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Stadium Travel and Subjective Well-Being of Football Spectators

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Abstract: In the context of leisure travel in sport, the United Nations' Sustainable Development Goals to promote public health and combat climate change may be addressed simultaneously. This study investigates football spectators' carbon footprint that is generated from traveling to the stadium. It also examines the effects of stadium travel and everyday pro-environmental behavior on spectators' subjective well-being. The study uses data that were gathered from an online survey in Germany in 2021 (n = 1605). For a detailed carbon footprint assessment, spectators were allowed to indicate multiple transportation means if they switched them during their stadium journey. Seemingly unrelated regression models were calculated to examine the effect of transportation behavior (i.e., stadium travel) and everyday recycling, consumption, and energy-saving behavior on life satisfaction and happiness. Traveling to a home game caused an average carbon footprint of 7.79 kg CO_2-e per spectator, or 190.4 tons CO_2-e for all home game spectators. Regression results showed that sustainable consumption increased both well-being measures while recycling behavior only positively contributed to happiness. Stadium travel and energy-saving behavior showed no significant effect. These findings implicate that achieving both sustainable development goals can go hand in hand in some contexts of pro-environmental behavior, but not in all dimensions.

Keywords: carbon footprint; football; leisure travel; life satisfaction; happiness; pro-environmental behavior

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1. Introduction

The societal call toward more sustainable development reached the sport industry within the last few years [1]. Initially, Gro Harlem Brundtland defined sustainable development as "meeting the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs" [2] (p. 292). In 2015, the United Nations' (UN) sustainability efforts were assembled in 17 Sustainable Development Goals (SDGs) [3]. These 17 SDGs overlap with other definitions of sustainability that are prevalent in the sport industry, including the three pillars of sustainability. Specifically, these three pillars suggest that organizations should act in a way that is economically, socially, and environmentally sustainable [4]. The sport sector as a whole was assigned an important role in achieving the SDGs, including the promotion of health (Goal 3) and combatting climate change (Goal 13) [5]. The promotion of public health is specified by ensuring healthy lives and promoting well-being at all ages [3]. Because of their prominence, the SDGs guide sustainability efforts of many sport leagues and clubs.

One prominent example is the German Football League (DFL), which is the governing body of the first and second division of the Football Bundesliga in Germany. Recently, the DFL announced that they will include social and environmental sustainability criteria in their licensing regulations for their league competitions, from the 2023–2024 season onward [6]. Hence, Football Bundesliga clubs need knowledge about their actual sustainability level, including the environmental impacts of their spectators. This knowledge is especially important because previous studies have shown that sport teams cannot only serve as promoters of pro-environmental behavior during sport events but also in spectators' everyday life [7,8]. Moreover, sport organizations and, in particular, European football clubs have a huge impact on their fan communities and can foster positive health, social, and environmental outcomes within those [9]. However, previous studies have suggested that sport events, such as football games, have rather negative environmental impacts [1]. Especially travel activities are a major contributor to the carbon footprint of the sport sector, which includes not only travel activities to actively participate in sports [10,11] but also spectator travel to all sorts of sport events, including games of various sport leagues [12,13]. These sport spectator travel activities can be attributed to leisure travel, which contributes to up to 8% of the global carbon footprint [14]. Thus, spectator travel produces carbon emissions at an individual level, which in turn has societal impacts, for example, on environmental sustainability and climate change.

Besides its effects on climate change, spectator travel and other forms of pro-environmental behavior might not only have societal impacts but also individual impacts on subjective well-being (SWB) [15]. Hence, spectator travel not only affects the SDG to combat climate change but it might also be associated with the goal to promote public health. Through the mechanisms of pro-social behavior that associate engaging in beneficial actions for other people with one's own SWB [16], pro-environmental behavior seems to follow the same logic [17]. Specifically, acting in an environmentally-friendly way contributes to the good of the natural environment and increases the environmental quality, which in turn benefits other people [16]. Positive effects of pro-social behavior on SWB were indicated not only for voluntary work [18] but also for pro-environmental behavior in sport [15]. Even though empirical evidence suggested that different dimensions of pro-environmental behavior have different effects on SWB [19], a nuanced and systematic analysis in the sports context is missing. Moreover, evidence of effects from behavioral changes in transportation behavior on SWB is relatively scarce [20].

Since pro-environmental behavior seems to influence two SDGs simultaneously, the first purpose of this study is to examine the carbon footprint of spectators of a German Bundesliga club, which is generated by traveling to home games in their leisure time. The second purpose is to determine the effect of this leisure-time stadium travel and other forms of pro-environmental behavior on spectators' SWB. The research context are spectators and fans of a German Football Bundesliga club (first division) because it is the first professional sport league worldwide that will include sustainability criteria in their licensing regulations. This study advances two research questions: (1) How many carbon emissions are generated through spectator travel to the home games of a German Bundesliga club, and what means of transport and travel distances contribute to the spectators' carbon footprint? (2) How do spectator travel and everyday pro-environmental behavior affect spectators' SWB? Both research questions are answered using data from an online survey. Answering these research questions contributes to the existing carbon footprint literature [12,21] by examining spectators from a professional sport league. Moreover, spectators were allowed to switch their means of transportation on their stadium journey, which enhances the understanding of travel journey patterns and allows for a more detailed carbon footprint assessment. Finally, the study contributes to the increasing body of literature inside [15] and outside the field of sport [19], examining the effects of pro-environmental behavior on well-being outcomes.

2. Theoretical Framework and Literature Review

2.1. Pro-Environmental Behavior

While the concept of pro-environmental behavior has been studied within (e.g., [15]) and outside (e.g., [22]) the field of sport, there is not one universal definition of pro-environmental behavior [22]. However, most definitions follow the idea suggested by Stern [23] that pro-environmental behavior proactively attempts to conserve or protect the natural environment. Such behavior can be performed either publicly or privately but is usually voluntary and intentional [24].

Following Diekmann and Preisendörfer [24], pro-environmental behavior can be divided into four dimensions, namely, transportation, recycling, consumption, and energy-saving behavior. Transportation behavior is shaped by the usage of different means of transport, such as cars, public transport, or a bicycle. In the present study, the focus is on transportation behavior of spectators to the home games of a German Bundesliga club and the carbon footprint generated by the travel habits of spectators of the club's games.

