of Sport dimensions, the survey included eleven value blocks or sets. In all cases, each value set included five value dimensions.

As to Schwartz' personal values, athletes were prompted by the following instructions: "*Sets of brief statements describing personal values are presented below. We are interested in your views about how important the values listed below are to you, as guiding principles in your life. For each set of five values, please choose the ONE value which, you think, is most important as a guiding principle in your life and choose the ONE value out of those five which, you think, is least important as a guiding principle in your life. There is NO right answer, the statements repeat, do not think too much, answer quickly – first reactions best capture your life values*". In each value set, the five dimensions (i.e., their wording was identical to that used in the Likert-type survey) were listed vertically and positioned at the center of the page, and athletes could indicate the "best" (i.e., most important") and the "worst" (i.e., least important") dimension on the right and left of the corresponding value item, respectively. Each personal value was presented five times across blocks/value sets and paired either *twice or three times* with each of the other (nine) personal values.

As to WADA Spirit of Sport dimensions, athletes were prompted by the following instructions: "*The Spirit of Sport is what the Olympic movement says make sport intrinsically valuable. We are interested in how important the different values that contribute to the Olympic Movement's Spirit of Sport are to you.*" As in the case of Schwartz' personal values, athletes could indicate the "best" and the "worst" dimension for each of the eleven value sets, and each Spirit of Sport dimension was presented five times across value sets and paired *twice* with each of the other (ten) dimensions.

The above block design yielded "imbalance" for athletes' BWS ratings of personal values, as each personal value item was, as mentioned, paired either twice or three times with each of the other nine value items. This imbalance might, in principle, have led to biases in athletes' ratings, as a value that was paired three times with another value across blocks might have had more chances of being selected as best/worst than a value that was matched twice with another value across blocks. However, preliminary data analyses did not give any indications of this sort (e.g., "best" personal value ratings did not increase systematically with stimulus exposure).

For each athlete participant, the above BWS method provided two separate ratings for each value item, that is, a "best" and a "worst" rating. Each rating could range from *zero* (i.e., value never selected across the five blocks where it appeared) to *five* (i.e., value selected five times across the five blocks where it appeared). Since there were *ten* blocks for personal values and *eleven* blocks for Spirit of Sport dimensions, it is important to point out that, across either type of value sets, no more than two values could, in principle, have been assigned a best/worst score of 5. As a result, it was quite likely that the modal score for each value rating would be zero (i.e., value never selected as "best" or "worst").

2.4. Statistical analyses

The analyses of athletes' value data focused on two distinct issues. The first was concerned with the univariate characteristics of the value dimensions, be they personal or Spirit of Sport. This focus seemed especially relevant for assessing possible distributional problems with the ratings collected via the best/worst approach. As mentioned earlier, the forced-choice design might lead to ratings with limited score ranges (i.e., any given value rating would or might have a modal score of 0), and this might consequently threaten the normality assumptions of

statistical multivariate analyses.

The second focus of the study was concerned with the multivariate relations linking personal values and Spirit of Sport dimensions, each assessed by three distinct measurements (i.e., Likert, and BWS). For this purpose, the present study relied on "network analysis" (i.e., NET) as the primary statistical tool and source of empirical evidence. NET is a data-driven statistical model of multivariate patterns of relations (Epskamp & Fried, 2018). Over the years, it has been used for assessing several psychological phenomena, including personality components (e.g., Cramer et al., 2012). The core assumption in NET analyses of personality is that patterns of individual differences do not need top-down explanations (e.g., personality traits). Instead, a NET personality model assumes that there exist systematic individual differences in the complex patterns of relations linking cognitive, affective, and behavioral data. Personality components may emerge from NET statistical analysis of these multivariate patterns (Costantini et al., 2015, 2017; Cramer et al., 2012). In the present work, the authors' choice of adopting NET seemed to fit well with some of the core assumptions of Schwartz' universal personal value system and WADA's Spirit of Sport principles. First, personal values are a fundamental component of people's personality organization, and Schwartz' value system represent a consolidated model of people's "psychological space" in which values are implicated in complex and dynamic relations (Caprara & Cervone, 2000). NET provides a plausible method of analysis for capturing these dynamic and complex patterns of relations. As to WADA's Spirit of Sport principles, they are conceptually distinct dimensions and unlikely to reflect overarching psychological, trait-like, components. Rather, their intrinsic reference to the notion of "sport integrity", which is fundamentally a dynamic concept and a desirable outcome, evokes the possibility that Spirit of Sport values might, if any, be implicated in patterns of relations which traditional statistical procedures may fail to capture. Following this rationale, the present study implemented NET to empirically establish the (relative) position of WADA Spirit of Sport dimensions within athletes' broader personal (i.e., Schwartz) value system. NET analyses were performed with the software RStudio 2024.09.1 (Rstudio Team, 2019). The input correlation matrix under scrutiny contained an initial set of sixty-three variables or "*nodes*" (ten personal values and eleven sport values, each assessed in three distinct ways) and a total of nearly two thousand paired-association parameters [(63 by 62)/2 = 1.953]. We treated this input matrix as a complex network of interrelations and submitted to NET as the primary method to examine its properties. The accuracy of NET findings increases when observations increasingly exceed the number of variables under scrutiny (Leme et al., 2020), as it was in the present work (i.e., $N = 833$, 63 variables).

