

Ger J Exerc Sport Res 2024 · 54:55–63
<https://doi.org/10.1007/s12662-023-00899-2>
 Received: 29 January 2023
 Accepted: 4 July 2023
 Published online: 11 August 2023
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Connectedness and sustainable attitudes and behavior in athletes

Supplementary Information

The online version of this article (<https://doi.org/10.1007/s12662-023-00899-2>) contains supplementary material, which is available to authorized users.

Introduction

One aspect that the European Commission mentions when describing sustainability is the use of resources in a way that the capacity of the earth is not exceeded (European Commission—Environment, 2016). For this, sustainable consumption is essential. Geiger, Otto, and Schrader (2018) developed a cube model of sustainable consumption behavior with three different dimensions (sustainability dimension, consumption phase, and consumption area), including a fourth dimension, the impact of chosen behavior. A relevant question is, which factors are related to sustainable attitudes and behavior. To answer this question, internal transformative qualities seem to play an important role (Ives, Freeth, & Fischer, 2020). One of these internal transformative qualities is connectedness (Wamsler, Osberg, Osika, Herndersson, & Mundaca, 2021). Connectedness can be differentiated as connection to others, pro-socialness, and connectedness to nature, which are related to sustainable behavior and attitudes (Jansen et al., 2023; Wamsler et al., 2021).

Data Availability Statement

The data for this study can be found at: <https://osf.io/2pfq3/files/osfstorage/63d659d386b98201cbbac449>

The connection to others factor, pro-socialness or prosocial behavior can be described as voluntary behavior intended to help or benefit another person (Eisenberg & Fabes, 1998). A distinction can be made between prosocial behavior, an emotional response to another individual's suffering, and a cognitive response, for example, the competence to take another person's perspective (Eisenberg, Fabes, & Spinrad, 2007). Prosocialness can be improved by some types of training, like mental (Böckler, Tusche, Schmidt, & Singer, 2018) or mindfulness-based training (Berry et al., 2020). For determining pro-socialness, a wide range of measurements, e.g., self-report questionnaires, or computer-controlled interactions can be used (Böckler et al., 2018). The connection to nature factor, called connectedness to nature, is described as a stable state that is reflected by a sustained awareness of the interrelatedness between the own person and the rest of nature (Thiermann & Sheate, 2021). Compared with this, Mayer and Frantz (2004) express it as a trait that enables the individual to feel emotionally connected to the natural world. Moreover, the term nature relatedness exists (Nisbet, Zelenski, & Murphy, 2009), which includes the awareness of all aspects concerning nature. Two main aspects are the expansion of self-identity to include the natural environment and the experience of belonging to nature (Whitburn et al., 2020).

Both aspects of connection, connectedness to nature (Whitburn et al., 2020) and prosocial behavior are linked to sustainable behavior (de Groot &

Thøgersen, 2018). To explain this relation, the two-pathway model of pro-environmental behavior (Thiermann & Sheate, 2021), which contains a normative and a relational pathway, is relevant. The normative pathway is built by the relevance of social and personal norms. The relational pathway is based on connectedness to nature, empathy, and compassion, with the latter two aspects being facets of prosocial behavior. If the relational pathway increases, e.g., by conducting mindfulness practice, the motivation to act pro-environmentally becomes more internalized (Thiermann, Sheate, & Vercammen, 2020). The framework of this model is an adaptation of the Comprehensive Action Determination Model.

The relevance of the connectedness factor has been rarely investigated until now in the sport context: For example, it has been shown that general physical activity can promote prosocial behavior in adolescents (Sukys, Majauskiene, & Dumciene, 2017) and adults (Di Bartolomeo & Papa, 2019). Furthermore, Moeijes, van Busschbach, Bosscher, and Twisk (2018) demonstrated that a membership in a sports club or frequent sport participation is correlated with enhanced prosocial behavior in children. The study of Duan et al. (2022) gives a hint that participation in mass sports, that is, a type of popular sports activity (in this Chinese study, walking, Tai Chi, badminton, and marathon) is related to prosocial behavior by the independent mediators of well-being and flow (Duan et al., 2022). Regarding the factor connectedness to nature and sports activity, the relationship

needs to be clarified. Nature sports refer to outdoor activities in natural or rural areas and involve a dynamic interaction between participants and their natural features, like waves, wind, etc. (Melo, Van Rheenen, & Gammon, 2020). Until now, it has not been investigated as far as we know if participants of nature sports feel a higher sense of connectedness to nature. However, this can be assumed due to the results of Mayer and Frantz (2004), who found a moderate positive association between both concepts. The results of Teixeira et al. (2022) showed that nature visits, nature connectedness, and physical activity levels were related to the adoption of pro-environmental behavior. Those results might lead to the assumption that athletes doing their sports extensively outdoors show a higher sustainable behavior, which was highlighted in an exploratorily qualitative study with extreme sports athletes (MacIntyre et al., 2019). However, even though this assumption seemed plausible, Wicker (2019) could show that athletes in nature sports had the highest emission levels, and athletes from individual sports produce more emissions than those from team and racket sports. Activity years, club membership, weekly exercise hours, performance levels, and income were positively associated with the annual carbon footprint. However, environmental consciousness significantly reduces the carbon footprint but only in the athletes who practice an individual sport.