Carbon footprint is a concept that has its origin in the ecological footprint and is defined as "a measure of the exclusive total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product" [25] (p. 4). The most common procedure to measure carbon emissions is following the greenhouse gas protocol (GHG protocol), consisting of three steps [26]. First, greenhouse gases are selected that are taken into account [27]. Following the GHG protocol, six types of gases regulated under the Kyoto Protocol are accounted for, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) [26]. These six gases are converted into carbon dioxide equivalents (CO_2-e), which are responsible for over 75% of all anthropogenic greenhouse gas emissions [28].

The second step includes setting organizational, temporal, and operational boundaries [26]. In this study, the organizational boundary includes spectators of the German Bundesliga club and the temporal boundary is defined as traveling to one home game. The operational boundary differentiates between three Scopes of emissions. All direct emissions from direct fuel consumption can be summarized as Scope 1 emissions (e.g., a car ride to a Bundesliga match). Scope 2 emissions are embodied emissions from purchased energy (e.g., lighting in a stadium). Scope 3 emissions cover all indirect emissions over a life cycle of a product that are not already included in Scope 2 emissions (e.g., production and disposal of footballs) [26,27]. Scope 2 and Scope 3 emissions require a lot of knowledge regarding the energy consumption, production, and disposal of products, and spectators usually do not possess this knowledge. Hence, this study concentrates on Scope 1 emissions of fan-related travel to the stadium.

Transportation behavior, in terms of carbon footprint analyses, in sport have been conducted in several contexts, including the carbon footprint of sport spectators (e.g., [21]), sport tourists [29], and active sport participants (e.g., [10]).

The average carbon footprint of sport spectators varied from 7.67 kg CO_2-e for spectators of the 2003/2004 FA Cup final [21], over 20.2 kg CO_2-e for spectators of the 2004 Wales Rally [30], to 50.5 kg CO_2-e for spectators of the UK stages of the 2007 Tour de France [31]. More recently, Cooper [12] estimated the emissions of football game day tourism of the University of Tennessee in the seasons 2015 to 2018, with total emissions per home game varying between 4719.9 t CO_2-e and 6947.5 t CO_2-e. For the 2019 National Collegiate Athletic Association (NCAA) men's basketball tournament, called March Madness, researchers calculated emissions of about 500 kg per participant, with 80% coming from travel behavior [32]. However, the calculations of the latter two studies included not only travel behavior but also overnight stays, food consumption, waste disposal, and stadium usage [12,32]. In European football, Loewen and Wicker [13] estimated a season carbon footprint of a Bundesliga fan of 311.1 kg CO_2-e. Finally, the average carbon footprint of spectators in eight semi-professional leagues in English football in the season 2012/2013 was 4.7 kg CO_2-e [33].

Turning to other dimensions of pro-environmental behavior, recycling behavior includes the separation of waste (paper, plastic, glass, organic) or the correct disposal of batteries and electronic devices [24,34]. Recycling behavior was previously examined among sport spectators [35] and sport participants [36]. Sport spectators that believed they should conserve natural resources at sport events had a lower perception of recycling inconvenience and a higher perception of recycling benefits [35]. Among sport participants, internal constraints (e.g., lack of knowledge) and external constraints (e.g., lack of interest by others to act sustainably) influenced their own recycling intention [36].

Consumption behavior includes purchasing regional and/or organic products, while energy-saving behavior includes purchasing energy-friendly electronic devices or turning off lights and heat in the household when they are not needed [24,37]. Studies that included consumption and energy-saving behavior did not examine these types of behavior separately but instead combined both dimensions into general pro-environmental behavior [10,38]. In both existing studies, respondents scored low on consumption behavior compared to the other dimensions and high on energy-saving behavior [10,38].

While these studies give valuable estimations in terms of different sports and countries, most studies only asked about one mean of transportation to travel to the events. The present study allowed for changing means of transportation up to three times to travel to the stadium, for example, driving with the car to a park and ride facility and continuing by bus or tram. Hence, the carbon footprint analysis includes multiple means of transportation, with their respective emissions.

2.2. Pro-Environmental Behavior and Subjective Well-Being

SWB is defined as "people's emotional responses, domain satisfactions, and global judgments of life satisfaction" [39] (p. 277), which includes a cognitive and affective dimension. The cognitive dimension is usually related to people's good life and their self-assessment of satisfaction with their own life [39]. The affective dimension refers to the experience of pleasure, usually measured through happiness with one's own life [40]. In general, people prefer activities that enhance their SWB [41], including activities within the sport sector, such as volunteering [42], physical activity [18], and live spectating of sport events [43]. However, the effect of pro-environmental behavior on the SWB of sport spectators has not been studied yet.

Theoretically, the relationship between pro-environmental behavior and SWB can be looked at from two perspectives, which suggest a negative effect (first perspective) and a positive effect (second perspective) on SWB, respectively. Starting with the first perspective, a number of studies assume that pro-environmental behavior is often costly, effortful, or inconvenient, which decreases SWB [16]. Following a rational choice paradigm, the effect of pro-environmental behavior on SWB is dependent on the associated costs and benefits perceived by individuals [44,45]. If the associated personal costs in terms of money, time, and effort for pro-environmental behavior are higher than the perceived or expected benefits, pro-environmental behavior might decrease SWB [16,17]. Conversely, if the associated benefits of pro-environmental behavior for one's own or others' benefit are perceived to be higher than the associated personal costs, pro-environmental behavior might increase SWB [16,19].

Different factors influence the perception of benefits from pro-environmental behavior. First, the recognition of others is important. Behavior that is observed and positively evaluated by others is more likely to be performed [46]. Hence, pro-environmental behavior that is performed in public may yield more perceived benefits than pro-environmental behavior that is performed in the private sphere and will, therefore, increase SWB [46]. Second, pro-environmental behavior should be performed voluntarily, meaning that the behavior is not forced by others [47]. Third, higher benefits are expected if the individual can directly observe that the behavior makes a difference [47]. For example, collecting waste and observing that the environment becomes cleaner might yield higher benefits than traveling with an environmentally-friendly mean of transportation because the effect from the recycling behavior is visible, contrary to the one from travel behavior.