NET allows to visually explore multivariate relationships that occur simultaneously between multiple variables, and it incorporates advanced tools in statistical analysis, such as, for instance, bootstrapping techniques (Borsboom et al., 2021; Leme et al., 2020). Furthermore, as Costantini and colleagues (2017) also have pointed out, NET allows analyzing the global structural organization, or topology, of a phenomenon or the role played by specific elements of the network structure, such as the identification of the most "central" or, rather, "peripheral" elements of a network system (see also Bringmann et al., 2019; Costantini et al., 2015). NET technically focuses on the statistical characteristics of "*edges*" (i.e., pairwise connections) linking "*nodes*" (i.e., observed variables) in a complex or large matrix of intercorrelations. Nodes can either be single items of a questionnaire or aggregates of multiple items, and which choice is most appropriate depends on scholars' scientific premises or goals (Costantini et al., 2017). Edges instead encode information about pairwise connections in terms of intensity of the relations (*weight*), their positive or negative value (*sign*), and the possible asymmetrical relations among nodes over time (*direction;* NET analysis of longitudinal data). NET thus provides both descriptive "*visual maps*" of the targeted network of relations, as well as statistical parameters of key characteristics of the network such as, for instance, nodes' *centrality estimates*. These nodes' centrality estimates or indices permit to assess the relative multivariate importance of nodes within the network structure of intercorrelations (Costantini et al., 2017; Epskamp & Fried, 2018). There typically are three key measures of node centrality, namely, node *strength* (which quantifies how well a node is directly connected to other nodes), *closeness* (which quantifies how well a node is indirectly connected to other nodes), and *betweenness* (which quantifies how important a node is in the average path between two other nodes). Illustratively, should the Spirit of Sport dimension of "*excellence in performance is important to me*" have a relatively high level of "*centrality*" in athletes' emerging multivariate value structure, it should show direct (*strength*) and indirect (*closeness*) links with other values and/or be implicated in many of the connections among other value dimensions (*betweenness*).

3. Results

3.1. Univariate measurement characteristics of value dimensions

Table 1 shows the means, standard deviations, and asymmetry for all twenty-one value dimensions (i.e., the ten personal values and the eleven Spirit of Sport principles), and for their corresponding Likert, "best", and "worst" ratings (i.e., a total of 63 observed ratings). The table also shows, but only for the best and worst ratings, the number of athletes who *never* selected the value item (e.g., the number of athletes who, across value sets/blocks where it appeared, never rated the SSV "*To me, being healthy is important*" as "*The most important*", aka, "*best*").

As to Likert-type ratings, they all were normally distributed, and scores ranged from a minimum of near 3 (personal value of "*Doing things in traditional ways to maintain customs*") to a score of nearly 7 (sport value of "*Showing respect for myself and other participants"*). Aggregation of Likert-type ratings for both personal and sport values showed that athletes, on average, expressed a statistically stronger endorsement of sport values than of personal values (mean = 5.66 vs. mean = 4.89, respectively; repeated measure $F_{(1832)} = 813.04$, $p < 0.001$, partial squared eta = 0.49). These aggregated scores were substantially and positively correlated (Pearson $r = 0.58$, $p < 0.001$), thus suggesting that athletes who, on average, expressed stronger endorsement of personal values would also tend to express stronger endorsements of sport values.

The twenty-one "best" ratings (i.e., "most important" values) had relatively low mean ratings, that ranged from a mean score of 0.33 ("*Doing things in traditional ways to maintain customs*") to a mean score of 1.85 ("*Enjoying life and doing things that give pleasure*") for personal values, and from a mean score of 0.46 ("*Displaying courage is important to me*") to a mean score of 1.71 ("*Showing respect for myself and other participants*") for spirit of sport dimensions. Incidentally, a substantial number of athletes selected some values as "best" every time they appeared across the corresponding five value sets, thus obtaining the highest possible rating score of 5. For personal values, 134 athletes (16 %) rated "*Enjoying life and doing things that give pleasure*" with the highest score, whereas 70 athletes (nearly 9 %) rated "best" the Spirit of Sport dimension of "*Having fun and joy in sport*" every time it appeared across the five sets. In line with these patterns, the distributions of value ratings also showed varying degrees of asymmetry, as the rating score of *zero* (i.e., a value that was never selected as "best" or "worst") was the most frequent (modal) score. Indeed, this was so *for all the "best" ratings*, as one can see from Table 1. The lowest and highest modal scores for personal values were, respectively, for "*Every person in the world should be treated equally*" (266 athletes *never* selected this personal value as "best") and for "*Doing things in traditional ways to maintain customs*" (632 athletes *never* selected this personal value as "best"). As to sport dimensions, instead, the lowest and highest modal scores were, respectively, for "*Showing respect for myself and other participants*" (192 athletes *never* selected this sport value as "best") and for "*Displaying courage is important to me*" (616 athletes *never* selected this sport value as "best"). Consequently, asymmetry across both types of values ranged widely from 0.51 (sport value of "*Showing respect for myself and other*

Table 1
Descriptive statistics of Likert-type, Best and Worst ratings for athletes' personal values and Spirit of Sport values.