The study's primary objective was to investigate the relationship between the transformational inner qualities of connectedness and sustainable attitudes and behavior in athletes of different sports. This study extended the study of Wicker (2019) in that way, that first, only athletes who have practiced their sport for more than eight years and several times per week (see Jansen, Hoja, & Meneghetti, 2021) participated, second, the combination of the two dimensions individual-team sports and indoor-outdoor sports is investigated as well as the relevance of the connection factor towards other

people, the pro-socialness.¹ In detail, the following hypotheses were investigated:

1. According to the study of Jansen et al. (2022), there is a positive correlation between the measurements of pro-socialness, connectedness to nature, and the degree of sustainable attitudes and behavior in all athletes.
2. Because prosocial behavior has been confirmed for team sports (Kavus-sanu & Al-Yaaribi, 2021), we expect higher values for team-sports athletes compared to athletes from individual sports in pro-socialness (hypothesis 2a). Because the relationship between nature contacts and nature connectedness has been proven (Liu, Cleary, Fielding, Murray, & Roiko, 2022), we expect outdoor athletes to have a higher value in nature connectedness than athletes practicing their sport indoors (hypothesis 2b).
3. Since it has been shown that prosocial behavior is a relevant predictor for some aspects of sustainable consumption (Jansen et al., 2023) we expect athletes in team sports to display higher sustainable attitudes and behavior than athletes in individual sports. Furthermore, because outdoor physical activities are positively related to sustainable behavior (Teixeira et al., 2022), we assume that athletes in outdoor sports show a higher sustainable attitudes and behavior. It must be investigated if there is an interaction effect in that way that athletes from team and outdoor sports show the highest values in sustainable attitudes and behavior.
4. It will be investigated which factors predict sustainable attitudes and behavior: According to Wicker (2019), we assume a significant prediction by the factors: activity years, club membership, weekly exercise hours, competition activity, and income. Furthermore, the group factor "sports practice space" (indoor-

outdoor sport) and "type of sport" (individual-team sport), as well as the connectedness to nature and prosocial behavior will be integrated. If age and sex differ between the four groups, the regression will include both factors.

Methods

Study design

The study uses a correlational and quasi-experimental design.

Sample

At the beginning, two hundred eighty-six athletes participated. The inclusion criteria were being 18 years and older; practicing their sport for more than eight years and more than twice a week. Sixty-one had to be excluded because of fast completion (1), no answer to the question of the type of sport (5), less than eight years practicing the sport (49), or younger than 18 years (6). The final two-hundred twenty-five athletes came from the following sports: 53 from individual indoor sports (5 × Ju-Jutsu, 19 × swimming, 11 × taekwondo, 18 × gymnastics), 46 from individual outdoor sports (4 × triathlon, 1 × biathlon, 1 × skiing, 1 × snowboard, 22 × athletics, 8 × cross-country skiing, 9 × mountain bike), 65 from team indoor sports (25 × basketball, 19 × ice hockey, 19 × handball, 2 × volleyball), and 61 from team outdoor sports (7 × American football, 54 × soccer).

Sample-size calculation. For hypothesis 1, small-medium effect sizes for the correlations according to the study of Jansen et al. (2023) ($r=0.26$) between the two aspects of connectedness and the categories of sustainable behavior and attitudes are assumed. Due to multiple testing (4 correlations), p was Bonferroni corrected and set to <0.0125 . The power analysis (power of $1 - \beta = 0.95$) resulted in $N=211$ participants (Faul, Erdfelder, Lang, & Buchner, 2007). To reduce complexity, we used the means for sustainable attitudes and behavior.

¹ For our convenience, we distinguish only individual and team sports, even though it is demonstrated that there are at least six typologies that distinguish types of sports groups according to levels of structural interdependence (Evans, Eys, & Bruner, 2012).

P. Jansen · S. Hoja · M. Rahe

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Abstract

Variables of connectedness (pro-socialness and connectedness to nature) are related to sustainable behavior and attitude. This study investigates if athletes of different types of sport differ in their sustainable attitudes and behavior. Two-hundred twenty-five athletes participated, 53 from individual indoor sports, 46 from individual outdoor sports, 65 from team indoor sports, and 61 from team outdoor sports. All athletes completed questionnaires on pro-socialness, connectedness to nature, and sustainable attitudes and behavior. The results provide evidence for the relationship between connectedness and sustainable attitudes and behavior. Sustainable attitudes were predicted by connectedness to nature ($\beta = 0.287, p < 0.001$) and age ($\beta = 0.230, p = 0.048$), sustainable behavior by connectedness to nature, ($\beta = 0.250, p = 0.001$) and pro-socialness ($\beta = 0.268, p = 0.003$). There is no difference in pro-socialness in athletes from individual vs team sports. However, athletes practicing outdoor sports are more connected to nature than those practicing indoor sports. Moreover, athletes from individual outdoor sports show the highest values in sustainable attitude and behavior. The underlying mechanism for this result might be worth to be investigated in more depth.