The second perspective is connected to the pro-social literature [16]. The basic idea is that pro-environmental behavior can be characterized as pro-social behavior because it benefits other people or society in general: Pro-environmental behavior helps to mitigate climate change and secures the long-time survival of natural resources [17]. Hence, pro-environmental behavior seems to achieve the same psychological effect as altruism:

Contributing to the good of others and acting selfishness creates a warm glow effect, which, in turn, increases one's SWB [41]. Other studies describe the warm glow effect coming from sustainable actions through a moral perspective, specifically that pro-environmental actions are morally good and hence, are meaningful to individuals [48]. Similar to performing behavior that benefits others, performing morally right or meaningful behavior makes people feel good about themselves, which, in turn, increases their SWB [16,48].

Empirical evidence showed positive SWB effects from various pro-environmental behavior dimensions, including recycling behavior (e.g., [34,49]), sustainable and local consumption behavior (e.g., [44,50,51]), energy-saving behavior (e.g., [37]), and vegetarian food consumption [52]. Even though a positive relationship could not be established in every study (for example, the authors of [53] did not find a positive relationship between energy-saving behavior and SWB), there is broad empirical evidence for positive effects of pro-environmental behavior on SWB from various continents, including North and South America, Europe, and Asia [19]. Among sport participants in Germany, the pro-environmental behavioral dimensions were not examined separately, but recycling, consumption, energy-saving, and transportation behavior in sport collectively increased the SWB of sport participants [15].

2.3. Environmental Consciousness and Subjective Well-Being

Next to pro-environmental behavior, previous studies also suggested a connection between environmental consciousness and SWB [54,55]. Environmental consciousness is defined as "awareness of the endangerment of human's natural resources by humans themselves, combined with a willingness to remedy the situation" [56] (p. 445). It consists of affective, cognitive, and conative components [57]. While the affective component refers to emotions (e.g., anger about environmental damages), the cognitive component includes knowledge about environmental consequences of one's own actions. The conative component refers to individuals' willingness to act [57].

Following Ferrer-i-Carbonell and Gowdy [54], environmental consciousness may have positive but also negative impacts on SWB. The effect direction depends on the connotation, meaning that positive connotations about being environmentally conscious about biodiversity positively impact SWB, while connotations about pollution might have a negative impact [53,54]. Empirical studies examining the effect of environmental consciousness on SWB provide mixed results: While Rehdanz and Maddison [55] showed a negative effect on SWB, Binder and Blankenburg [58], as well as Nisbet et al. [59], documented a positive effect on SWB. Other scholars showed both, positive and negative effects, depending on the connotation [54]. In summary, even though empirical results suggested that environmental consciousness and SWB are connected, the effect direction remains unclear.

3. Method

3.1. Data Collection

Data were collected from 29 August to 31 October 2021 using an online survey that targeted spectators and fans of a German Bundesliga club that is located in the Northwestern part of Germany (Arminia Bielefeld). The minimum age of respondents was 18 because this is the minimum age in Germany to drive a car without supervision, which is an important indicator for spectator travel to the stadium. The online survey was programmed on the platform www.soscisurvey.de.

The survey link was distributed through social media channels of the club and through e-mailing lists from the university. This approach represents a convenience and top-down sampling procedure, which has repeatedly been applied in sport ecology research [35,38]. Overall, 1652 respondents finished the online survey. However, 47 respondents had to be deleted because they never visited a home game of the club and hence, did not answer the carbon footprint questions. The final sample consisted of n = 1605 respondents, who were included in the empirical analysis.

3.2. Questionnaire and Variables

Table 1 gives an overview of all variables used in this study. The first two variables represent the dependent variables, followed by the four pro-environmental behavior variables and environmental consciousness as the main independent variables. Finally, a set of control variables are presented.

Table 1. Overview of variables and summary statistics (*n* = 1605).

Variable	Description	Mean	SD
Life satisfaction	Current satisfaction with one's own life (0 = totally unsatisfied; 10 = totally satisfied)	7.55	1.82
Happiness	Current happiness with one's own life (0 = totally unhappy; 10 = totally happy)	7.33	1.98
CF	Carbon footprint of traveling to one home game (in kg CO_2-e)	7.79	19.36
Recycling	2-item everyday recycling behavior (1 = never; 5 = always)	4.53	0.76
Consumption	2-item everyday consumption behavior (1 = never; 5 = always)	3.45	0.65
Energy	2-item everyday energy-saving behavior (1 = never; 5 = always)	3.99	0.86
Environmental consciousness	Environmental consciousness index (1 = not environmentally conscious at all; 5 = highly environmentally conscious; Table 3)	3.82	0.75
Club interest	I am interested in the club (1 = totally disagree; 5 = totally agree)	4.93	0.31
Games typical season	Number of games attended in a typical season	10.43	5.54
Male	Respondent identifies as male (1 = yes; 0 = no)	0.743	—
Female	Respondent identifies as female (1 = yes; 0 = no)	0.252	
Diverse	Respondent identifies as diverse (1 = yes; 0 = no)	0.004	—
Age	Respondent's age (in years)	32.41	—
Age squared	Age × Age	1191.98	—
Low education	Educational level is below A-levels (1 = yes; 0 = no)	0.209	—
A-levels	Educational level is A-levels (1 = yes; 0 = no)	0.418	—
University	Educational level is university or university of applied sciences degree (1 = yes; 0 = no)	0.376	—
Full-time	Respondent works full-time (1 = yes; 0 = no)	0.624	—
Part-time	Respondent works part-time (1 = yes; 0 = no)	0.119	—
Self-employed	Respondent is self-employed (1 = yes; 0 = no)	0.048	—
Short-time work	Respondent has short-time work (1 = yes; 0 = no)	0.007	—
Student	Respondent is student (1 = yes; 0 = no)	0.216	—
Pupil	Respondent is pupil (1 = yes; 0 = no)	0.054	—
Pensioner	Respondent is retired (1 = yes; 0 = no)	0.012	—
Unemployed	Respondent is unemployed (1 = yes; 0 = no)	0.021	—
Income	Personal monthly net income (in EUR 1000)	1.96	1.15
Migration	Respondent has a migration background (1 = yes; 0 = no)	0.074	—
Disability	Respondent has a physical or mental disability (1 = yes; 0 = no)	0.072	—

3.3. Subjective Well-Being

SWB was measured with two different variables. First, a measure of general life satisfaction was included (*Life satisfaction*) and second, a measure for the general happiness with one's own life (*Happiness*). Both variables represent single-item measures that were measured on an 11-point scale. They have been applied in previous sport and SWB research (e.g., [18,60]). Moreover, life satisfaction and happiness have been frequently applied in studies examining the relationship between pro-environmental behavior and SWB (e.g., [44,61]).

