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Article

Does Higher Exposure to Green Spaces Lead to Higher Life Satisfaction and Less Leisure Travel? A Case Study of Reykjavík, Iceland

Johanna Raudsepp [1,*], Kamyar Hasanzadeh [2], Áróra Árnadóttir [1], Jukka Heinonen [1] and Michał Czepkiewicz [3]

1 Faculty of Civil and Environmental Engineering, University of Iceland, 102 Reykjavík, Iceland; arora@hi.is (Á.Á.); heinonen@hi.is (J.H.)
2 Department of Geosciences and Geography, University of Helsinki, 00100 Helsinki, Finland; kamyar.hasanzadeh@helsinki.fi
3 Centre for European Regional and Local Studies (EUROREG), University of Warsaw, 00-927 Warszawa, Poland; m.czepkiewicz@uw.edu.pl
* Correspondence: jor14@hi.is

Abstract: Urban areas have a significant impact on climate change, with transport and mobility as one major source. Furthermore, the impact of urban areas on transport extends beyond their own geographic areas, via leisure travel. Research has suggested several mechanisms through which urban areas drive leisure travel, such as social norms, compensation for what is lacking in the urban environment or for the hectic daily life, and cosmopolitan attitudes, all of which increase leisure travel for its expected wellbeing benefits. More research is needed, however, about how the daily exposure to the urban environment affects leisure travel activity and how perceived wellbeing is associated with this. Therefore, this study was set to examine data from a 2017 softGIS survey from Reykjavík, Iceland, to study the connections between urban environment, local mobility, leisure travel, and life satisfaction. The study employs activity spaces as a basis for exposure modeling and canonical correlation analysis for statistical analysis. The results reveal that although exposure to green and gray spaces is important to overall life satisfaction, underlying socio-economic background is more relevant. Further, higher exposure to gray spaces was found to be associated with more emissions from long-distance leisure travel when socio-economic background was included, but it lost importance when attitudinal factors were added. Furthermore, indications of high levels of urban mobility leading to more leisure travel away from the city were found. Although overarching policy recommendations cannot be made, the study suggests having a more citizen-oriented approach in urban planning, particularly for mobility, which could yield benefits for both wellbeing and climate mitigation outcomes.

Keywords: environmental exposure; long-distance travel; leisure travel; life satisfaction; green spaces; wellbeing; urban environment

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1. Introduction

Urban settlements contribute roughly 70% of CO_2 emissions from all settled areas worldwide [1]. As urban populations continue to grow, cities are becoming more and more crucial for climate change mitigation efforts [2–5]. The transport sector is one of the main contributors to the emissions of both CO_2 and other air pollutants in urban areas [6]. Densification of the urban form has been a strategy to reduce transport emissions from reduced levels of car use, shorter everyday travel distances, as well as smaller living spaces that require less energy and, broadly, less infrastructure required per person [7–9]. Lohrey and Creutzig (2016) estimate that the population density should be between 50 and 150 people/ha, and public transport and active transport modes combined should make up more than half of the urban modal share for cities to fit within the sustainability window [10].

However, within a dense urban form, people have been shown to extend their living spaces with external services and goods consumption, thus increasing their emissions [11–14]. In addition, the dense urban form, while reducing the need for personal car ownership and use [15], has also been linked to higher engagement in long-distance leisure travel, which counteracts the emission reductions [16,17]. Prior studies have suggested that part of the reason for engaging in more leisure travel is due to the increased density and lack of greenness in the urban environment [18]. Considering the above, this study examines the connections between exposure to the urban environment during local travel and its impact on both long-distance leisure travel and perceived wellbeing. Understanding these dynamics is crucial for developing policies that not only mitigate emissions but also enhance the overall life satisfaction of urban residents, particularly in the face of increasing urbanization.

1.1. Travel, Wellbeing, and the Urban Environment

Travel both within and away from one's urban environment is connected to the perception of one's satisfaction with life, or to one's perceived wellbeing. While prior studies have covered varying measures and used a variety of different terms, in the below overview, the general term, "wellbeing", is used. On a broad level, the perspectives to wellbeing can be divided into two categories: studies on hedonic wellbeing and studies on eudaimonic wellbeing. Hedonic wellbeing refers to the enjoyment of life, happiness, and comfort, whereas eudaimonic wellbeing is related to the meaning and value we place on different life aspects and our contentment with life based on those expectations [19,20]. When examining the relationship between travel and wellbeing, more studies focus on the hedonic wellbeing associated with local travel behavior than eudaimonic wellbeing. In local or daily travel, travel satisfaction is mostly linked to travel mode and travel distances and is related to one's emotional wellbeing and overall life satisfaction. For example, reduced car use could support satisfaction with life, even if the person's goal is not to reduce their environmental impact [21]. However, the influence of long-distance leisure travel, driven by urban form and residents' quest for wellbeing, also plays a significant role in shaping life satisfaction.

Local travel in our context refers to the regular, day-to-day mobility patterns of people. Local travel can impact wellbeing in varying directions, depending on people's mood, personality, and many other factors. Local level travel can influence wellbeing through travel mode [22–24], travel time [24,25], travel distance [23–25], quality of transport mode and travel experience [22,25], trip purpose [24,26], companionship [27], and accessibility [24].

Leisure travel, on the other hand, can have a mainly positive effect on wellbeing, as leisure trips offer a break from daily life and worries. In our context, leisure travel refers to long-distance travel away from people's usual area, or in this case, away from the city they live in. Leisure travel could influence wellbeing through a multitude of factors, like trip duration or trip type. Even short weekend getaways have shown positive results on wellbeing and stress reduction [28,29]. Trips with the purpose of relaxation increase hedonic wellbeing more, whereas trips with activity purpose stimulate eudaimonic wellbeing through the sense of achievement (e.g., doing extreme sports) [30]. Furthermore, events that occur on the trip relate to many life satisfaction domains and therefore can trickle upwards into one's overall wellbeing [31]. Also, anticipation of the leisure trip has been associated with increased wellbeing of individuals [30,32].