*		LIKERT RATINGS			BEST RATINGS				WORST RATINGS			
	SCHWARTZ'S GENERAL VALUES	Mean	SD	Skewness	Mean	SD	Skewness	0 cases	Mean	SD	Skewness	0 cases
GV1	Behaving properly to avoid doing anything wrong	4,71	1,96	−0,15	0,63	1,11	2,05	555	1,09	1,33	1,01	407
GV2	Doing things in traditional ways to maintain customs	2,95	1,78	0,33	0,33	0,66	2,04	632	2,04	1,53	0,36	157
GV3	Helping and responding to the needs of others	5,59	1,63	−0,40	1,39	1,47	0,84	322	0,55	1,01	1,95	583
GV4	Every person in the world should be treated equally	6,05	1,80	−0,68	1,53	1,52	0,89	266	0,56	0,93	1,67	551
GV5	Doing things in your own way	5,10	1,68	−0,46	0,88	1,02	1,22	375	0,66	1,10	1,96	527
GV6	Taking risks and trying new things	5,08	1,79	−0,33	1,07	1,22	1,06	365	0,68	1,08	1,69	525
GV7	Enjoying life and doing things that give pleasure	6,36	1,65	−1,06	1,85	1,81	0,62	269	0,43	0,84	2,37	610
GV8	Being successful and doing better than others	4,42	2,08	−0,12	0,86	1,17	1,43	449	1,30	1,38	0,93	325
GV9	Being the leader and the one making decisions	3,55	2,10	0,27	0,63	1,09	1,71	568	2,13	1,81	0,25	247
GV10	Having things organized, clean and stable	5,10	1,77	−0,22	0,83	1,11	1,41	438	0,55	0,94	2,11	543
	WADA Spirit of Sport VALUES											
SV1	Playing fairly with honesty and ethics	6,28	1,44	−0,60	1,59	1,40	0,69	209	0,40	0,73	2,22	589
SV2	To me, being healthy is important	6,29	1,59	−0,69	1,15	1,47	1,27	391	0,54	0,92	2,28	538
SV3	Excellence in performance is important to me	4,86	1,99	−0,37	0,69	1,21	1,92	552	1,94	1,80	0,43	275
SV4	Character and education are important to me	5,15	1,86	−0,18	0,78	1,10	1,68	451	1,42	1,38	0,75	278
SV5	Having fun and joy in sport	6,37	1,51	−0,58	1,66	1,52	0,82	214	0,79	1,01	1,25	434
SV6	Working as part of a team	5,33	1,80	−0,48	0,72	1,06	1,47	501	1,25	1,40	1,09	334
SV7	Showing dedication and commitment	5,60	1,63	−0,24	0,73	1,08	1,64	485	1,03	1,22	1,14	386
SV8	Respecting the rules and laws of sport	6,26	1,49	−0,83	0,71	0,97	1,61	454	0,49	0,76	1,89	520
SV9	Showing respect for myself and other participants	6,58	1,32	−0,98	1,71	1,38	0,51	192	0,25	0,60	3,00	673
SV10	Displaying courage is important to me	4,41	1,77	−0,04	0,46	0,91	2,19	616	2,10	1,54	0,11	180
SV11	Showing community and solidarity	5,10	1,70	−0,24	0,81	1,16	1,41	486	0,78	1,07	1,53	450

* Note: The column marked with * shows the value dimensions' labels that will be utilized for all following figures. The columns labelled "0 cases" summarize the number of athletes who never selected the corresponding value dimension as either "best" or "worst" across the five value sets.

participants") to 2.19 (sport value of "*Displaying courage is important to me"*), but most of the "best" value ratings (18/21) had asymmetry scores that were lower than 2, thus permitting authors to treat "best" value ratings as normally distributed variables (Hair et al., 2010).

As to the twenty-one "worst" value ratings (i.e., "least important" values), the descriptive statistics showed a consistent picture. Personal value scores ranged from a mean score of 0.43 ("*Enjoying life and doing things that give pleasure*") to 2.13 ("*Being the leader and the one making decisions*"). Likewise, spirit of sport ratings ranged from 0.25 for "*Showing respect for myself and other participants"*) to 2.10 for "*Displaying courage is important to me"*. As in the case of "best" ratings, some values reached the highest (worst) rating scores of 5 among a substantial number of athletes. For personal values, 134 athletes (16 %) rated "*Being the leader and the one making decisions"* as the "worst" personal value in each of the five value blocks in which it appeared, whereas 117 athletes (14 %) rated "*Excellence in performance is important to me*" as the worst spirit of sport dimension every time they could. "Worst" ratings showed more asymmetry problems, as only 16/21 ratings had asymmetry scores that were lower than 2. In line with these indications, nearly 73 % of the athletes *never* (i.e., a rating score of 0) judged "*Enjoying life and doing things that give pleasure*" as the "worst" personal value, and 81 % of the athletes never judged "*Showing respect to myself or other participants"* as the "worst" sport value ($N = 610$, and $N = 673$, asymmetry of 2.37 and 3.00, respectively).

Finally, the ratings of personal and sport values across types of measurements (i.e., Likert-type, "best", and "worst") were correlated in a meaningful and expected way, thus supporting the tenets of choosing to utilize three distinct measurement approaches (see supplementary material – SM1 for details). These correlational patterns showed some variance across value dimensions. For the ten personal values, the correlations between athletes' Likert-type ratings and their corresponding "best" ratings were all positive and statistically significant, with coefficients ranging from 0.27 ("*Doing things in traditional ways to maintain customs"*) to 0.56 ("*Taking risks and trying new things"*). A similar pattern held for the correlations between Likert-type and "best" ratings of the eleven Spirit of Sport Values, with coefficients ranging from 0.15 ("*Showing community and solidarity"*) to 0.50 ("*To me, being healthy is important"*). Likewise, the correlations linking Likert-type and corresponding "worst" ratings were, as expected, negative, and this was so for both personal values (coefficients ranged from −0.32 for "*Having things organized, clean and stable*" to −0.62 for "*Being the leader and the one making decisions*") and sport values, (coefficients ranged from −0.16 for "*Showing community and solidarity*" to −0.55 for "*Excellence in performance is important to me*").

In sum, the univariate data on athletes' ratings of personal values and spirit of sport dimensions provided some valuable information and showed some considerable consistency across (Likert and BWS) measurements. The personal values of "*Enjoying life and doing things that give pleasure*" and "*Every person in the world should be treated equally*", as well as the sport value of "*Having fun and joy in sport*" and "*Showing respect for myself and other participants*" seemed to be the values athletes considered most important for them. Conversely, the personal values of "*Doing things in traditional ways to maintain customs*" and of "*Being the leader and the one making decisions*", as well as the spirit of sport dimensions of "*Displaying courage*" and "*Excellence in performance*" seemed instead athletes' least important values. There, however, was considerable variance in athletes' value mean scores, as well as in the magnitude of the correlations linking Likert-type, "best", and "worst" scores.

These variances overall suggested that systematic individual differences might exist among athletes in the ways personal and sport values are linked, both within and across value measures. These multivariate patterns were the focus of NET analyses, and the following section summarizes the results of these analyses.