3.4. Pro-Environmental Behavior

Pro-environmental behavior was measured with four different variables, mirroring the four dimensions of pro-environmental behavior explained in the theoretical framework [24]. Pro-environmental transportation behavior was assessed using the spectators' carbon footprint that was generated by their stadium travel. The carbon footprint resulted from multiple questions about their journey to the stadium, including the one-way travel distance and the means of transportation employed. Contrary to previous carbon footprint studies that only included one mean of transportation and one distance [10,13], the survey allowed the spectators to indicate up to three different means of transportation, with the respective distances. This procedure allowed capturing a change in means of transportation, if the spectators, for example, drove their car to a park and ride facility and changed to public transport afterward. Hence, the carbon footprint calculation is more precise than in previous calculations.

The means of transportation offered in the survey matched those of the Federal Environmental Office [62], providing average direct emissions that are generated when one person travels one kilometer with the respective transport mean. These emission factors are used for the carbon footprint calculation. The Federal Environmental Office provided the following direct emissions (Scope 1) for different means of transportation in grams of CO_2-e for the reference year 2019: Passenger car (154); regional train (54); long-distance train (29); bus (83); tram or streetcar (55). The means of transportation in the form of a bicycle, e-bicycle, e-scooter, and walking were added as answer options. However, since only Scope 1 emissions were included, the direct carbon emissions from those means of transportation equaled zero. The carbon footprint calculation included the multiplication of emissions factors for the means of transportation used with the distances traveled by that form of transportation, which was then multiplied by 2 because only the one-way distance was obtained. This calculation resulted in a carbon footprint per fan, which was converted into kilograms of CO_2-e per person because of large numbers and for comparative purposes (*CF*). Since the questionnaire also asked for the postal code and the approximate distance from the spectator's residence to the stadium, all indicated travel distances were double-checked for plausibility using Google Maps.

Pro-environmental recycling, consumption, and energy behavior were assessed using a five-point scale from never to always, asking respondents how often they perform the respective behavior in their everyday life (Table 2). Pro-environmental behavior in everyday life was included in the study because it is often not possible to behave environmentally-friendly in the stadium, but clubs need information about spectators' general behavior to plan environmentally-friendly stadium initiatives. Everyday pro-environmental behavior was shown to spill over to other areas of life, meaning that performing pro-environmental behavior in one dimension of daily life increases the probability of acting in an environmentally-friendly way in other dimensions of daily life [63]. Hence, everyday pro-environmental behavior of sport spectators is assumed to be a good indicator of their pro-environmental behavior in the stadium, also because a connection between event and at-home pro-environmental behavior was shown in previous research [64].

Table 2. Overview of pro-environmental behavior items.

Items	Mean	SD
Recycling behavior	*4.53*	*0.76*
I separate my waste (paper, plastic, residual waste, glass, organic waste).	4.62	0.76
I throw empty batteries and old electronic devices into the household waste. [a]	4.43	1.11
Consumption behavior	*3.45*	*0.65*
I buy food from controlled organic cultivation.	3.33	0.83
I buy regional food.	3.56	0.71
Energy-saving behavior	*3.99*	*0.86*
When I buy household appliances, I make sure that they are energy efficient.	3.95	1.00
I turn down the heating when I leave the apartment/room for several hours.	4.04	1.09

Note: [a] Item recoded into 1 = always to 5 = never.

Turning to the measurement of pro-environmental behavior, first, everyday recycling behavior (*Recycling*) was assessed with two items asking the respondents about their waste separation behavior (paper, plastic, glass, organic waste) and their recycling of batteries and electronic devices. These items were adapted from Diekmann and Preisendörfer [24] and have been previously applied for measuring recycling behavior (e.g., [34]). Second, everyday consumption behavior (*Consumption*) included the purchase of controlled organic cultivation and regional food. These items were also adapted from Diekmann and Preisendörfer [24] and were previously applied for measuring pro-environmental consumption behavior (e.g., [61]). Third, everyday energy-saving behavior (*Energy*) was captured with two items asking about energy-efficient household devices and the behavior of turning down the heating when leaving their home. Both items were adapted from Diekmann and Preisendörfer [24] and similar items were previously applied to measure energy-saving behavior (e.g., [37,61]).

The dimensionality of the everyday pro-environmental behavior measures was tested using confirmatory factor analysis [65]. In this analysis, three goodness-of-fit indices were used for the three-factor model: First, the comparative fit index (CFI) whose values should exceed 0.9 [66]. Second, the root mean squared error of approximation (RMSEA) that should be below 0.08 [67]. Third, the standardized root mean square residual (SRMR) which should have values below 0.1 [67]. The results showed very good goodness-of-fit indices for the three-factor model (CFI = 0.978; RMSEA = 0.045; SRMR = 0.018), revealing factorial validity of each dimension of pro-environmental behavior [67].

3.5. Environmental Consciousness

Environmental consciousness was measured with 9 items that represent the affective, cognitive, and conative components (three items per component) of the construct (see Table 3) [24]. The resulting environmental consciousness index represents the average of the nine items (*Environmental consciousness*). The index was previously validated [57] and has been frequently applied in existing sport ecology research [10,11]. Scale reliability was assessed using Cronbach's α, which was 0.894, suggesting very good reliability [66].

Table 3. Environmental consciousness scale.