Keywords

Pro-socialness · Connection to nature · Indoor and outdoor sport · Individual and team sport · Pro-environmental behavior

For hypothesis 2a, we expected a medium effect size $d = 0.5$ for the better pro-socialness of team-sports athletes compared to athletes from individual sports. With an alpha level of $p = 0.05$, a power of $1 - \beta = 0.95$, and two groups, $N = 176$ athletes must participate. The same holds true for hypothesis 2b: We expected a medium effect size $d = 0.5$ for the better nature connectedness of athletes from outdoor sports compared to athletes from indoor sports. With an alpha level of $p = 0.05$, a power of $1 - \beta = 0.95$, and two groups, $N = 176$ athletes must participate.

For hypothesis 3, two ANOVAs for the dependent variables (“sustainable attitudes” and “sustainable behavior”) and the independent factors “sport practice space” (indoor sport—outdoor sport) and “type of sport” (individual sport—team sport) were planned. With an alpha level of $p = 0.05$, a power of $1 - \beta = 0.95$, $N = 210$ participants are needed. In contrast to the preregistration and because the reliability of eight of the ten subscales of sustainable attitude and behavior was acceptable, we decided to calculate a MANOVA for the four aspects of sustainable attitude and behavior with good reliability. With a medium effect size of $f(V) = 0.25$, an alpha level of $p = 0.05$, a power of $1 - \beta = 0.95$, and two groups, $N = 129$ athletes must participate.

With eleven possible predictors for the two dependent variables sustainable attitudes and sustainable behavior, a power analysis for the linear regression (Faul et al., 2007) with a medium effect size of $f^2 = 0.15$, an alpha-level of $p = 0.05$, a power of $1 - \beta = 0.95$, resulted in $N = 178$ participants for each regression analysis.

Material

This study investigated demographic data, pro-socialness, connectedness to nature, and the measurements of sustainable attitudes and behavior.

Socio-demographic questions. First, a demographic questionnaire was used with the following variables: Sex (male, female, diverse), age, level of high-

est degree (categorical: no-qualification, high school, A-levels, bachelor, master, Ph.D.), net income per month (in Euro), activity years, weekly exercise hours in the main sports activity, club membership (yes or no), competition (yes or no), sports salary (yes or no). No diverse people participated. All demographic data are presented in **Table 1**.

Prosocialness scale for adults (Caprara, Steca, Zelli, & Capanna, 2005). Pro-socialness was measured with 16 items which were answered on a 5-point Likert scale ranging from 1 = *never/rarely true* to 5 = *almost always/always true* (example item: “I try to console those who are sad.”) The questionnaire was based on item response theory (IRT). Reliability ($\alpha = 0.91$), difficulty parameter, and discrimination parameter were suitable, and the IRT analyses support effectiveness and sensitivity (Caprara et al., 2005). For the German version, the questionnaire was forward- and backward-translated. The reliability was good (Cronbach’s $\alpha = 0.829$). A mean score was calculated.

Connectedness to nature scale (CNS, Pasca, Aragonés, & Coello, 2017). Connectedness to nature was measured with 13 items answered on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree* (example item: “Like a tree can be part of a forest, I feel embedded within the broader natural world.”). In this study, two items had to be excluded because of low corrected item-total correlations. The reliability for the remaining eleven items was good (Cronbach’s $\alpha = 0.869$). A mean score was calculated.

Five-factor sustainability scale (FFSS, Haan et al., 2018). The Five-Factor Sustainability Scale measured attitudes towards sustainability (31 items, with five subscales) and sustainable behavior with 39 items. Regarding sustainable attitudes, participants expressed their agreement on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The five subscales were sustainable spending (Cronbach’s $\alpha = 0.694$), sustainable skepticism (Cronbach’s $\alpha = 0.763$), sustainable responsibility (Cronbach’s $\alpha = 0.784$), sustainable support (Cronbach’s $\alpha = 0.552$), and sustainable mobility (Cronbach’s $\alpha = 0.797$). Moreover, the 39 behavioral items had to be answered on a 5-point Likert scale. Subscales were general (Cronbach’s $\alpha = 0.720$), household (Cronbach’s $\alpha = 0.495$), consumption (Cronbach’s $\alpha = 0.700$), mobility (Cronbach’s $\alpha = 0.761$), and nature (Cronbach’s $\alpha = 0.726$). Internal consistencies for the mean scores of sustainable attitudes (Cronbach’s $\alpha = 0.763$), sustainable responsibility (Cronbach’s $\alpha = 0.784$), sustainable support (Cronbach’s $\alpha = 0.552$), and sustainable mobility (Cronbach’s $\alpha = 0.797$). Moreover, the 39 behavioral items had to be answered on a 5-point Likert scale. Subscales were general (Cronbach’s $\alpha = 0.720$), household (Cronbach’s $\alpha = 0.495$), consumption (Cronbach’s $\alpha = 0.700$), mobility (Cronbach’s $\alpha = 0.761$), and nature (Cronbach’s $\alpha = 0.726$). Internal consistencies for the mean scores of sustainable attitudes (Cronbach’s $\alpha = 0.763$), sustainable responsibility (Cronbach’s $\alpha = 0.784$), sustainable support (Cronbach’s $\alpha = 0.552$), and sustainable mobility (Cronbach’s $\alpha = 0.797$).