3.2. Network analysis of the multivariate relations linking personal and spirit of sport values

A preliminary phase of the analyses first focused on pairs of value ratings which were "*redundant*" (i.e., showed highly similar multivariate correlational characteristics, cutoff value = 0.20, evaluated trough the "UVA" function of the "EGAnet" package, Golino & Christensen, 2024) and, subsequently, on those which were "*unstable*" (i.e., showed little consistency in their multivariate relations with other value ratings across bootstrapped random samples of data, cutoff value = 0.70, "bootega" function from "EGAnet" Golino & Christensen, 2024; see also Christensen & Golino, 2021). The choice of performing these preliminary NET analyses did not represent, in our view, a threat to the quality or rigor of the NET analyses. NET analyses do not require

multiple indicators of the dimensions under investigation. Furthermore, since each of the twenty-one (personal and SSV) value dimensions relied on three distinct rating measurements, we considered quite likely that the examination of values' redundancy and stability would allow us to retain at least one of the three ratings for each of the twenty-one value dimensions. Nine pairs of value items showed high redundancy. On conceptual grounds, we privileged and retained, in each pair, either the Likert or the Best rating and disregarded the remaining item rating (i.e., "worst" ratings were disregarded across pairs, whenever present), leading to a remaining set of fifty-four value ratings. Through a bootstrapping procedure, the multivariate relations among these fifty-four value ratings were then calculated across a thousand randomly generated samples to estimate each item's "stability" (i.e., consistency). *Higher* stability estimates would indicate higher consistency of multivariate relations across bootstrapped samples. As a result of this preliminary analysis, thirteen additional value ratings were disregarded from any further NET analysis (see supplementary material – SM2 for details).

The twenty-two value ratings that were removed from further analyses after this preliminary phase (i.e., nine ratings removed because of redundancy and thirteen ratings removed because of low stability) were quite balanced across types of ratings (i.e., 7, 7, and 8 items for, respectively, Likert-type, best, and worst ratings), and most of them (14/22) referred to personal values. The personal value of "*Doing things in traditional ways to maintain customs*" was the only value dimension which was no longer represented in the final set (i.e., its Likert-type, BWS ratings were removed during the preliminary phase of analyses). All the other value dimensions were retained in the final set. In particular, for two of the personal values (i.e., "*Taking risks and trying new things*", "*Having things organized, clean and stable*") and five of the spirit of sport dimensions ("*Playing fairly with honesty and ethics*", "*Excellence in performance is important to me*", "*Showing respect for myself and other participants*", "*Displaying courage is important to me*", and "*Showing community and solidarity*"), the final set included all three measurements (Likert-type, BWS). Of the remaining twelve values, three personal values and four sport values retained two ratings, whereas the remaining five value dimensions retained one rating.

3.3. Network analyses of the multivariate structure of value dimensions

The final set of forty-one value ratings was subjected to two relatively distinct NET procedures. The first one focused on the multivariate relations among the general and the Spirit of Sport Values and generated a *graphical representation or map* of the network structure of the relations among the value dimensions (using the "bootnet" package, relying on EBICglasso NET estimation method, Epskamp, Borsboom & Fried, 2018). To this end, NET estimated the so-called "*weighted*" partial correlation network (Epskamp & Fried, 2018). That is, this procedure permitted to *simultaneously* estimate the strength and direction of the multiple relations among network nodes (variables). Importantly, these estimates are calculated conditionally (i.e., after controlling for all the other connections among nodes). Strength and direction of the multiple relations were then graphically depicted in terms of *position* of nodes, as well as *thickness and color* of the edges (linkages). Illustratively, "closer" nodes in the network map tend to have stronger multivariate relations and thicker edges than nodes that are or appear to be further apart. Furthermore, blue color edges typically signify positive relations, whereas red color edges stand for negative relations (Leme et al., 2020). Fig. 1 graphically shows the weighted partial correlation network representing the multivariate relations among the general and Spirit of Sport Values. It is worth noticing that Fig. 1 offers a visualization of patterns of multivariate relations that are quite complex and difficult to appreciate by solely relying on traditional methods of analysis (e.g., cluster analysis). Visualization relied on the "Fruchterman-Reingold

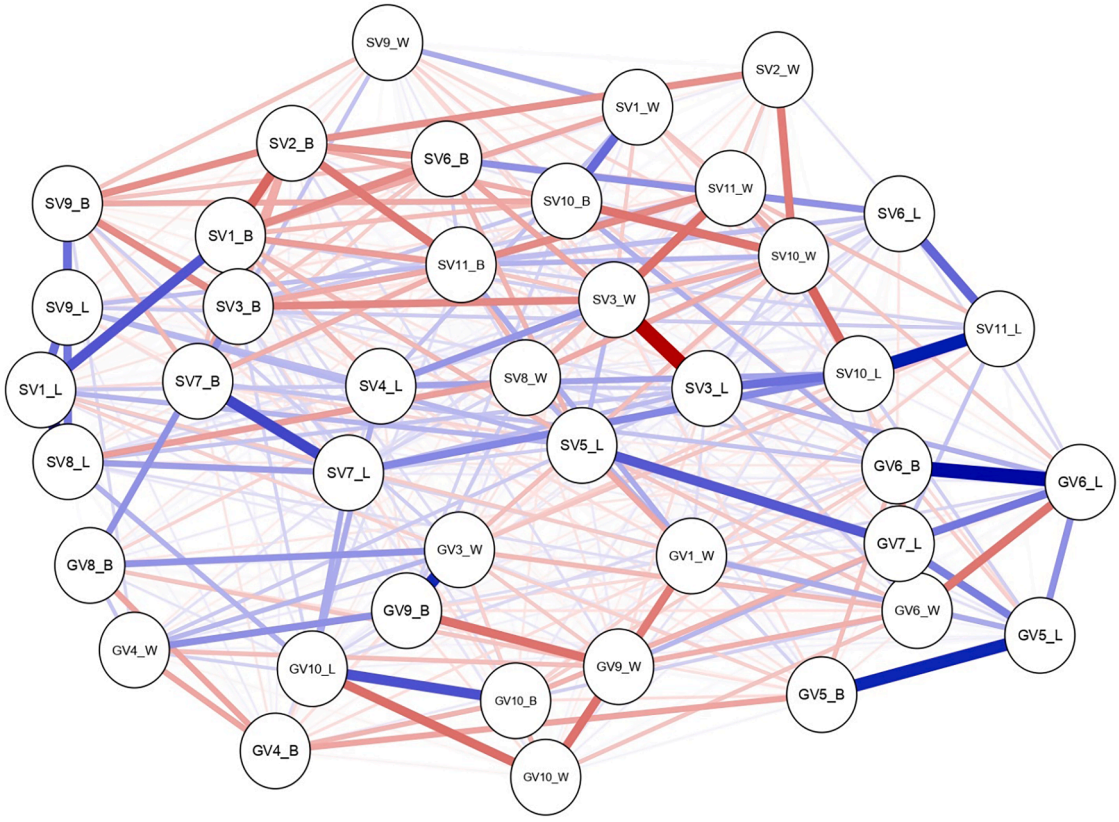

Fig. 1. Network "weighted" representation of the multivariate relations among the forty-one ratings of athletes' personal values and Spirit of Sport values. Red lines represent negative relations, and blue lines represent positive relations.