Dimensions	Items (1 = Strongly Disagree; 5 = Strongly Agree)	Mean	SD
affective	It worries me when I think about the environmental circumstances under which our children and grandchildren have to live	4.11	0.93
affective	When watching TV or reading newspaper articles about environmental problems, I am often embarrassed and angry	3.76	0.95
affective	If we continue our current style of living, we are approaching an environmental disaster	4.31	0.90
conative	It is still true that politicians do not do enough to protect the environment	4.23	0.92
conative	In favor of the environment, we should all be willing to reduce our current standard of living	3.86	1.04
conative	Environmental protection measures should also be enforced when jobs are lost as a result	3.27	1.17
cognitive	There are limits of economic growth that our industrialized world has already passed or will reach soon	3.76	1.05
cognitive	In my opinion, environmental problems are greatly exaggerated by proponents of the environmental movement (reverse-coded) [a]	2.25	1.08
cognitive	Science and technology will solve many environmental problems, without us having to change our way of life (reverse-coded) [a]	2.71	1.06
	Environmental consciousness (index)	3.82	0.75
	Cronbach's α	0.894	

Note: [a] Items recoded into 1 = strongly agree to 5 = strongly disagree.

3.6. Control Variables

Several control variables were included that were found to affect SWB in previous research [43,60,68]. The spectators' interest in the club (*Club interest*) was assessed using a five-point scale, from totally disagree to totally agree. Moreover, respondents were asked how many games they attend in a typical season (*Games typical season*). Finally, control variables for socio-economic characteristics were added, including gender (*Male*; *Female*; *Diverse*), age (*Age*), educational level (*Low education*; *A-levels*; *University*), occupation (*Full-time*; *Part-time*; *Self-employed*; *Short-time work*; *Student*; *Pupil*; *Pensioner*; *Unemployed*), income (*Income*), migration background (*Migration*), and physical or mental disability (*Disability*). Since the literature suggested a potential non-linear relationship between age and SWB [69], the squared term of age (*Age squared*) was also included in the analysis.

3.7. Empirical Analysis

The empirical analysis consisted of two steps. First, descriptive statistics are provided to give an overview of the sample structure and a detailed overview of the spectator-related carbon footprint of a German Bundesliga club. Specifically, the results will provide detailed information about employed transport means and travel distances, and how much each transport mean contributed to the overall carbon footprint of stadium travel. Second, a seemingly unrelated regression (SUR) model was calculated, with life satisfaction and happiness as dependent variables. This type of regression analysis is preferred over two separate regression models because both dependent variables are SWB measures and are, therefore, likely correlated. The Breusch-Pagan test checks for the potential correlation of error terms [70] and this test was statistically significant (χ^2 = 909.28; $p < 0.001$). This test result indicates that the error terms of both regression equations are correlated. Since SUR allows for this kind of correlation, SUR models should be preferred over two separate linear regression models [71].

The four pro-environmental behavior measures and environmental consciousness were included as independent variables of interest and the remaining variables from Table 1 were included as controls. Since the carbon footprint variable was positively skewed, the natural logarithm was calculated and was included in the regression analysis. All variables were checked for potential multicollinearity. Except of the squared term of age, all correlation coefficients were below 0.8 and variation inflation factors were below 5, indicating that multicollinearity was not an issue in the present analysis [66].

4. Results

An overview of the sample structure is presented in Table 1. The sample consisted of 74.3% male respondents. Respondents had an average age of 32.4 years and a rather high educational level (37.6% with a university degree; 41.8% with a university entrance degree). Nearly two-thirds of respondents were employed full-time and 21.6% were students. The average monthly net income of respondents was EUR 1960. The general interest in the club was high with a mean value of 4.93 and respondents attended 10.4 games on average.

Regarding everyday pro-environmental behavior, recycling behavior was performed the most frequently, followed by energy-saving behavior and environmentally-friendly consumption behavior. The average level of environmental consciousness was 3.82 on a five-point scale, with items of the affective dimension scoring highest. The average life satisfaction and happiness of respondents was 7.55 and 7.33, respectively, on a scale from 0 to 10.

Concerning the first research question, traveling to a home game caused an average carbon footprint of 7.79 kg CO_2-e per fan. If this average value is multiplied by 24,400 spectators, which represents the full stadium capacity of home fans, the carbon footprint of one home game amounts to 190.4 t CO_2-e. Since one Bundesliga team plays 17 home games per season, the seasonal carbon footprint of home fans amounts to 3237 t CO_2-e.

Figure 1 displays the partial carbon footprints per mean of transportation for one home game. The largest share of the total carbon footprint comes from car travel, with 143.5 t

CO_2-e, followed by regional trains (23.0 t CO_2-e) and long-distance trains (14.9 t CO_2-e). Table 4 provides an overview of usage and distance traveled by mean of transportation. As the first mean of transportation, cars were used the most frequently (35.8%), followed by regional trains (18.4%), trams (15.1%), and buses (8.6%). Overall, 11.2% of respondents walked directly to the stadium and 5.8% of respondents traveled there by bicycle. Only 0.6% of respondents used the car as second mean of transportation, suggesting that many people used park and ride facilities, to continue their journey by tram (30.0% of respondents) or to walk to the stadium (24.4%). Figure 2 compares the shares of usage, distances, and carbon footprints for the different means of transportation. The figure indicates that cars are used for only 20.8% of all trips, which cover 44.8% of all kilometers traveled but produced 75.3% of the total carbon footprint.