Table 1 Demographic data

Type of Sport		Age (years)	Sports practice time (years)	Weekly sports practice (hours)	Income (Euros per month)	Club connection		Competition	
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Non (%)	Yes (%)	Non (%)	Yes (%)
Indoor (n = 118)	Individual (n = 53)	32.89 ± 14.388	20.353 ± 9.917	4.284 ± 2.977	2149.975 ± 1773.346	7.5	92.5	20.8	79.2
	Team (n = 65)	26.83 ± 9.560	16.677 ± 8.326	7.546 ± 6.303	1636.762 ± 1299.795	3.1	96.9	6.2	93.8
Outdoor (n = 107)	Individual (n = 46)	39.22 ± 15.012	15.696 ± 8.946	7.156 ± 5.240	2536.442 ± 1724.893	45.7	54.3	30.4	69.6
	Team (n = 61)	24.43 ± 4.224	17.317 ± 5.322	7.259 ± 4.174	1665.000 ± 1102.288	1.6	98.4	3.3	96.7

For statistical differences see supplementary material

pha = 0.903) and behavior (Cronbach's alpha = 0.903) were excellent. For the German version, the questionnaire was forward and backward translated and used in the study by Jansen et al. (2023).

Procedure

Before implementing the study, the following sports activities were rated on two 5-point scales “sports practice space” (indoor sport—outdoor sport) and “type of sport” (individual sport—team sport) from 89 students at the university (42 men, 44 women, three not specified; mean age $M = 23.5$ years, $SD = 2.5$ years). Those chosen sports activities were partly in line with the study of Wicker (2019): Aikido, alpine ski, American football, athletics, badminton, basketball, beach volleyball, biathlon, cross-country skiing, golf, gymnastics, handball, ice hockey, Ju-Jutsu, karate, mountain bike, snowboarding, soccer, swimming, taekwondo, tennis, triathlon, and volleyball.

According to Fig. 1, athletes from all sport types without tennis and badminton were rated explicitly to one of the four categories and therefore, included in the study (see Fig. 1).

All questionnaires were implemented in SoSci Survey (Leiner, 2019). The link has been advertised to the athletes via newsletter and social media. First, all participants gave informed consent and then provided demographic information. After this, they completed the questionnaires on pro-socialness and connectedness to nature. Then the questionnaires regarding sustainability were applied.

The study has been conducted according to the ethical guidelines of the Helsinki declaration and approved by the Ethic Research Board of the University of Regensburg (no. 22-3059-101). The study was preregistered at OSF (<https://doi.org/10.17605/OSF.IO/YGX9Z>).

Statistical analysis

First, correlations (hypothesis 1) between the study variables were calculated. After this and following hypotheses 2a and b, two independent one-sided t-tests for pro-socialness and the factor “type of sport” and for connectedness to nature and the factor “sports practice space” were calculated. Regarding hypothesis 3, for sustainable attitude and behavior, two MANOVAS with the dependent four scales of sustainable attitudes (sustainable spending, sustainable skepticism, sustainable responsibility, and sustainable mobility) and sustainable behavior (general, consumption, mobility, and nature) the independent factors “sports practice space” (indoor sport—outdoor sport) and “type of sport” (individual sport—team sport) were conducted. For hypothesis 4, two regression analyses (method: Enter) were conducted with the possible 11 predictors (activity years, club membership, weekly exercise hours, competition activity, income, “sports practice space” (indoor-outdoor sport), “type of sport” (individual-team sport), connectedness to nature, pro-social behavior, sex, and age). The alpha level was Bonferroni corrected and set to an alpha level of $p < 0.025$.

Results

Correlation between pro-socialness, connectedness to nature, and sustainable attitudes and behavior

There were significant positive correlations between nature connectedness and sustainable attitudes, $r = 0.31$, 95% [0.187, 0.424] and behavior $r = 0.42$, 95% [0.309, 0.525], and between sustainable behavior and pro-socialness $r = 0.26$, 95% [0.131, 0.375], but not between sustainable attitudes and pro-socialness $r = 0.13$, 95% [0.000, 0.257].

Pro-socialness and connectedness to nature in athletes

There was no significant difference between athletes from individual sport ($M = 3.853$, ± 0.519) compared to team sport athletes in pro-socialness ($M = 3.884$, ± 0.432), $t(223) = -0.486$, $p = 0.314$, 95% of the difference [-0.156, 0.094]. However, there was a significant difference between athletes from indoor sports ($M = 3.015$, ± 0.692) compared to outdoor sports athletes in connectedness to nature ($M = 3.169$, ± 0.684), $t(223) = -1.672$, $p = 0.048$, 95% of the difference [-0.305, -0.002].