It has been suggested that long-distance leisure travel of urban residents could be driven by the urban form and characteristics within both their immediate and broader urban environments [33] as well as traveling for the sake of wellbeing [18]. The compensation or escape hypothesis addresses this by saying that people leave the urban area for leisure because it does not meet their needs, is too dense, or creates general distress in their lives [13,14,18,34]. Other studies indicate that people adjust their travel-related attitudes and behaviors to their urban environment [35]. This hints at a complex linkage between local travel/urban mobility, leisure travel, and wellbeing.

Beyond travel behaviors, the physical attributes of urban environments, particularly the availability of green spaces, are closely linked to the wellbeing of residents [36]. Urban form and land use can influence the wellbeing of people living in urban areas [37,38]. Compact cities have the potential to improve wellbeing if they consider people's needs [23,39]. More open and green spaces have been found to be positively associated with satisfaction with the local living environment [40] and with life overall [41–44]. Furthermore, urban green spaces can have a positive impact on physical and psychological health [43,45].

Conversely, the loss of urban green spaces, or higher levels of green space fragmentation, may have a negative relationship with wellbeing [46,47]. Higher levels of gray areas in the home neighborhood or, alternatively, a lack of green space, have been associated with increased leisure travel [48]. Walking in green areas has shown more benefits to psychophysiological health than walking in gray areas, with the added benefit of temperature and pollution mitigation [49]. A study of 60 developed countries indicates that urban green spaces are conducive to happiness in countries with higher GDPs, suggesting that urban green spaces could be important factors in "understanding happiness beyond economic success" [50]. Moreover, lower levels of wellbeing have been associated with higher carbon footprints [51], while people who engage in environmentally friendly behaviors may have a higher satisfaction with life overall [52].

It is worth noting that in this study, we use life satisfaction as a measure of wellbeing. Life satisfaction is a cognitive component of subjective wellbeing [53] and can be used to measure both the hedonic and eudaimonic components of wellbeing [54], although leaning more toward the eudaimonic side due to its dependence on people's perception of and expectations for life [19,20,55].

1.2. Research Aims

Considering the rising populations in urban areas, the significant environmental impact of cities and travel [1–6], and the connection of both to wellbeing [18], it is imperative to understand the interplay between urban environments, travel behavior, and wellbeing. To reduce the environmental impact of cities, urban planning and policies should aim to meet the needs of the residents on multiple levels [23,39]. Thus, the aim of this study is to examine the connections between environmental exposure during local travel and its impact on both long-distance leisure travel habits, with a focus on the amount of travel emissions, and perceived wellbeing, with a focus on life satisfaction. The study is based on a softGIS survey conducted in 2017 in Reykjavík, Iceland, wherein people were tasked with mapping their regularly visited locations in the city and answering questions about them alongside questions about their travel habits, perceived life satisfaction, and background. These data were used to analyze regular urban mobility through activity space modeling, with the exposure to green and gray spaces within each activity space calculated and studied in relation to both life satisfaction and greenhouse gas (GHG) emissions from leisure travel. Canonical correlation analysis was applied to explore these associations. More specifically, the study seeks to answer the following research questions:

RQ1: How is exposure during local travel associated with life satisfaction?
RQ2: How is exposure during local travel connected to GHG emissions from long-distance leisure travel?

The results of the study show that exposure to green and gray spaces during daily mobility contributes to overall life satisfaction; however, socio-economic background is likely more relevant. The study finds indications of high levels of urban mobility and higher exposure to gray spaces leading to more leisure travel away from the city.

2. Materials and Methods

2.1. Study Area

This study was conducted in the Reykjavík Capital Area in Iceland (in Icelandic: Höfuðborgarsvæðið, referred to as Reykjavík in the remainder of the paper). The small island nation is relatively isolated in its position in the North Atlantic Ocean, situated just below the Arctic Circle. It is sparsely populated, with 2/3 of the 375,000 residents living in the Reykjavík Capital Area [56]. The Reykjavík Capital Area is formed from Reykjavík City and the surrounding suburbs of Kópavogur, Hafnarfjörður, Garðabær, Mosfellsbær, Seltjarnarnes, and Kjósarhreppur, which are their own municipalities. The capital area is shaped by its sub-polar oceanic climate, with greatly varying weather that is mild in temperature throughout the year, and wind and precipitation are common. Reykjavík is characterized by low-density urban design, car-oriented mobility lifestyles, high levels of air travel, and high affluence of the general population [15,17]. Compared with many European and Nordic cities, Reykjavík is relatively sparsely built, even in the downtown area, and has good access to waterfronts and views of the mountains (Figure 1).

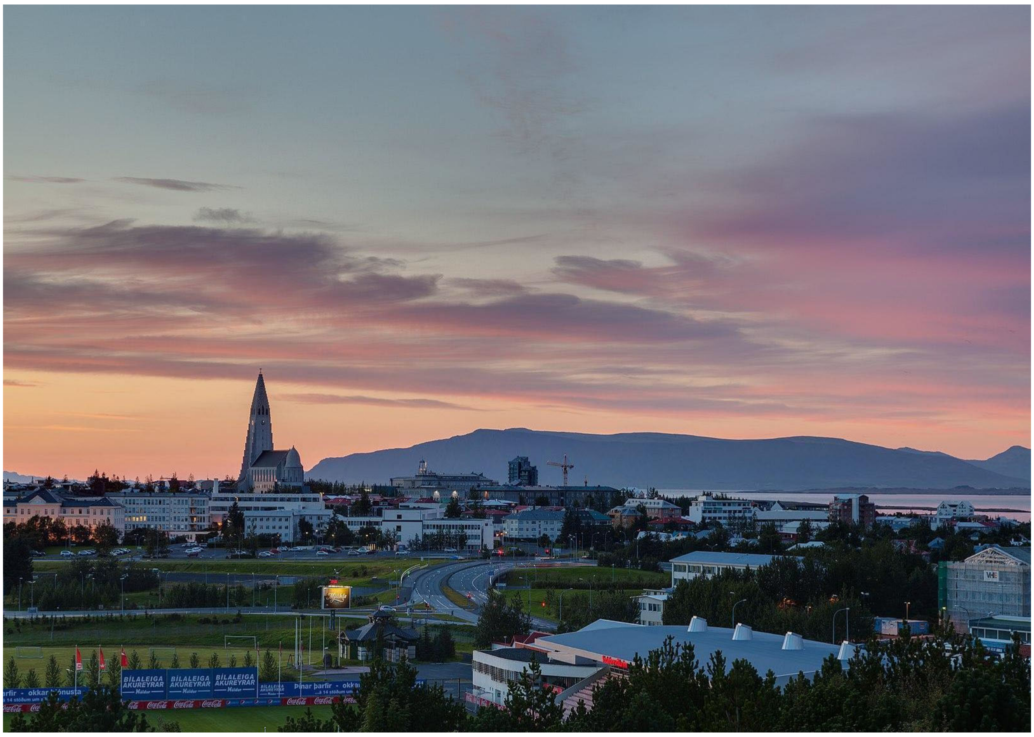

Figure 1. View over central Reykjavík. Photo by Diego Delso, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=36346934 (accessed on 7 June 2024).