algorithm", which optimized appearance and avoided node overlapping.

Upon inspection, Fig. 1 elicits several considerations. First, the network of relations appears to be quite condensed and rich. Second, across value dimensions, the network shows some measurement consistency, in that the "Likert-type" and BWS ratings of any given value dimension seem to be positioned relatively close to each other in the network structure. Furthermore, the value ratings show relatively strong relations. For instance, as one would expect, "Likert-type" and "best" ratings of a value tend to show thicker (blue) positive relations. For instance, as Fig. 1 shows, this seems to hold for the general values of "*Doing things in your own way*", and "*Taking risks and trying new things*" (i.e., respectively, GV5 and GV6 on the right side of Fig. 1) and for the two Spirit of Sport dimensions of "*Playing fairly with honesty and ethics*", and "*Showing dedication and commitment*" (i.e., respectively, SV1 and SV7 on the left side of Fig. 1). Third, one must consider that network analyses tend to position items that are more strongly connected with other items toward the center of the network, whereas items with weaker multivariate connections tend to be positioned toward the outward edges of the network. Fig. 1 shows that the SSV of "*Excellence in performance*" (SV3), "*Having fun and joy*" (SV5), "*Working as part of a team*" (SV6), "*Showing dedication and commitment*" (SV7), and "*Showing community and solidarity*" (SV11) appear to be located toward the center. On the contrary, the general values of "*Every person in the world should be treated equally*" and "*Having things organized, clean and stable*" (GV4 and GV10, respectively) and the SSV of "*Showing respect for myself and other participants*" (SV9) occupy a more peripheral position in the network structure. Finally, there seem to be only two clear instances of across-construct connections, despite the semantic and conceptual overlap that one might potentially recognize across types of values (see supplementary material – SM3 for details). "*Being successful and doing better than others"* (GV8) shows a relatively high positive connection with "*Showing dedication and commitment"* (SV7), and "*Enjoying life and doing things that give pleasure"* (GV7) shows a relatively high positive relation with "*Having fun and joy in sport"* (SV5).

Two additional NET analyses provided further information about the tenets of the network structure reported in Fig. 1. The first one examined to what extent the network structure is confirmed across increasingly smaller samples of data. In broad terms, this analysis provides estimates of the correlation between the original network structure and network structures obtained from increasingly smaller samples created via bootstrapping (i.e., the sign and magnitude of these correlation estimates are reported on the y-axis of Fig. 2). In general, relatively strong correlations tend to confirm the tenets of the original structure. Fig. 2 shows the results of this check. As one can see, the network structure depicted in Fig. 1 is substantially confirmed, as its overall correlation with smaller samples' network structures remained at a magnitude level higher or equal to 0.75 even when estimates were calculated on a much smaller bootstrapped sample (i.e., see far right of Fig. 2– with 30 % of the original sample of 833 cases, which corresponds to 250 cases, the correlation level is still at a value of 0.75).

Some of the above analyses anticipated the issue of "*centrality*", that is, whether and which (personal and Spirit of Sport) dimensions may have a particularly relevant position in athletes' multivariate network value structure. As anticipated earlier, NET evaluates the centrality of target dimensions in terms of "*strength*" (i.e., an indication of the number of multivariate *direct* relations of a value with other values), "*closeness*" (i.e., an indication of the number of multivariate *indirect* relations of a value with other values), and "*betweenness*" (i.e., an indication of the extent to which a value was implicated in the relations linking other values).

For each of the forty-one value ratings, Fig. 3 shows the standardized estimates (i.e., z-scores) of these three centrality criteria. In visioning Fig. 3, we considered centrality to be relatively high if estimates for each criterion were equal to or greater than a z-score of 1.5. As one can see in Fig. 3, there are dimensions that appear particularly "*central*" and, for some of them, centrality seems to be supported by both Likert-type and BW ratings (see supplementary material – SM4 for the centrality standardized estimates). Overall, the SSV dimensions of "*Displaying courage*