Sustainable attitudes and behavior in athletes

The multivariate analysis for sustainable attitudes with “type of sport” and “sports practice space” as inde-

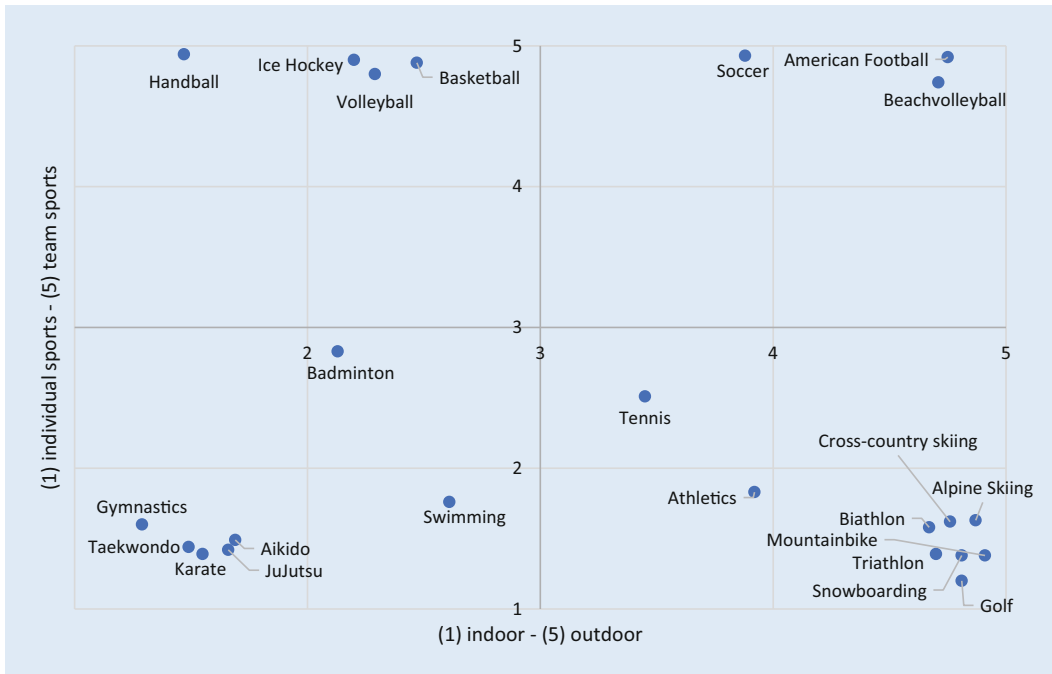


Fig. 1 ◀ Result of the rating of the different sport types

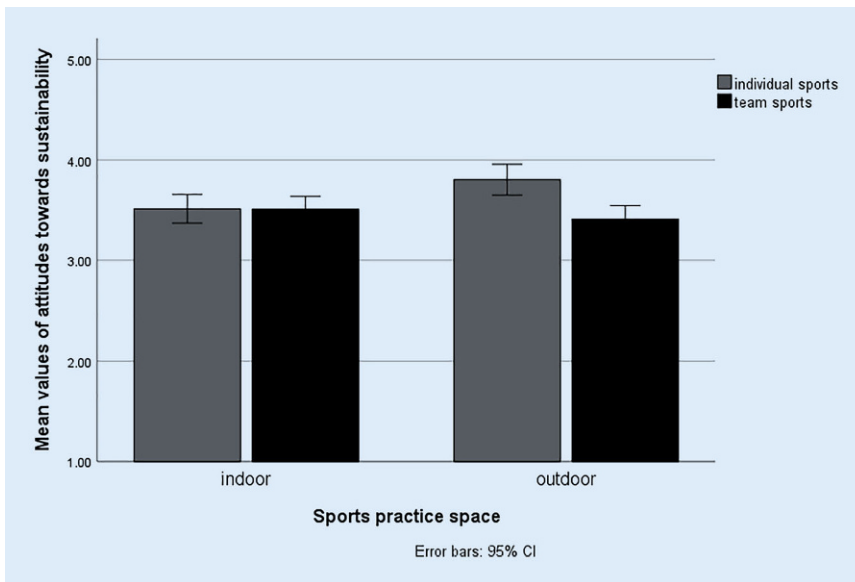


Fig. 2 ▲ Mean sustainable attitudes dependent on type of sport and environment of sport

pendent variables using Pillai's trace showed a significant effect of type of sport, $F(4, 218) = 4.830$, $p < 0.001$, $\eta_p^2 = 0.081$, but not for sports practice space, $F(4, 218) = 1.398$, $p = 0.239$, $\eta_p^2 = 0.025$ and an interaction between both factors, $F(4, 218) = 2.797$, $p < 0.05$, $\eta_p^2 = 0.049$. The main effect for type of sport was significant for the scales of sustainable skepticism and sustainable mobility whereas the interaction between both independent factors was significant

for the scales sustainable spending and sustainable mobility ($p_s < 0.05$).