The "center" of the capital city is situated on a peninsula that is accessible by land from the East, which contributes to the traffic in the city. Many people commute daily from the suburban municipalities toward the central area for work. The local public transportation system consists of buses only, and the daily travel habits are dominated by private cars [15]. The city's climate influences people's mobility habits in many ways, for example, by restricting the usability of active transport modes [57]. Furthermore, Reykjavík's sub-arctic location is reflected in the city's green spaces, with low trees, shrubs, and sparse distribution of green spaces. Urban planning in the Reykjavík Capital Area has been criticized in Icelandic media in recent years, particularly relating to concerns about increased densification [58,59], less daylight in homes [58–61], street safety [62], and reduction in green spaces [59]. All these issues combined make this an interesting area for a case study about the urban area and the life satisfaction of people living within it.

2.2. Data and Key Variables

2.2.1. Data Collection

The data sample was collected at the end of 2017 using a softGIS public participation survey. The softGIS approach combines a traditional questionnaire with a mapping feature where participants can mark locations on a digital map and further details about the place [63,64]. The survey was aimed at 25- to 40-year-old people living in the Reykjavík Capital Area at the time. The survey covered a variety of questions about the travel habits of people and their urban environment, such as residential locations, regularly visited urban locations, engagement in long-distance leisure travel, travel habits in the urban area, attitudes related to travel, perceived life satisfaction, and socio-demographic background variables. Respondents were asked to mark locations frequently visited over the previous 3 months and their home location, which were used in the GIS analysis (activity space mapping) in this study (Figure 2). The average number of locations visited was 7 (SD: 5.84). In addition, they were asked to mark trips away from the Reykjavík Capital Area within the past 12 months and which travel mode they used, which was then used to calculate emissions (see also Section 2.2.4). In total, 706 full responses were gathered, out of which, after erasing those who had missing home and/or visited locations, 667 were used for geographic and statistical analysis. In addition to the softGIS data, we used other datasets to calculate environmental exposures.

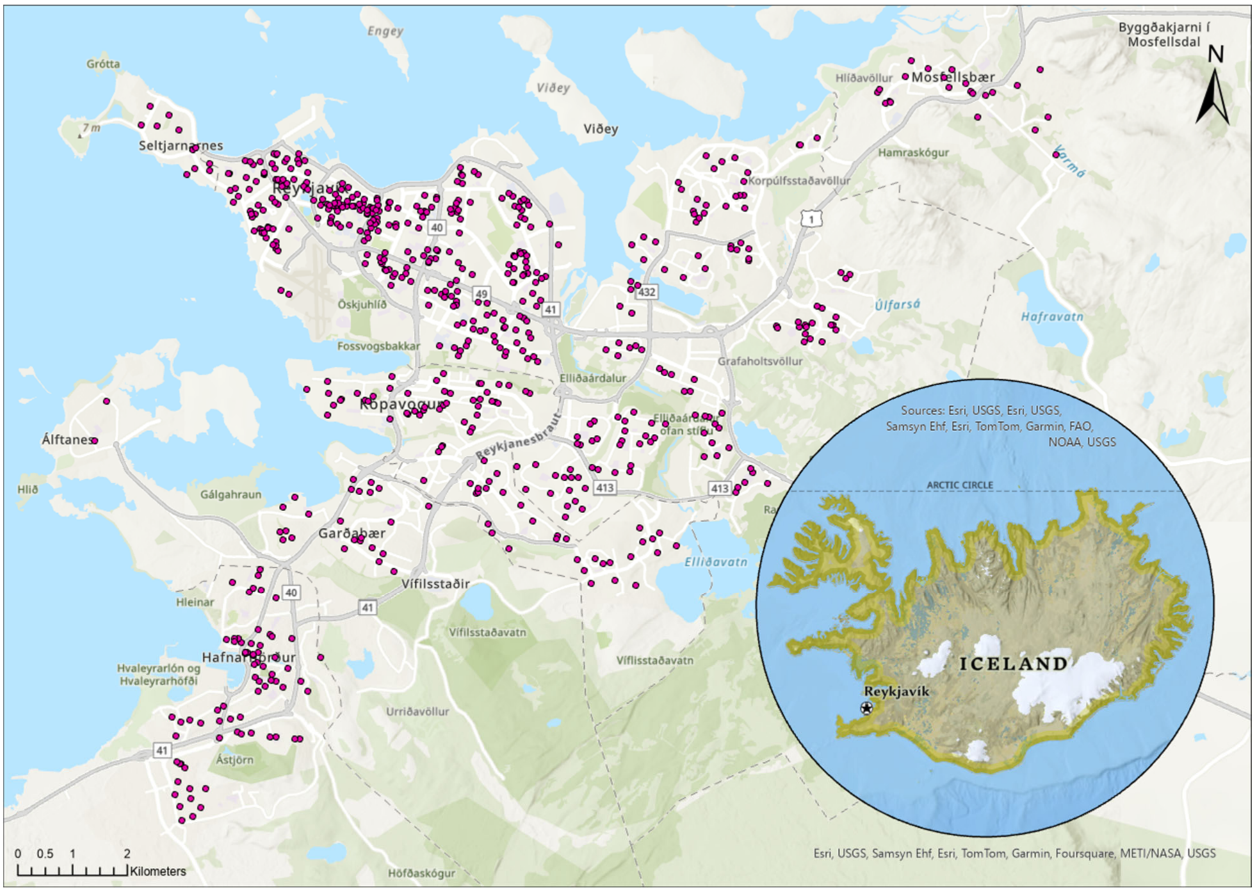

Figure 2. Distribution of respondents in the Reykjavík Capital Area. Points represent home locations marked by respondents.