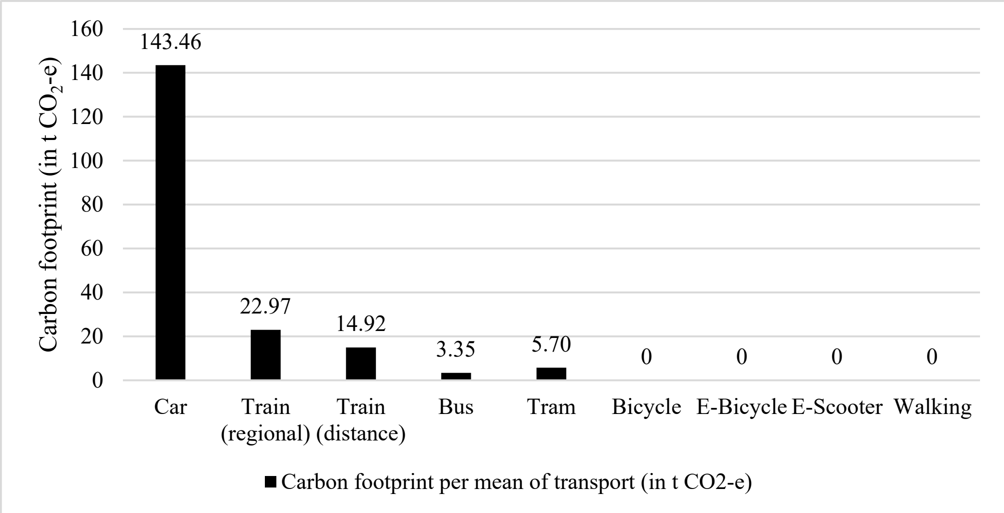

Figure 1. Partial carbon footprints for one home game by mean of transportation.

Table 4. Overview of transportation means and distances traveled (share of respondents in %).

	1st Mean of Transportation		**2nd Mean of Transportation**		**3rd Mean of Transportation**		**All Transportation Means**	
	Share (in %)	**Average km**	**Share (in %)**	**Average km**	**Share (in %)**	**Average km**	**Share (in %)**	**Average km**
Car	35.8	53.14	0.6	9.44	0	0	20.8	52.47
Regional train	18.4	40.64	4.4	26.82	0.1	36.0	13.1	37.95
Long-distance train	4.2	241.64	0.4	83.33	0	0	2.6	228.30
Bus	8.6	8.99	0.8	6.62	0	0	5.4	8.78
Tram	15.1	6.68	30.0	3.46	4.0	2.78	28.1	4.40
Bicycle	5.8	4.87	1.0	4.12	0	0	3.9	4.76
E-Bicycle	0.6	8.78	0.3	5.75	0	0	0.5	7.85
E-Scooter	0.4	3.83	0.1	2.00	0	0	0.2	3.57
Walking	11.2	1.79	24.4	2.05	8.9	1.46	25.4	1.87
Total	100	39.02	61.9	5.17	13.0	2.20	100	24.30
n	1605		994		209		2808	

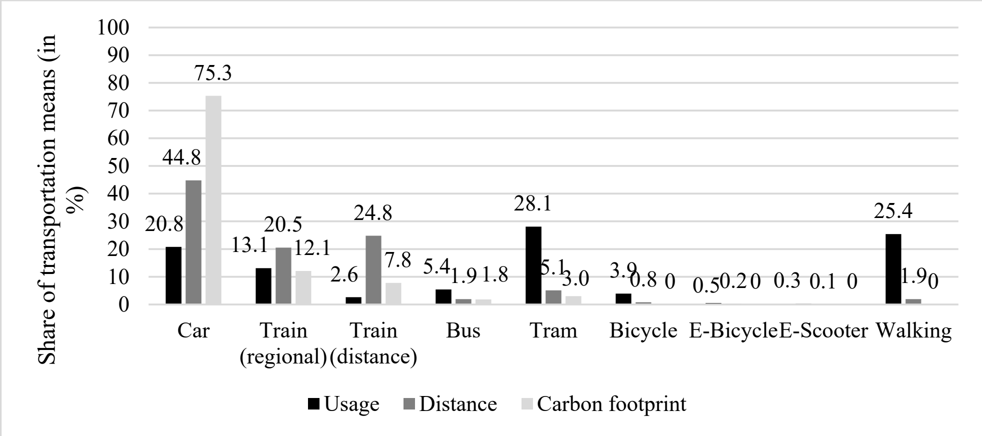

Figure 2. Comparison of usage, distance, and carbon footprint by mean of transportation.

Turning to the second research question, Table 5 shows the results of the SUR model. The results show different effects for stadium travel and the three everyday pro-environmental behavior measures. Stadium travel has no significant impact on spectators' SWB. With respect to everyday pro-environmental behavior, environmentally-friendly consumption has a positive and significant effect on both life satisfaction and happiness, while performing recycling behavior only increases happiness. Energy-saving behavior has no significant effect on SWB. In contrast, higher environmental consciousness decreases both life satisfaction and happiness.

Table 5. Seemingly unrelated regression results for life satisfaction and happiness (n = 1605).

	Life Satisfaction	Happiness
Ln CF	0.011	−0.016
Recycling	0.095	0.156 *
Consumption	0.298 ***	0.336 ***
Energy	0.061	−0.005
Environmental consciousness	−0.212 **	−0.225 **
Club interest	0.261	0.466 **
Games typical season	−0.010	−0.008
Male	−0.179	−0.247 *
Female	Ref.	Ref.
Diverse	0.971	0.300
Age	−0.087 ***	−0.081 **
Age squared	0.001 ***	0.001 **
Low education	Ref.	Ref.
A−levels	−0.219	−0.342 *
University	−0.175	−0.328 *
Full−time	0.327 *	0.449 **
Part−time	0.258	0.328
Self−employed	0.061	0.011
Short−time work	−0.133	−0.656
Student	Ref.	Ref.
Pupil	−0.064	0.135
Pensioner	0.495	0.354
Unemployed	−0.307	0.176
Income	0.281 ***	0.232 ***
Migration	−0.561 ***	−0.465 *
Disability	−0.871 ***	−0.799 ***
Constant	6.558 ***	5.445 ***
Pseudo R2	0.094	0.078
χ^2	166.25 ***	136.59 ***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Ref. = reference category.

Several control variables show significant effects on SWB. The higher the interest in the club, the higher is the respondents' happiness. However, life satisfaction is not affected. Males are less happy than females. Age has a u-shaped effect on SWB, as indicated by the negative coefficient of age and the positive coefficient of age squared. The turning point of the U is at an age of 40.9 years. While working full-time and having a higher income both increase SWB, having a migration background and having a disability decrease SWB.