To reduce complexity in the description, only the mean values for the mean of the four scales for sustainable attitudes were analyzed further and discussed later: There were no significant differences between athletes from individual sports ($M = 3.513$, ± 0.605) compared to team sport athletes for indoor activity ($M = 3.508$, ± 0.530), $t(116) = 0.036$, $p = 0.971$, 95% of the dif-

ference $[-0.203, 0.211]$. However, there was a significant difference for outdoor activity favoring athletes from individual sport (individual sport, $M = 3.803$, ± 0.539 , team sport: $M = 3.424$, ± 0.436), $t(105) = 4.250$, $p < 0.001$, 95% of the difference $[0.204, 0.578]$. Also, for sustainable attitudes, individual athletes from outdoor sports show higher values compared to individual athletes from indoor sports ($p < 0.005$), there was no such effect for team sports athletes ($p = 0.265$). The interacting effect for the mean of sustainable attitudes is presented in **Fig. 2**.

The multivariate analysis for sustainable behavior with "type of sport" and "sports practice space" as independent variables using Pillai's trace showed a significant effect of type of sport, $F(4, 218) = 5.554$, $p < 0.001$, $\eta_p^2 = 0.092$, but not for sport practice space, $F(4, 218) = 0.425$, $p = 0.790$, $\eta_p^2 = 0.008$ and an interaction between both factors, $F(4, 218) = 3.359$, $p < 0.001$, $\eta_p^2 = 0.058$. The main effect for type of sport was significant for the scales of behavior consumption, mobility, and nature ($p_s < 0.05$), as well as the interaction ($p_s < 0.05$).

To reduce complexity in the description only the mean values for the mean of the four scales for sustainable behav-

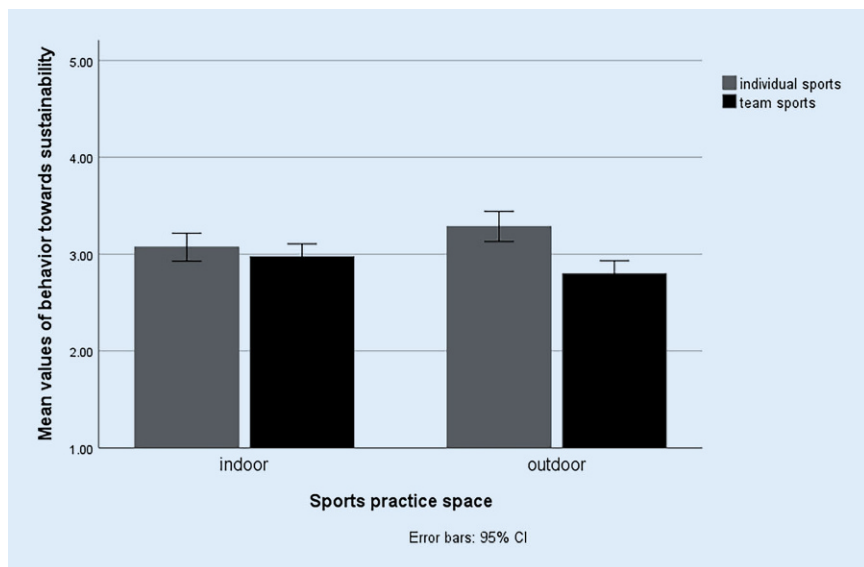


Fig. 3 ▲ Mean sustainable behavior dependent on type of sport and environment of sport

ior were analyzed further and discussed later: There were no significant differences between athletes from individual sports ($M = 3.072$, ± 0.650) compared to team sport athletes for indoor activity ($M = 2.975$, ± 0.503), $t(116) = 0.913$, $p = 0.363$, 95% of the difference $[-0.223, 0.307]$. However, there was a significant difference for outdoor activity favoring athletes from individual sport (individual sport, $M = 3.285$, ± 0.538 , team sport: $M = 2.798$, ± 0.445), $t(86.083) = 4.987$, $p < 0.001$, 95% of the difference $[0.292, 0.681]$. Also, for sustainable behavior, team athletes from outdoor sports show higher values compared to team athletes from indoor sports ($p < 0.05$), there was no such effect for individual sports athletes ($p = 0.081$).

The interacting effect for the mean of sustainable behavior is presented in [Fig. 3](#).

Prediction of sustainable attitude and behavior in athletes

The prerequisites for the regression analysis (no multi-collinearity, no autocorrelation, normal distribution of residuals, homoskedasticity) were given. In the regression analysis with the criterion sustainable attitude, the 11 predictors showed that the model was significant. All predictors explained 25.7% of the variance of the criterion,

$F(11, 155) = 4.535$, $p < 0.001$. However, only connectedness to nature and age were significant positive predictors, see [Table 2](#).