2.2.2. Spatial Analysis and Exposure Estimations

Respondents' local travel behavior was modeled as individual activity spaces, which spatially encompass the home location and frequently visited locations within the urban area [65,66]. We employed the method described by Hasanzadeh et al. (2018) to calculate exposures within activity spaces using the Individualized Residential Exposure Model (IREM), which estimates activity spaces as raster data [67]. The model first defined activity space boundaries based on participants' home and visited locations using a customized minimum convex polygon [68]. Subsequently, the shortest paths between homes and visited locations were calculated using network analysis, considering the mode of transport.

The exposure intensity was then interpolated using an inverse distance weighting (IDW) function to create a raster grid, which accounts for variations in exposure based on mobility patterns, travel modes, and travel frequencies for each individual. This raster layer was then integrated with land-use data to assess place-based environmental exposure [67].

For land use data, we utilized data for Iceland from OpenStreetMap [69] (retrieved 19 February 2024 from Geofabrik GmbH repository [69,70]). The data provided 18 land use classes, which were divided by the authors into green spaces and gray spaces as follows. Green spaces: allotment, cemetery, farm, forest, grass, heath, meadow, nature reserve, orchard, park, recreation ground, scrub. Gray spaces: commercial, industrial, military, quarry, residential, retail.

We multiplied the place exposure raster of each individual with binary rasterized land use data capturing the green and gray areas. Subsequently, green and gray exposures were calculated in two ways using the total and mean exposure values yielded from raster statistics. The resulting variables were used in the study: average gray exposure, average green exposure, total gray exposure, total green exposure, distance to nearest water body. In addition, the ratio of green and gray exposure was calculated. In the statistical analysis (Section 2.3), the exposure parameters were narrowed down to the most significant ones in relation to our dependent variables (life satisfaction, long-distance travel emissions).

The modeling was performed using the available Python scripts [71]. Other spatial analyses were performed in ArcGIS Pro 2.9 and with the help of custom Python 3.10 scripts.

2.2.3. Life Satisfaction

For the wellbeing component, the paper focuses on ten life satisfaction questions, which asked about respondents' satisfaction with different aspects of their lives. Respondents were able to answer on an 11-point scale, with 0 being "not at all satisfied" and 10 being "completely satisfied". In the analysis, the questions were used individually to capture potentially varying directions of relationships for the different life satisfaction domains. A summary of the questions and their statistical averages is provided (Table 1). On average, life satisfaction in Reykjavík can be considered high, with median values at 7 or 8, apart from satisfaction with the local environment at 6.

Table 1. Statistical overview of life satisfaction variables included in the study.

						Percentiles		
Variable Name	**How Satisfied Are You with. . .?**	**N**	**Mean**	**Median**	**SD**	**25th**	**50th**	**75th**
Life overall	your life as a whole these days	667	7.35	8	2.2	7	8	9
Material	your material standard of living	667	6.67	7	2.5	5	7	8
Health	your current state of health	667	6.99	8	2.5	6	8	9
Personal relationships	your personal relationships	667	7.57	8	2.3	7	8	9
Community	feeling part of your community	667	6.84	8	2.6	6	8	9
Local environment	the quality of your local environment	667	6.03	6	2.6	4	6	8
Job/studies	your main occupation such as job or studies	667	7.09	8	2.4	6	8	9
Sense of achievement	things you are achieving in life	667	7.29	8	2.1	7	8	9
Leisure time	the amount of time you have to do things you like doing	667	6.92	7	2.4	6	7	8
Safety	how safe you feel	667	7.85	8	2.2	7	8	9

2.2.4. GHG Emissions from Long-Distance Leisure Travel

In this study, long-distance leisure travel emissions were examined on two scales—domestic and international—as a dependent variable set to show the engagement in long-distance leisure travel behavior. The emissions were estimated based on well-to-wheel lifecycle assessment methods [72] calculated and explained in detail by Czepkiewicz et al. [17]. The scope of emissions used in this study does not include vehicle manufacturing, only direct and indirect emissions stemming from fuel and electricity consumption. The domestic leisure travel emissions pertain to trips made within Iceland, while international leisure travel emissions pertain to trips made away from Iceland. The study uses a consumption-based approach where the emissions are allocated to the end user, or in this case, the traveler. Coefficients used in the GHG emissions calculations are shown in Table 2.

Table 2. Coefficients used for GHG emissions calculations per travel mode per person kilometer traveled (kg CO_2-eq/PKT).

Travel Mode	Description	Direct Emissions from Combustion	Indirect Emissions from Fuel Production	Total Emissions Factor
Car	Fuel efficiency of vehicle reported by respondents (L/km) (survey data) multiplied by 2.36 kg CO_2-eq/L [73], divided by 1.3 average car occupancy rate [74]. Indirect emissions [72].	0.138	0.026	0.164
Bus	Diesel bus with average occupancy rate on long-distance trips (12/50 passengers) [74].	0.049	0.037	0.086
Plane (under 800 km)	LLGHGs and SLCFs included in emissions factors [75]. Indirect emissions used are for a midsize aircraft [72].	0.300	Incl. in combustion factor	0.300
Plane (over 800 km)		0.240		0.240
Ferry	Based on data for the Helsinki–Stockholm ferry using average occupancy rate [74]; indirect emissions for fuel production are the same as for a midsize aircraft [72].	0.223	0.015	0.238
Train	Pendolino and intercity trains with average occupancy rate [74]. Indirect emissions based on an SFBA Caltrain [72].	0.022	Incl. in combustion factor	0.022

2.2.5. Attitudes

Previous studies have shown the influence of attitudes on travel behavior [17]. Therefore, we have included four attitudinal variables in our analysis generated from the original data. A factor analysis with principal axis factoring with oblique rotation was conducted on a total set of 34 statements (Likert scale 1 to 5, where 1 = strongly disagree, 3 = neither agree nor disagree, and 5 = strongly agree) to find common factors. Out of those factors, four were chosen for this study based on previous studies [17] (Table 3).

Table 3. Overview of attitudinal variables included in the study.