5. Discussion

This research set out to investigate the stadium travel patterns of spectators of a German Bundesliga club within one home game, as well as how the carbon footprint generated by stadium travel, everyday recycling, consumption, and energy-saving behavior affects SWB. The present sample size of 1605 is similar to that in a study of spectators in semi-professional football in England [33] and is larger than in a previous study about German Bundesliga spectators including all 18 first division teams [13]. Similar to most studies in sport, male, younger, and more highly educated respondents are slightly overrepresented in the sample compared to the German average [10,72]. Even though official data about the total population of football spectators are not available, it can be expected that male and rather highly educated spectators are also overrepresented among spectators of the German Bundesliga. The well-being levels of respondents are similar to previous values for German residents reported in the German Socio-Economic Panel [18].

The average carbon footprint of spectators in this study is similar to that of spectators of the 2003/2004 FA Cup final, with 7.79 kg CO_2-e, compared to 7.67 kg CO_2-e in 2004 [21]. However, the study from the FA Cup Final approximated the carbon footprint not only based on travel but also included food consumption, waste, and infrastructure. This means that the travel-related carbon footprint in this study is slightly higher than that for spectators in the 2003/2004 FA Cup final [21]. This aspect also applies in comparison to spectators in semi-professional football in England, who only emitted 4.70 kg CO_2-e on average [33].

In contrast, the average carbon footprint in the present study is lower than for spectators of the Wales Rally 2004 [30] and the UK stages of the 2007 Tour de France [28], which might be due to the rather regional or national focus of the event in this study and the international focus of the other two events. The carbon footprint of one home game in this study is less than 5% of the lowest carbon footprint in Cooper's [12] study examining University of Tennessee football game days. However, Cooper [12] also included estimates for accommodation, waste and food consumption, and stadium infrastructure. Hence, the total carbon footprint in Cooper [12] is not solely connected to spectator travel, which explains the large difference, in addition to the higher stadium capacity at the University of Tennessee.

Overall, the carbon emissions of the German resident population accumulated to 739 million tons of CO_2-e in 2020, which results in per capita emissions of 8.90 t CO_2-e. Hence, the CO_2-e emissions of spectators from one home game are equivalent to the annual CO_2-e emissions of 21 German inhabitants [73]. Interestingly, in the present study, the car was used for only 20.8% of all trips, in comparison to 49.4% of trips where public transport was used and 29.8% of all trips that were traveled using climate-neutral alternatives. This rather low usage share of cars can be explained by the stadium location, which is located downtown, without any parking opportunities. Nonetheless, the comparison in shares of carbon footprint per mean of transportation showed that switching from traveling by car to public transport is the most effective way to reduce carbon footprints from spectator travel, as car travel amounts to 75.3% of all emissions.

In the SUR model, the control variables had similar effects as in previous SWB research. Similar to previous studies on SWB in sport, having a higher income increased SWB, even though this relationship is not automatically given [74]. This positive effect of income on SWB was evident when looking at the resident population [60,75], sport participants [76], and sport spectators [43,68]. The u-shaped age effect on SWB is in line with previous studies looking at the resident population [60,75] and sport participants [76], but was not shown for sport spectators [43]. Moreover, the negative effect of a disability on an individual's SWB was already evident in SWB studies [77].

Turning to the independent variables of interest, the spectators' carbon footprint from stadium travel is not significantly related to life satisfaction and happiness. Hence, a higher or lower carbon footprint does not yield any SWB benefits or reductions. Since other studies among sport tourists [29] and sport participants [11] already indicated that leisure travel is associated with rather high perceived costs, this relationship might also apply to sport spectators. Moreover, the stadium location might indicate why perceived benefits from using environmentally-friendly travel alternatives are low. Since there are no parking spaces available at the stadium, traveling with environmentally-friendly alternatives is not chosen completely voluntarily. Hence, spectators might be forced, due to capacity restrictions in car parking, to use more environmentally-friendly travel alternatives, such as a bicycle or public transport. However, most spectators are used to the parking situation (the stadium was built in 1926), so this behavior does not affect their SWB and, importantly, it does not reduce it. Another reason for the insignificant effect might be the low frequency of pro-environmental behavior. On average, spectators reported attending ten home games in a typical season. Thus, stadium travel is performed much less frequently than everyday pro-environmental behavior and might, therefore, occur too infrequently to have an impact on individuals' SWB. Finally, spectators might be focused on the game and especially, on the game outcome, which could overshadow the effect of environmentally-friendly travel behavior on SWB.

The effect of everyday pro-environmental behavior on SWB was mixed among the different dimensions. While recycling behavior only had a positive effect on happiness, consumption behavior was the only dimension that increased both life satisfaction and happiness. Theoretically, differences between behavioral dimensions might be explained by perceived costs and benefits from pro-environmental behavior [16]. The costs from environmentally-friendly food consumption come mostly with monetary costs because regional or organic food products are often more expensive than non-sustainable products. However, environmentally-friendly food consumption often happens in public spaces, for example, in local markets, which increases the associated benefits because others can see and positively evaluate one's environmentally-friendly behavior [46]. Moreover, there are usually regional and non-regional food products available, which means that choosing the environmentally-friendly alternative happens voluntarily, thereby also increasing the perceived benefits [47]. Hence, the results regarding consumption are in line with previous studies that showed environmentally-friendly consumption increases SWB (44,50].

The positive effect of recycling behavior on happiness, but not on life satisfaction, might be explained by the different dimensions of SWB. Happiness refers rather to the experience of pleasure, but less to the cognitive dimension of one's satisfaction with life. Hence, recycling might yield some form of pleasure because it is easy to perform and the costs in terms of effort and money are relatively low. The effect of recycling behavior is also directly visible and might produce a feeling of having done something good. Additionally, without laws that punish the pollution of the environment, recycling is an individual's own choice. Since the perceived benefits from recycling are also rather low because it is usually performed in private spheres [46], recycling might only affect happiness, but not life satisfaction. Moreover, recycling behavior is common in Germany and, hence, is rather expected than recognized.

The insignificant effect of everyday energy-saving behavior on SWB could also relate to the private sphere, in which energy-saving behavior is usually performed. Both energy-saving household devices and switching off heating and lights are performed privately, which decreases the perceived benefits from recognition by others [17]. The main benefits from energy-saving behavior are rather personal in terms of cost savings and previous research already indicated that increasing the economic benefits does not automatically yield higher SWB [74]. Likewise, previous studies showed mixed results for energy-saving behavior: Some scholars provided evidence of positive effects on SWB [49], while others reported insignificant results for the relationship with SWB [53].