The prerequisites for the regression analysis regarding no multi-collinearity, no autocorrelation and normal distribution of residuals were given. However, there was heteroskedasticity (Breusch-Pagan-Test, $p = 0.039$). For this, the parameters were estimated with robust standard errors. The regression analysis with the criterion sustainable behavior, the 11 predictors showed that the model was significant. All predictors explained 34.7% of the variance of the criterion, $F(11, 155) = 6.960$, $p < 0.001$. However, only connectedness to nature and pro-socialness were significant positive predictors, age failed to be significant ($p = 0.053$), see [Table 3](#).

Discussion

First, our results confirm the relationship between connectedness to nature and, in part, pro-socialness and sustainable attitudes and behavior, confirming (partly) hypothesis 1. The regression analyses confirm these results, only connectedness to nature and age were significant positive predictors for sustainable attitudes, and connectedness to nature and pro-socialness predicted positively sustainable behavior. In contrast to the first

part of our second hypothesis, pro-socialness did not differ between athletes from individual and team sports. However, in line with the second part of our hypothesis, athletes from outdoor sports had higher values in nature connectedness. Furthermore, differences between various sports types in sustainable attitudes and behavior were found. Athletes from individual outdoor sports show higher values than athletes from team outdoor sports.

The results concerning the relation between pro-socialness and connectedness to nature and sustainable attitudes and behavior are in line with the results of other studies (de Groot & Thøgersen, 2018; Whitburn et al., 2020) demonstrating that the internal transformative qualities of pro-socialness and connectedness to nature are related to sustainable attitude and behavior and the model of Wamsler et al. (2021) showing the relevance of the internal transformational qualities of connection for sustainable behavior and attitude. The new finding is that this holds for both aspects, sustainable attitudes and sustainable behavior. In general, the relation is higher with connectedness to nature than pro-socialness because connectedness to nature was related to both aspects, sustainable attitudes and behavior. One reason might be the choice of the questionnaire of sustainable attitudes and behavior (Haan et al., 2018). No question relates to an interpersonal relationship, whereas a scale regarding the relationship to nature is included. Another reason might be that connectedness to nature is the most relevant internal transformative quality. However, a qualitative differentiation of the importance of internal transformative qualities remains speculative. Next to pro-socialness and connectedness to nature, age predicted positively sustainable attitudes. This result aligns with a meta-analysis by Wiernick, Dilchert, and Ones (2016) demonstrating that age was positively associated with pro-environmental behavior, although the effect was relatively small. While positive trends between age and pro-environmental attitude could be detected, these effects are minor. However, one might propose that older athletes play

Table 2 Regression of sustainable attitude

	b	SE	β	t	p
Constant	2.014	0.498	–	4.046	<0.001
Connectedness to nature	0.237	0.068	0.287	3.509	<0.001
Prosocialness	0.064	0.091	0.056	0.698	0.486
Club membership	0.201	0.163	0.113	1.234	0.219
Competition (yes, no)	0.067	0.146	0.039	0.458	0.648
Activity years	–0.009	0.006	–0.134	–1.516	0.132
Weekly exercise hours	–0.010	0.008	–0.099	–1.251	0.213
Age	0.011	0.005	0.230	1.992	0.048
Sex	0.195	0.100	0.172	1.954	0.053
Income (netto, per month, €)	<0.001	0.000	–0.157	–1.665	0.098
Type of sport	–0.030	0.104	–0.027	–0.294	0.769
Sport practice space	0.041	0.089	0.037	0.457	0.649

Table 3 Regression of sustainable behavior

	b	Robust SE	t	p
Constant	0.831	0.478	1.857	0.065
Connectedness to nature	0.250	0.076	3.302	0.001
Prosocialness	0.268	0.088	3.033	0.003
Club membership	0.199	0.175	1.139	0.256
Competition (yes, no)	0.138	0.161	0.857	0.393
Activity years	–0.008	0.008	–0.998	0.320
Weekly exercise hours	–0.002	0.007	–0.303	0.763
Age	0.013	0.007	1.951	0.053
Sex	0.056	0.103	0.545	0.587
Income (netto, per month, €)	<0.001	<0.001	–0.668	0.506
Type of sport	–0.088	0.111	–0.796	0.427
Sport practice space	–0.098	0.086	–1.139	0.257

an important role when sports clubs want to improve sustainable behavior.

Regarding the internal transformative quality of prosocialness in athletes, team sports athletes did not show higher values than individual sports athletes. One reason for this might be that not the “team” situation is essential to develop prosocial behavior but the motivation independent of the type of sports group. For example, it has been shown that autonomous motivation and autonomy-supportive climate are positively related to prosocial behavior (Hodge & Gucciardi, 2015). However, in a team, the teammate’s prosocial and antisocial behavior can have consequences for the other teammates, like showing more enjoyment and effort in an atmosphere of pro-socialness and lower effort in antisocial behavior (Kavussanu & Stanger, 2017). From the teams investigated here, we did not investigate the motivational climate. Regarding the other

transformative quality, connectedness to nature, outdoor athletes showed higher values than indoor athletes. Spending much time outside while practicing the sport might increase nature contact, leading to a higher nature connectedness (Liu et al., 2022). This is an interesting result because nearly half of the participants from outdoor sports are soccer players who might not be in direct contact with nature during their sports practice. Although they play mainly outside, they do not explore the outside in some way. For example, they perceive nature more passively than athletes from mountain bikes. Furthermore, within one group of outdoor team athletes, e.g., soccer players, the involvement characteristics can differ; it is a difference if a football field is set in an urban rather than a rural area. For this, it seems necessary to answer the question of the quality of connectedness to nature in various athletes from out-

door sports to consider the quality of the exposition to nature during the execution of their sport.