Variable	Statements
Pro-environmental attitude	I want to live as ecologically as possible. I am very concerned about environmental issues. I think about how I can reduce environmental damage when I go on holiday. I think about environmental impact of services I use. When shopping, I rarely think about the environmental impact of the things I buy (negative score). I am willing to reduce my use of air travel because of the environment.
Climate awareness	I am very concerned about environmental issues. There is evidence of global climate change. The main causes of global warming are human activities. Global warming will bring about some serious negative consequences.
Cosmopolitan attitude	Experiencing different cultures is very important for me. Experiencing different cultures and destinations is more important than saving natural resources. Exploring new places is important part of my lifestyle. It is easy for me to jump to a plane and go on a trip. I feel at home wherever in the world I go. Sometimes it is necessary to take a break from urban life.
Preference for leisure in urban areas vs. in nature	Sometimes it is necessary to take a break from urban life (negative score). I find it more interesting on a city street than out in the forest looking at trees and birds. I would rather spend my weekend in the city than in wilderness areas.

2.2.6. Socio-Economic Background

Socio-economic background factors were used as control variables. These included age, education level, weekly working hours, income level, and household size (Table 4).

Table 4. Overview of socio-economic variables used in the study.

Variable	Variable Type	Categories Used in the Study	Averages
Age	Continuous	-	Mean: 32.6
Education level (highest level attained)	Categorical	Low: basic and secondary education Medium: lower tertiary education High: higher tertiary education	Median: lower tertiary
Working hours (weekly)	Categorical	Less than 30 30 to 35 35 to 40 40 to 45 More than 45	Median: 40 to 45
Income level (based on per capita monthly income)	Categorical	Low: below ISK 300,000 Medium: ISK 300,000–600,000 High: ISK 600,000–900,000 Very high: over ISK 900,000	Median: high income
Household size	Continuous	-	Mean: 3

2.3. Statistical Analysis

In this study, we employed canonical correlation analysis [76,77] to explore the complex relationships between environmental exposure variables and two distinct sets of outcomes: life satisfaction and long-distance leisure travel emissions. Our approach involved two sets of multidimensional variables: environmental exposure variables, including various measures of green and gray space exposures, and outcome variables, which included multiple aspects of life satisfaction and leisure travel emissions. There have been indications in prior studies that in Reykjavík, an association might exist where the broader urban environment and people's contact with it during daily local travel might influence wellbeing and leisure travel away from the city (e.g., [33]). However, it is uncertain which urban environment factors might influence which wellbeing aspects or leisure travel. The method has been shown to be useful in studies examining the links between urban green spaces and wellbeing and/or health [78,79], particularly due to its in-built dimension reduction method, similar to that of principal component analysis. Owing to this, canonical correlation analysis can help extract the combination of variables among independent and dependent groups that have the greatest linear correlation between them [76–79]. Therefore, canonical correlation analysis was deemed suitable for this study as it allowed us to investigate the linear relationships between two sets of variables simultaneously, capturing the complexity and multidimensionality of the data [76,77].

The canonical correlation analysis forms groups of variables, or variates, from the independent group (X) that are significant in explaining a group of dependent variables (Y), somewhat similar to a factor analysis or principal component analysis. The canonical correlation coefficient shows how much of the relationship between the two variable sets (X and Y) is explained by the variables within them. Most relevant variables in the independent and dependent groups are determined by canonical loadings (−1 to +1), which show the strength of the impact each variable has within the examined relationship. Canonical loadings between −0.300 and 0.300 showed minimal impact of the variable on the dependent group, while the rest were considered as relevant variables. If the variables repeated across variates, the strongest impacting variables were observed for each variate only (that is, variables with the highest canonical loadings). Lastly, the direction of the effect was examined using standardized canonical correlation coefficients, with the focus on most relevant variables based on the canonical loadings [76,77].

In our analysis, we structured the canonical correlation analysis into several models to systematically explore the relationships. We first examined the relationships between the full set of environmental exposure variables and the sets of life satisfaction (Model 1) and travel behavior variables (Model 2) separately, which helped us identify the most relevant exposure variables. We then focused on these most relevant exposure variables to explore their associations with life satisfaction and travel behavior more deeply. To account for potential confounding effects, we included socio-economic background variables in the analysis, allowing us to assess the independent contribution of environmental exposure to life satisfaction (Model 3) and travel behavior (Model 4), controlling for demographic factors. Lastly, attitudinal factors were added as an additional set of independent variables as they are known to affect leisure travel (Model 5). The analysis process using canonical correlation analysis is visualized in Figure 3, and the process is described in more detail below.

First, in Models 1 and 2, the set of environmental exposure variables, as described in Section 2.2.2, was used as the independent variable set, and its relationship with both life satisfaction and leisure travel was examined. The aim of Models 1 and 2 was to determine the exposure variables that are potentially the best fit to explain the relationships. Then, Models 1 and 2 were repeated (Models 1b and 2b) with only the exposure variables most relevant within the first round (Models 1a and 2a). First (Models 1a and 2a), the relationship between a group of exposure variables (X) and a group of life satisfaction variables (Y) was examined to narrow down the exposure variables that are the best fit in relation to life satisfaction and leisure travel emissions, respectively. The standardized correlation coefficients were not examined in this model, as the aim was to determine the variables with the best explanatory power. Then, Models 1 and 2 (referred to here as Models 1b and 2b) were repeated using only the variables for exposure in the independent set that emerged from Models 1a and 2a, with the dependent set remaining the same, to show the correlation between the canonical variables.