The consistent negative effect of environmental consciousness on SWB might have different explanations. First, especially the connotations of the affective items are rather negative and since the respondents scored highest in the affective dimension, this might lead to a negative effect on SWB. This relationship between environmental consciousness and SWB for negative connotations has been shown before [54,55]. Second, since the latest report of the Intergovernmental Panel on Climate Change (IPCC) assumed that the world, including Germany, is not on track to meet the 1.5 degree Celsius climate goal, which would result in irreversible changes, the SWB of environmentally conscious individuals might decrease [78].

The findings of this study have implications for club managers and policy makers. The insignificant effect of spectator travel to the stadium comes with challenges but also opportunities. Behavioral changes in spectator travel would not decrease their SWB but would benefit the natural environment. For example, a 10% reduction in car distances traveled would decrease the overall carbon footprint of one game day by 4.66 t CO_2-e when switching to regional trains; by 5.82 t CO_2-e when switching to long-distance trains; by 3.31 t CO_2-e when switching to public busses; by 4.61 t CO_2-e when switching to trams; and by 7.17 t CO_2-e when choosing carbon-neutral travel alternatives. Since free public transport is usually already included in the ticket price for professional sports in Germany, club managers could promote carpooling or establish climate-themed game days, with special promotions for spectators that arrive by bicycle/on foot.

Club managers can also learn about their spectators' everyday pro-environmental behavior and their general level of environmental consciousness. Since many Football Bundesliga clubs are currently in the process of becoming more environmentally sustainable, given the new licensing criteria, knowledge about spectators' attitudes and behavior in everyday life is valuable and can inform measures and initiatives employed on game days. For example, the positive effect of everyday sustainable consumption on SWB yields opportunities to establish sustainable food options or sustainable merchandise products within the stadium, as consuming sustainable products achieves at least two SDGs. In turn, such pro-environmental game day initiatives cannot only influence spectators' behavior during the event but might also increase their everyday pro-environmental behavior even further as sport teams were shown to serve as good environmental promoters [7,8]. For example, spectators who have tried sustainable clothing through merchandise products (i.e., sustainably produced t-shirts) might also consider purchasing sustainable clothes in their future everyday life. Moreover, the negative effect of environmental consciousness on SWB should be carefully considered in the communication of environmental themes. Clubs should ensure that they use positive connotations for their environmental initiatives. Specifically, protecting biodiversity or protecting the forest is connoted more positively than stopping the destruction of natural resources.

For policy makers, this study shows that policy goals for sustainable consumption and promoting public health can go hand-in-hand. Policy makers already realized that taking urgent action to combat climate change (SDG 13) must include a shift in economic activity, for example in individuals' consumption behavior. This shift can include consuming more regional and ecological products. The present study suggests that such a shift should not only occur in the private sphere but also within leisure activities, such as football spectating. The findings indicate that sustainable consumption not only contributes to combatting climate change but also to promoting public health (SDG 3), which includes promoting the well-being of individuals at all ages.

6. Conclusions

This study examined the carbon footprint from spectator travel of home fans at a German Bundesliga club and examined the effect of spectators' everyday pro-environmental behavior on SWB. While contributing to the UN's SDGs has become increasingly important for the sport industry in recent years, achieving the sustainability criteria from the DFL becomes essential for German Bundesliga clubs. Hence, understanding how multiple SDGs interact, in this case, promoting public health through the promotion of well-being and combatting climate change, is important for clubs and league officials. Moreover, the carbon footprint analysis provides a detailed understanding of how spectators travel to the stadium and sets out a starting point to reduce clubs' carbon footprints in the future.

The present study adds to the existing carbon footprint and SWB literature. It is the first study that allowed for switching the means of transportation for traveling to the stadium. The results showed that the inclusion of multiple means of transportation is important because the majority of spectators switched transportation vehicles for their stadium journey. Additionally, the study provided evidence of spectator-related travel behavior of professional football clubs in Germany. Contributing to the literature examining the effect of pro-environmental behavior on SWB, this study was among the first to link stadium travel with spectators' SWB. The study also adds to the literature on SWB of sport spectators. While previous studies have mainly focused on how live spectating might influence SWB, this study adds a pro-environmental behavioral perspective to sport spectators' SWB.

The study is not without limitations, which can guide future research. Since everyday recycling and consumption behavior were found to increase spectators' SWB, an inclusion of waste and consumption emissions into the spectators' carbon footprint might be necessary. Specifically, not only Scope 1 emissions from stadium travel should be included but also Scope 3 emissions from food consumption and the production of waste. Even though recycling of waste and consuming regional products are environmentally-friendly behaviors, both behaviors still produce negative environmental effects in terms of carbon emissions, which should be included when investing their effect on SWB. However, the inclusion of these kinds of emissions requires detailed information from the clubs and their suppliers. Hence, cooperation between academics and local sport clubs could close this information gap. Another benefit of such cooperation could be to assess the overall carbon footprint of the club, including employee travel, power usage, and facility-related emissions. This study combined leisure travel with everyday pro-environmental behavior, but it neglected to ascertain how the club can contribute through environmental initiatives to spectators' everyday pro-environmental behavior. Since recycling and consumption increased spectators' SWB, future studies might examine how clubs' environmental measures can increase spectators' pro-environmental behavior in their everyday life. Finally, the stadium location might represent a limitation. Since the stadium in question is located downtown, it is easy to reach by public transport or even by bicycle or on foot. This might not be applicable to every German Bundesliga club, which should be recognized when comparing the carbon footprint results. Future well-being studies could also not only compare regional and national league competitions but also include leisure travel to international sport events. This type of comparison might be interesting since travel alternatives to international sport events range from environmentally-friendly travel modes, such as trains, to cars and airplanes. Hence, there will be greater differences in the carbon footprint of spectators, and it would be interesting to see if these transportation modes have a different impact on SWB. Finally, this study only looked at one German football club as one part of socio-economic life. Even though football clubs have a large impact on their communities and culture, achieving sustainability throughout the elements of socio-economic life requires further, more spatial measurement.

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