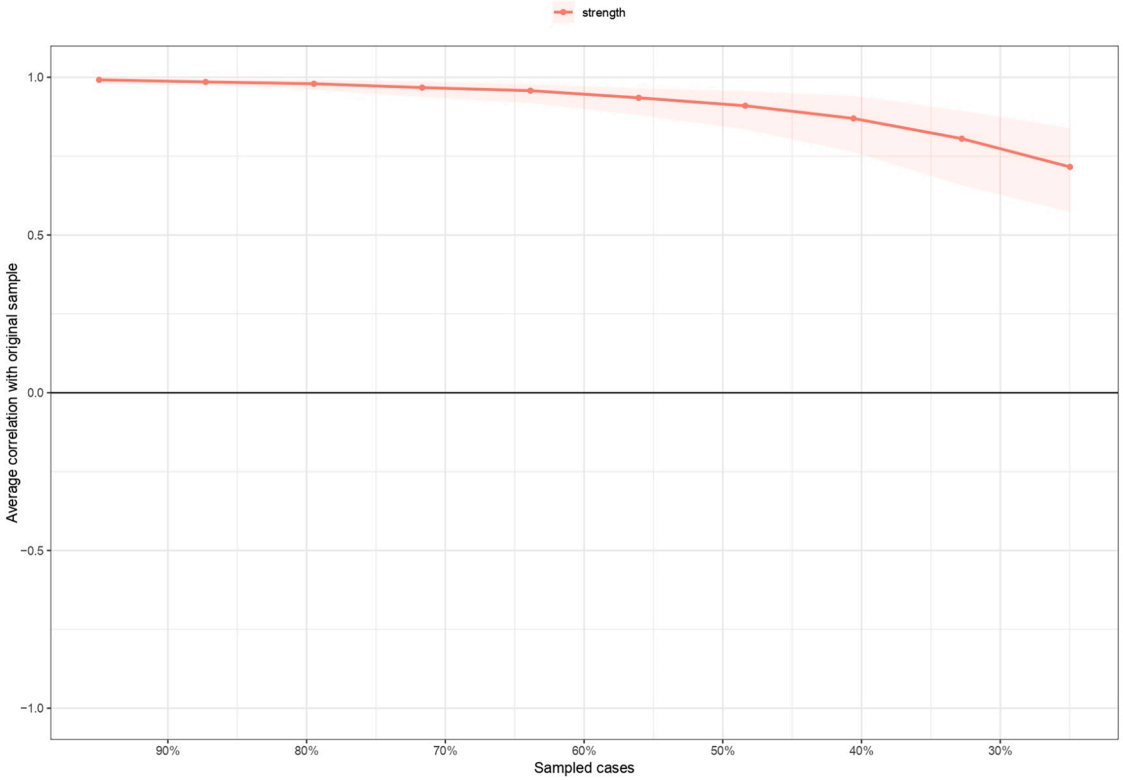

Fig. 2. Changes in the average correlation of the original network structure with networks estimated across increasingly smaller samples.

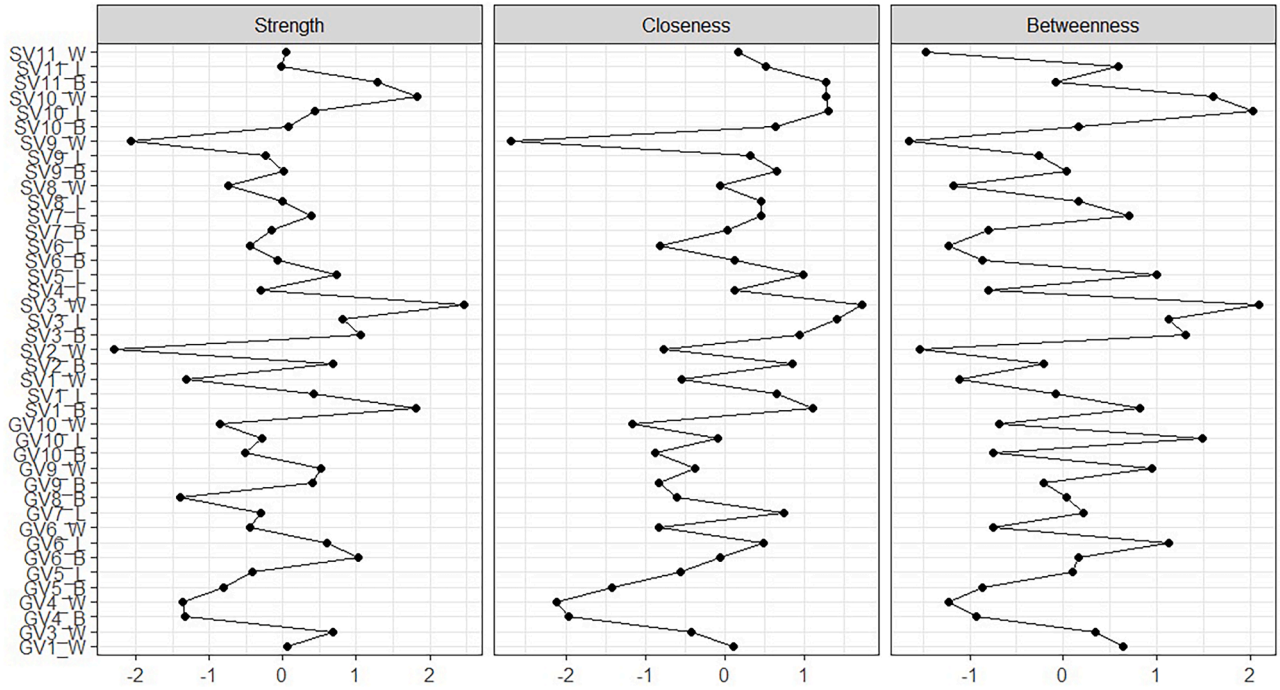

Fig. 3. Plot of centrality indices for the ratings of athletes' personal values and Spirit of Sport values.

is important to me" (SV10), "*Excellence in performance is important to me*" (SV3), "*Playing fairly with honesty and ethics*" (SV1), and "*Showing community and solidarity*" (SV11) seemed to be the "most central". Furthermore, for two of them (SV3 and SV10) the centrality seemed to hold across types of measures (i.e., Likert-type ratings and BWS ratings). Finally, the general value of "*Having things organized, clean and stable*" (i.e., GV10) was the only personal value dimension reaching the z-score 1.5 (i.e., "betweenness" estimate of the Likert-type rating).

Finally, we again performed a last series of NET analyses ("NetworkComparisonTest" R package; van Borkulo et al., 2023) to examine whether the overall findings concerning the structure of multivariate relations linking personal values and WADA Spirit of Sport values would statistically hold for both competitive/elite vs recreational athletes. The results of these analyses showed invariance in the overall network multivariate structure across the two groups of athletes (i.e., NETWORK INVARIANCE TEST: Test statistic M: 0.21, p-value 0.12; GLOBAL STRENGTH INVARIANCE TEST: Global strength per group: 0.544 .and 23.79, Test statistic S: 0.54, p-value 0.93).