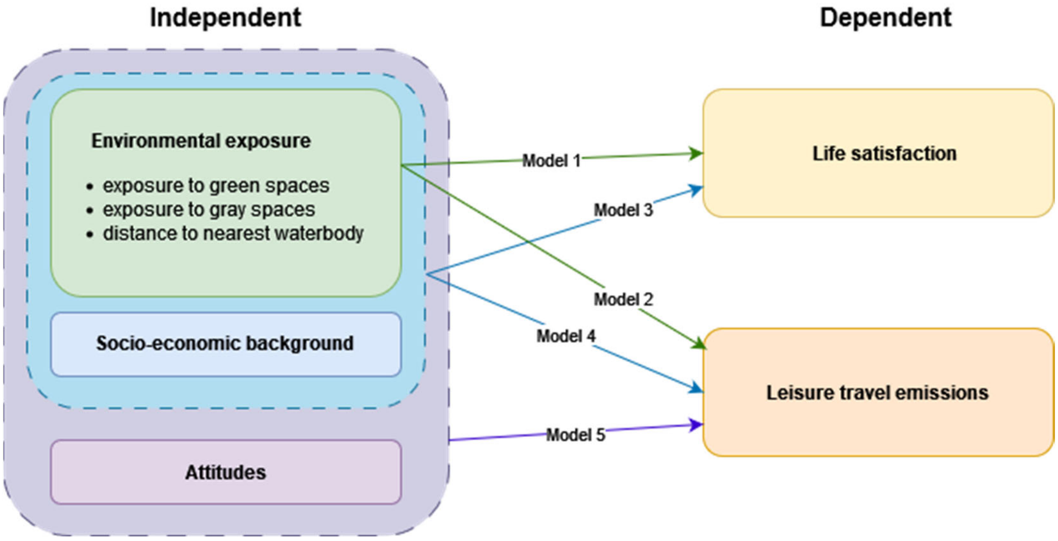

Figure 3. Models for canonical correlation analysis explored in this study.

Secondly, considering the complexity of both wellbeing and travel behavior, it was important to capture some underlying demographic variables in addition to exposure. Therefore, in Models 3 and 4, socio-economic background variables were added to the set of independent variables, and the process was repeated with life satisfaction and leisure travel emissions as dependents, respectively. Lastly, in Model 5, attitudinal variables known to influence leisure travel decisions were added based on prior studies [17].

Only statistically significant variates are described further in the Results Section (Section 3), while full canonical correlation tables with all variates per model can be found in Appendix A. Variates are labeled based on the model and order of the variate in the canonical correlation analysis.

3. Results

The results show a limited relationship between exposure and life satisfaction when socio-economic factors are accounted for. Exposure during daily mobility is important in explaining some of the leisure travel emissions when accounting for socio-economic background, but adding attitudinal factors limits the impact of exposure. In this section, we will walk through the statistical analysis and key findings following the models as described in Section 2.3. This is followed by a discussion in Section 4, which interprets the results in the context of the previous literature.

First, the most relevant exposure variables were identified. Canonical correlation analysis showed one significant variate (set of variables) ($p < 0.05$), in which total green exposure and total gray exposure appeared as the most relevant variables due to their high canonical loadings (Table 5).

Similarly to Model 1a, when examining the canonical correlations between exposure and travel emissions in Model 2a, one set of variables was revealed as significant ($p < 0.01$). The canonical loadings revealed the same as Model 1a—total green exposure and total gray exposure were the most relevant variables (Table 6). Average green and gray exposure also had high values, but due to the overlap in function—the variables describe the same pattern but in a different form—they were excluded in the next steps.

Table 5. Canonical loadings for statistically significant variates in Model 1a.

	Variate 1a-1
Correlation coefficient	0.240
Sig.	0.010
Canonical loadings Independents	
Exposure	
Distance to nearest water body	0.187
Total green exposure	−0.800
Average green exposure	0.136
Green exposure ratio	−0.192
Total gray exposure	−0.866
Average gray exposure	0.233
Gray exposure ratio	0.259
Dependents	
Life satisfaction	
Material	−0.023
Health	0.042
Personal relationships	−0.232
Community	−0.036
Leisure time	0.344
Job/studies	0.436
Local environment	−0.266
Sense of achievement	0.250
Safety	−0.222
Life overall	0.245

Table 6. Canonical loadings for statistically significant variates in Model 2a.

	Variate 2a-1
Correlation coefficient	0.175
Sig.	0.006
Canonical loadings Independents	
Exposure	
Distance to nearest water body	0.208
Total green exposure	−0.734
Average green exposure	−0.603
Green exposure ratio	−0.166
Total gray exposure	−0.793
Average gray exposure	−0.528
Gray exposure ratio	0.156
Dependents	
Travel emissions	
Domestic	−0.829
International	−0.623

Next, the significant exposure variables from Models 1a and 2a were taken and the models were repeated as 1b and 2b. For Model 1b, there were two significant canonical correlations between exposure and life satisfaction variables. Canonical loadings for Model 1b show that both exposure variables are relevant for both canonical variates (Table 7). Variate 1b-1 showed a relationship with satisfaction with job/studies, sense of achievement, and life overall (loading over 0.3), whereas variate 1b-2 showed a stronger relationship with satisfaction with leisure time and the local environment (Table 7).

Table 7. Canonical loadings for statistically significant variates in Model 1b.

	Variate 1b-1	Variate 1b-2
Correlation coefficient	0.221	0.174
Sig.	<0.001	0.017
Canonical loadings Independents		
Exposure		
Total green exposure	−0.792	−0.611
Total gray exposure	−0.912	−0.409
Dependents		
Life satisfaction		
Material	0.032	0.006
Health	0.068	0.202
Personal relationships	−0.148	0.219
Community	0.106	0.030
Leisure time	0.365	0.379
Job/studies	0.527	−0.206
Local environment	−0.021	−0.399
Sense of achievement	0.409	−0.103
Safety	−0.230	0.069
Life overall	0.324	0.172

In analyzing the effect direction between the two variable groups in Model 1b, the focus is put on the variables highlighted by the canonical loadings in Table 8. For Variate 1b-1, it can be seen that as total green exposure increases and gray exposure decreases, satisfaction with job/studies, sense of achievement, and life overall increases (Figure 4).

Table 8. Canonical loadings of statistically significant variates in Model 2b.