Regarding sustainable attitudes and behavior in athletes, our results show that athletes who practice an individual outdoor sport show the highest values in sustainable attitudes and behaviors, which is partly in line with our assumptions. One potential explanation for this outcome could be attributed to the fact that only half of the athletes within this cohort engage in a nature sport characterized by a dynamic interplay between participants and elemental aspects of their environment, such as snow or wind (Melo et al., 2020). As mentioned above, no dynamic interaction with natural features was given in the group of athletes who practice an outdoor team sport. For this, the study provides evidence that it is not enough to be outside to affect pro-environmental behavior, but the quality of interaction with nature is relevant. One reason for this result might be a higher environmental consciousness of this group of athletes because the study of Wicker (2019) hints that environmental consciousness significantly reduced carbon footprint in individual sports but not in team and racket sports. However, this study did not investigate environmental consciousness, and the assumption remains speculative.

In general, our hypotheses that athletes from different types of sport differ in their internal transformative qualities of connectedness, especially pro-socialness, and connectedness to nature, could only be confirmed partly. In other words, if there are differences in pro-environmental behavior in athletes of various types of sport, they might be only related partly to the factors of connection investigated here. Other variables seem to be also important, as mentioned before, for example, motivation (Kavussanu & Stanger, 2017) or environmental consciousness (Kollmus & Agyeman, 2002), which should be investigated in more depth within the groups of individual and team sport athletes in indoor and outdoor sports. However, because the role of the internal transformative qualities is not quite clear now in athletes from different sport types, clubs should

encourage their athletes to increase sustainable behavior in daily life by reducing water consumption, recycling, and sustainable transportation.

The fact limits the study that the outdoor space can differ in several ways between different sport types, for example, it can be in a natural environment, like the forest, or only outside at a soccer field. Therefore, the degree of interaction with nature while practicing sports outside must be included in further studies. Moreover, the four groups differ in other variables, like age, income, club membership, and competition participation. Even though those factors are included in the regression, searching for more homogeneous groups of athletes in relevant variables might be helpful and include the physical activity level. Furthermore, the measurement of sustainable attitudes and behavior applied here is only one; several other measurements exist, focusing on other dimensions of sustainable attitudes and behavior, for example, nutrition and clothes (Geiger et al., 2018). Besides this, this study is cross-sectional, and causal conclusions are not allowed, which leads to the proposal of further studies: With these first results in mind, it might be useful to develop an intervention study with training in pro-socialness and connectedness to nature compared to an active control-group to investigate the effect of training in connectedness on sustainable attitudes and behavior.

To conclude, connectedness is a relevant bottom-up factor regarding the relation towards sustainable attitudes and behavior. Furthermore, some type of sport, individual-outdoor sport, seems to foster sustainable consumption, suggesting that more conscious contact with nature is a relevant factor contributing to a higher pro-environmental behavior in athletes. From a practical implication point, it seems to be worth fostering connectedness to nature in general. Bearing in mind the correlational design, we might tentatively suggest that the educational and social system might integrate much more this nature contact. Connectedness seems to be a crucial factor for the individual to change its own behavior towards sustainable consumption. For the mitigation of the climate crisis,

we need top-down as well as bottom-up processes, the feeling of connectedness might be one bottom-up process.

However, this first result must be elaborated on in more differentiated further studies. In those further studies, it is important to elaborate on the differentiation between individual and team sports as well as on indoor and outdoor sports and on the measurement of sustainable attitudes and behavior. It will be worth to introduce more behavioral-based measurements of sustainable behavior for example the ecological footprint or the choice of a sustainable or non-sustainable product after completing the study. Furthermore, it might be worth to implement interventional studies like the practice of team sport for a specific period in outdoor and indoor, while trying to maintain as many variables as possible comparable.

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Acknowledgments. The authors want to thank the students of the master's degree Motion and Mindfulness for discussing the study and Antonia Voll for helping with editing.

Author Contribution. First author: Conceptualization, Analyzing, Writing, Editing; Second author: Conceptualization, Implementation, Editing. Third author: Implementation, Analyzing, Editing;

Funding. Open Access funding enabled and organized by Projekt DEAL.

Declarations

Conflict of interest. P. Jansen, S. Hoja and M. Rahe declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The studies involving human participants were reviewed and approved the Ethic Research Board of the University of Regensburg (no 22-3059-101). The participants provided their written informed consent to participate in this study.

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