4. Discussion

In WADA's general view, the Spirit of Sport is best represented by a set of values (e.g., character and education; dedication and commitment) that are, or should be, at the core of athletes' "sport integrity." As such, WADA considers these values as a meaningful means for educational anti-doping policy, as well as the basis for anti-doping regulations and the prohibition of specific substances or methods. Upon reviewing existing scientific contributions, there however seems to be uncertainty or lack of consensus on what Spirit of Sport truly stands for, as well as on whether the Spirit of Sport dimensions indeed are part of athletes' value systems (see also Obasa & Borry, 2019).

Broadly, the present study empirically focused on the extent to which athletes would endorse WADA's Spirit of Sport. In doing so, the study rested heavily on three distinct yet related conceptual choices. First, we assessed athletes' personal values following Schwartz's model of value system. Since this model is widely recognized as a universal framework for understanding how personal values guide people's thoughts, choices and actions, we reasoned that it might provide a solid and rigorous counterpart for assessing athletes' endorsement of WADA Spirit of Sport dimensions. Second, we assessed athletes' value endorsements in two distinct ways by relying on a traditional Likert-type method and on a forced best-worse choice assessment. This choice was made on the conceptual basis that a person may evaluate values both in absolute (i.e., distinct) terms and via comparative evaluations across sets of values. Third, we did not assume or hypothesize an underlying overarching personality-like system that might account for the patterns of relations linking athletes' personal and sport values. We instead adopted a data-driven network structure analysis of the athletes' response data and examined whether and which dimensions would stand out, so to speak, within a representation of the interconnections among personal values and Spirit of Sport dimensions.

Descriptively, athletes on average expressed the highest endorsement for the two personal values of "*Every person in the world should be treated equally*" and "*Enjoying life and doing things that give pleasure*". This endorsement appeared for both the Likert-type and "best" ratings. Not surprisingly, athletes on average also *rarely* rated these two personal values as the "worst" (i.e., values showed *relatively low* mean ratings). As to WADA's Spirit of Sport dimensions, athletes on average highly endorsed "*Showing respect for myself and other participants*" and "*Having fun and joy in sport*". One must note that, for some value dimensions, ratings had quite asymmetrical distributions (e.g., nearly 75 % of the athletes *never* selected as "best" the personal value of "*Doing things in traditional ways to main customs*" and the Spirit of Sport dimension of "*Displaying courage*"). Finally, athletes' ratings showed meaningful systematic variances, and the findings overall demonstrated quite adequate multi-method validity. For instance, athletes who showed higher Likert-type endorsement of the personal value of "*Taking risks and trying new things*" were also those who were more likely to select it as the "best" value among other value alternatives. Likewise, athletes with relatively higher Likert-type ratings of the Spirit of Sport dimension of "*Being healthy*" were also those who showed relatively higher "best" ratings of the same value. Taken together, these descriptive findings highlight the notion that athletes tend to show highly diversified endorsements of both personal values and Spirit of Sport dimensions. That is, different values matter differently for different athletes, and systematic and substantial variance (i.e., individual differences) exist in athletes' value

endorsements.

To this regard, the findings of the network structure analysis provided further insights. Broadly speaking, the multivariate relations depicted in Fig. 1 show that substantial "unique" relations exist within both personal and Spirit of Sport values (i.e., the depicted relations are *weighted partial* relations) and that the interconnected structure of multivariate relations is quite stable (i.e., it is replicated quite well by NET bootstrap runs across increasingly smaller samples of data – see Fig. 2).

More substantively, personal values and WADA Spirit of Sport dimensions seem to represent distinct, yet occasionally overlapping, domains. There seemed to be (see Fig. 1) noteworthy linkages between personal values and WADA (Spirit of Sport) values, particularly where these values are *bona fide* "true" values. There only were two relatively clear instances of these across-domain linkages. The pair linking *"Enjoying life* with *joy and fun in sport"*, and the pair linking *"Achieving success"* with *"Showing dedication and commitment"*. The first pair of values seamlessly align with hedonistic values and suggest that *personal enjoyment* in sport and beyond is quite meaningful for athletes. Having highly endorsed it both as a personal and a sports-specific value testifies to the true nature of 'joy' as a value transcending different contexts (Sagiv & Schwartz, 2022). The second pair – linking success with dedication and commitment – instead seems to offer a more nuanced view, as each dimension seems uniquely amplified within the context of typical athletes' sport experiences. In the context of personal life experiences, success tends to be broadly acknowledged as a meaningful and relevant value, whereas dedication and commitment might be classified either as values or virtues, depending upon the context of reference. Thus, when viewed as guiding principles, dedication and commitment might function and be perceived as values (e.g., commitment to career, family, or community). Conversely, when they are thought of as trait-like moral dimensions, they might embody and be perceived as virtues (e.g., commitment to ethical practices or dedication to helping others). In typical sports contexts, success, dedication and commitment instead converge nicely in the general notion that success is not merely celebrated in the presence of a positive outcome, but also in presence of (perceived) hard work, dedication, and commitment. These latter considerations would plausibly account for the strong positive link between *"Achieving success"* and *"Showing dedication and commitment"*. This convergence of values, along with the fundamental element of joy, may have captured the intrinsic essence of sport, encompassing both the individual and societal admiration for success achieved through effort and resilience. This intrinsic value of sport - understood and cherished across cultures - highlights the potential universal qualities that athletes and societies across all cultures cultivate and hold in high regard (Petróczi et al., 2021). SSV dimensions, like courage and excellence, which are fundamental to the notion of "sport integrity", may instead represent and be thought of as general characteristics or traits society expects athletes to embody, as it might be for characteristics such as, for instance, perseverance or rule adherence. This general view would perhaps account for athletes' ratings of "least important" assigned to the dimensions of "courage" and "excellence". In this regard, the forced-choice best-worst method may have revealed athletes' true priorities, sidelining dimensions or principles which athletes may instead view as "obligations". This possibility is, at this time, utterly speculative, as the present study did not address directly this type of distinction but raised it here for future research directions.