	Variate 2b-1
Correlation coefficient	0.147
Sig.	0.002
Canonical loadings Independents	
Exposure	
Total green exposure	−0.957
Total gray exposure	−0.998
Dependents	
Travel emissions	
Domestic	−0.960
International	−0.354

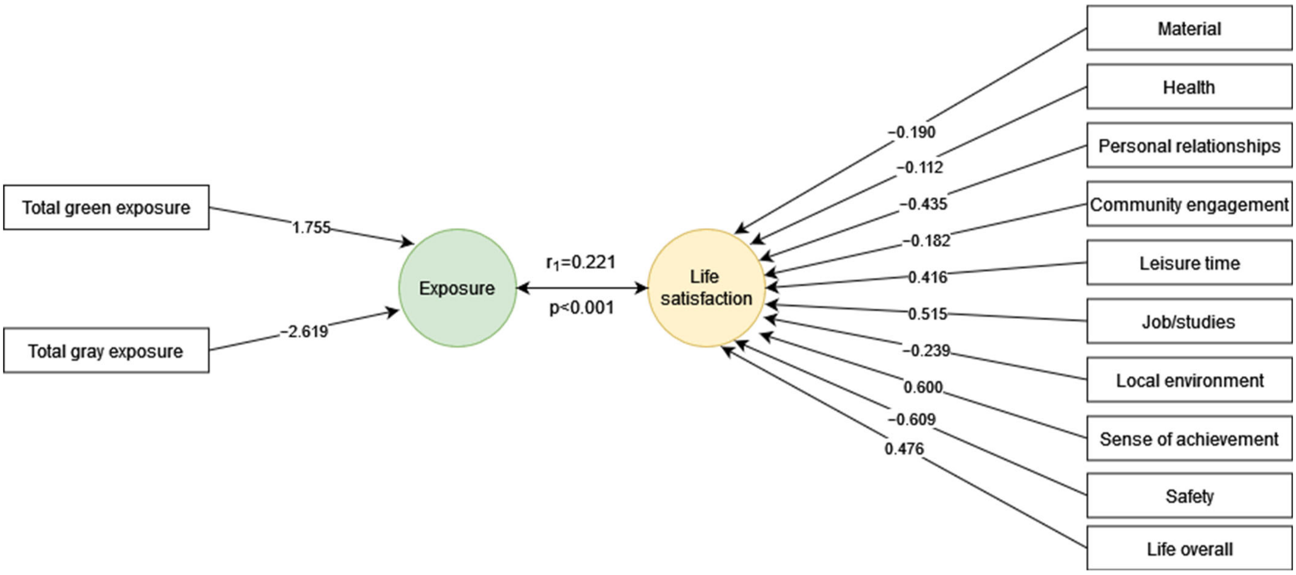

Figure 4. Standardized canonical correlation coefficients for exposure (X) and life satisfaction (Y) for Variate 1b-1.

For Variate 1b-2, it can be seen that as total green exposure decreases and gray exposure increases, satisfaction with leisure time availability increases and satisfaction with the local environment decreases (Figure 5).

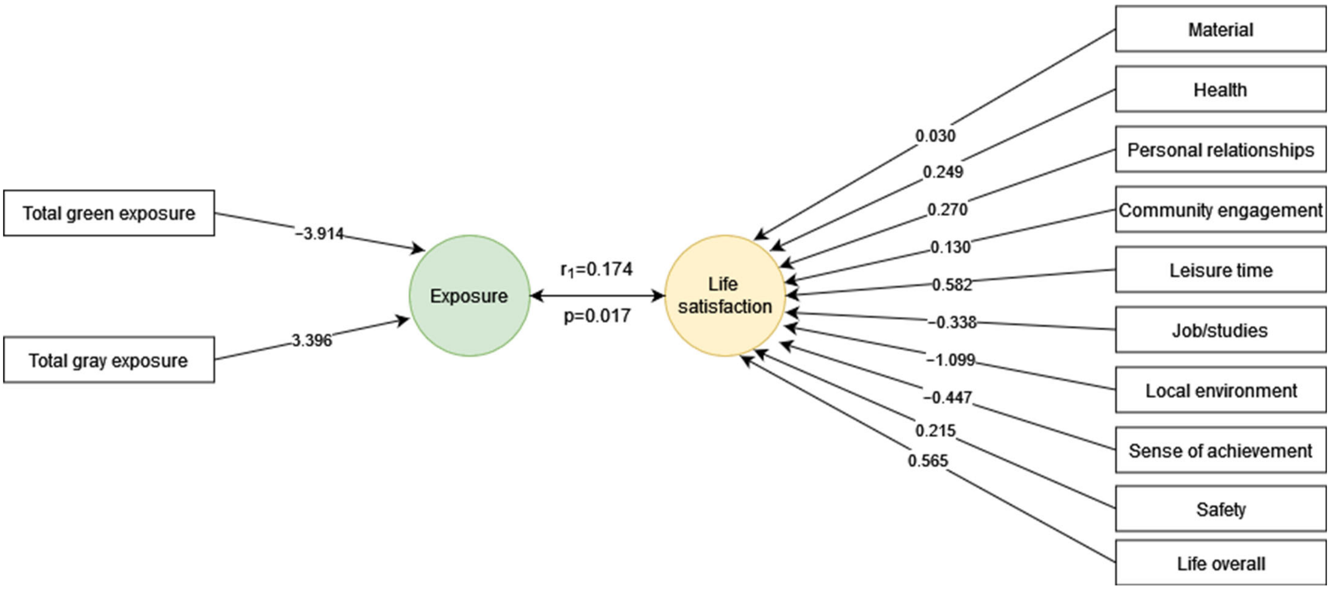

Figure 5. Standardized canonical correlation coefficients for exposure (X) and life satisfaction (Y) for Variate 1b-2.

A similar procedure was repeated for Model 2b, wherein exposure is the dependent (X) and participation in leisure travel is the independent (Y) set. The analysis revealed one significant variate. Canonical loadings showed the importance of all variables in both sets (Table 8).

For Model 2b, it can be seen that more green exposure and less gray exposure are connected to less domestic and international leisure travel emissions. The influence of exposure is higher on domestic emissions than on international emissions, and gray exposure had an overall higher influence on both leisure travel emissions than green exposure (Figure 6).