This notwithstanding, excellence and fair play emerged as central network hubs — bridging personal and WADA dimensions — despite low standalone endorsement, suggesting that athletes may consider the distinction between institutional importance and personal resonance at the time of formulating relative importance ratings of value dimensions. That is, the two Spirit of Sport dimensions might be critical for maintaining cohesion within the value system and for facilitating interactions — such as bridging achievement-driven personal values and ethics-focused institutional principles. This possibility would plausibly account for the two cross-system links (success ↔ dedication; enjoyment ↔ fun), insofar they represent athletes' value priorities. To put it differently, athletes would only endorse, adopt, and act upon Spirit of Sport values if they aligned with personal priorities like enjoyment or success.

While personal values tend to form and stabilize by adulthood, value priorities can still be influenced (Russo et al., 2022). Albeit tentatively, our study suggests that values-based education initiatives should focus on athletes' existing personal value *priorities* as a context-sensitive starting point for discussing Spirit of Sport Values. In the end, anti-doping education should recognize the difference between values, which guide decisions and life-priorities, and broader, societal or institutional principles, which might stand as specific "*triggers*" of moral behaviors.

4.1. Caveats, limitations and directions for future studies

The present study, despite its novelty, did not address relevant issues which are still pending and might be meaningfully addressed in future research. Participants were European athletes, and any conclusion or consideration about the study findings needs caution, as the risk of Eurocentric biases in sport and doping research and policy are quite possible. Future studies might focus on countries and cultures outside Europe. Sensitivity to culture effects would also call for disentangling possible cultural differences in value priorities within and across the European countries that were involved in the study. Furthermore, our findings stem from an explorative network analysis of the "architecture" of athletes' possibly interconnected value systems. In this regard, the study did not address athletes' subjective meanings or moral reasoning associated with their value systems, and any plausible distinction between personal and institutional values therefore requires further validation through research linking possible value structures to sensemaking, ethical decisions, or perceptions of legitimacy in sport institutions. Future studies may also need to integrate qualitative data and behavioral indicators to examine how the type of structural differences highlighted in the study may manifest in ecologically valid ethical reasoning and educational outcomes.

From a methodological standpoint, the study was also limited in some respects. The study focused on whether the multivariate relations linking personal values and Spirit of Sport dimensions may systematically vary (i.e., yield meaningful individual differences) in a large European sample of athletes. The findings overall supported the guiding research goal. Nonetheless, any conclusion about the generalizability of our findings would be premature, as they may also have depended on factors that were not tested, such as, for instance, type of sport, level of experience and professionality, training volume, or competition participation. Likewise, the survey was designed to collect separate ratings of personal and sport values, and any multivariate linkage across types of values were tested empirically via network analyses. Future studies may address these linkages more rigorously by creating an assessment that combines the two types of values in novel forms of value survey.

From yet another standpoint, the study findings may also have depended on the block design that was used for the assessment of athletes' value structure. We originally intended to collect all the data via Qualtrics, a web platform allowing to randomize values within sets and value sets across participants. Nevertheless, this procedure was not completed with all athletes (i.e., some data was collected via paper-and-pencil surveys). As a result, we cannot exclude the possibility that findings were at least partly affected by order effects.

From an analytical perspective, the network analyses permitted us to visualize the interconnected structure of athletes' values and to evaluate the quantitative outcome of the Network (e.g. node strength). As to the issue of visualization, we are aware that the Fruchterman-Reingold algorithm (standard option in the "*bootnet*" *R* package) is not the only approach when discussing the visual outcomes of NET analyses (Jones et al., 2018). As such, some considerations on the visual characteristics

of the interconnected structure of athletes' values must be taken cautiously. More broadly, we are aware of the issues that relevant literature has raised concerning the interpretation of network analyses from the standpoint of psychological research (Bringmann et al., 2019), especially with regards to centrality indices and their meaning. As such, future studies focusing on the substantive meaning athletes may assign to values might provide independent validation of findings from network analyses.

Lastly, although the data were collected from five European countries, they did not permit a nuanced analysis of cultural differences. Previous reports (Woolway et al., 2021) have highlighted country-specific variations in value priorities within the same dataset. Therefore, it is possible that cognitive mapping of general personal and 'Spirit of Sport' principles may vary across cultural contexts, even within Europe. Future studies should aim to specifically explore how cultural influences shape normative views of sport (what should develop and demonstrate) and athletes' personal values and value priorities.

5. Conclusions

In this study, we examined whether and how athletes endorse WADA's Spirit of Sport dimensions, alongside and framed within a broader set of personal values.Using network analysis, we provided a novel perspective on this complex interplay without imposing predefined assumptions about their relations. Our key findings - the limited overlap between athletes' general values and the Spirit of Sport dimensions, as well as the relative importance of spirit of sport dimensions such as "excellence" and fair play in the network of interrelations - highlight the need for greater conceptual clarity concerning the notion of Spirit of Sport and the understanding of how the dimensions embedded in it may co-exist with athletes' values and priorities that are likely to characterize their experience and shape decision-making. Addressing these complexities is essential for developing more tailored, meaningful, potentially personalized, and effective anti-doping education strategies that resonate with athletes' intrinsic values. Future research should also address cultural limitations, as our European sample may reflect Eurocentric biases in how Spirit of Sport principles are mentally represented and internalized.

Funding

Data used in this study were collected as part of the SMART project, funded by the International Olympic Committee.

Data availability

Data will be made available on request

CRediT authorship contribution statement

Arnaldo Zelli: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Andrea Chirico:** Methodology, Formal analysis, Data curation. **Alessandra De Maria:** Supervision, Methodology, Data curation. **Federica Galli:** Supervision, Methodology, Formal analysis, Data curation. **Luca Mallia:** Visualization, Methodology, Data curation. **Vassilis Barkoukis:** Visualization, Supervision, Resources, Investigation. **Dmitriy Bondarev:** Visualization, Supervision, Resources, Investigation, Conceptualization. **Anne-Marie Elbe:** Visualization, Resources, Methodology, Investigation. **Lambros Lazuras:** Visualization, Resources, Methodology, Investigation. **Andrea Petróczi:** Writing – original draft, Validation, Resources, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.peh.2026.100418.

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