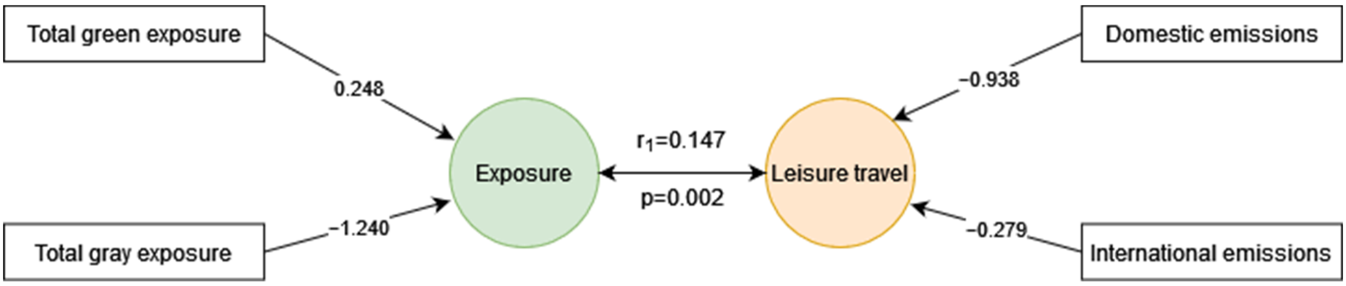

Figure 6. Standardized canonical correlation coefficients for exposure (X) and leisure travel behavior (Y) for canonical variate 1 in Model 2b.

Average exposure to green or gray spaces did not significantly differ between the socio-demographic groups (Tables A1 and A3). Some significant differences between the groups remained for both life satisfaction (tested with a composite wellbeing variable summarizing all life satisfaction variables used here) and leisure travel emissions (varying results for both domestic and international travel emissions) (Tables A1 and A2). After adding socio-economic background to the independent set of variables, the canonical correlation analysis revealed five significant variates for Model 3 for the relationship between exposure and socio-economic background (independent) and life satisfaction (dependent). Total green and gray space exposures are not the main influencing factors in most life satisfaction categories when socio-economic background is accounted for as well (Table 9). Exposure had a strong role in Variate 3-3 together with overall life satisfaction.

Table 9. Canonical loadings of statistically significant variates in Model 3.

	Variate 3-1	Variate 3-2	Variate 3-3	Variate 3-4	Variate 3-5
Correlation coefficient	0.465	0.344	0.259	0.243	0.169
Sig.	<0.001	<0.001	<0.001	<0.001	0.011
Canonical loadings					
Independents Exposure					
Total green exposure	−0.154	−0.006	−0.658	0.195	0.604
Total gray exposure	−0.147	0.094	−0.716	0.295	0.483
Socio-economic background					
Age	−0.005	−0.161	0.085	0.673	−0.364
Education level	−0.443	0.548	0.067	−0.325	−0.256
Working hours (weekly)	−0.741	−0.368	−0.344	−0.136	−0.298
Income level	−0.714	0.265	0.368	0.402	0.296
Household size	−0.277	−0.400	0.545	0.295	0.072
Dependents Life satisfaction					
Material	−0.721	0.473	0.301	0.057	0.211
Health	−0.521	0.286	−0.040	−0.255	−0.299
Personal relationships	−0.269	0.284	0.279	0.207	−0.232
Community	−0.459	0.150	0.222	0.179	−0.219
Leisure time	0.155	0.638	0.353	−0.150	0.035
Job/studies	−0.427	−0.180	0.262	−0.257	−0.207
Local environment	−0.372	0.092	0.034	0.059	0.298
Sense of achievement	−0.485	0.178	0.447	−0.401	−0.192
Safety	−0.429	0.480	−0.198	0.004	−0.255
Life overall	−0.350	0.146	0.461	0.178	−0.344

Lower gray exposure and higher green exposure are associated with higher overall life satisfaction (Variates 3-3 and 3-5) (Table 10). For other life satisfaction categories, the impact of socio-economic background was stronger than the impact of exposure (Table 9). For example, in Variate 3-1, it can be seen that weekly working hours and income level have a moderate positive correlation with satisfaction with the material standard of living (Table 10).

Table 10. Standardized canonical correlation coefficients for significant variates in Model 3.

	Standardized Canonical Correlation Coefficients				
	Variate 3-1	**Variate 3-2**	**Variate 3-3**	**Variate 3-4**	**Variate 3-5**
Independents Exposure					
Total green exposure	−0.048	−1.667	0.401	−1.475	2.153
Total gray exposure	−0.067	1.683	−1.098	1.689	−1.617
Socio-economic background					
Age	0.139	−0.172	−0.104	0.644	−0.417
Education level	−0.303	0.518	0.014	−0.476	−0.293
Working hours (weekly)	−0.624	−0.550	−0.382	−0.179	−0.395
Income level	−0.458	0.454	0.375	0.456	0.457
Household size	−0.216	−0.492	0.396	−0.024	0.018
Dependents Life satisfaction					
Material	−0.775	0.433	0.407	0.343	0.635
Health	−0.403	0.086	−0.479	−0.395	−0.323
Personal relationships	−0.001	0.034	0.207	0.298	−0.160
Community	−0.324	0.114	−0.156	0.390	−0.268
Leisure time	0.732	0.723	0.260	−0.299	0.137
Job/studies	−0.088	−0.606	0.000	−0.302	−0.172
Local environment	0.023	−0.484	−0.333	0.031	1.029
Sense of achievement	−0.105	−0.002	0.562	−1.153	0.045
Safety	0.060	0.545	−0.894	0.031	−0.541
Life overall	0.243	−0.287	0.710	0.903	−0.574

Model 4 examined the relationship between exposure and socio-economic background (independent set) and long-distance leisure travel emissions (dependent set). The canonical correlation analysis revealed one significant variate. In the composition of the variate, exposure to both green and gray spaces was more important than some socio-economic variables like working hours and income level. The strongest contributors to the variate were total green exposure, total gray exposure, and household size. Age and education level were also included but had a weaker relationship (Table 11).

Table 11. Canonical loadings for statistically significant variates in Model 4.

	Variate 4-1
Correlation coefficient	0.257
Sig.	<0.001
Canonical loadings	
Independents Exposure	
Total green exposure	0.523
Total gray exposure	0.571
Socio-economic background	

Table 11. *Cont.*

	Variate 4-1
Age	−0.412
Education level	0.301
Working hours (weekly)	0.294
Income level	0.233
Household size	−0.613
Dependents **Travel emissions**	
Domestic	0.811
International	0.647

When looking at the standardized correlation coefficients (Figure 7), higher education level was associated with higher leisure travel emissions both domestically and abroad. Younger age and smaller household size were correlated with higher emissions in both categories. Exposure to green and gray spaces had a moderate influence on both domestic and international emissions, but in varying directions. The coefficients showed that a decrease in total green exposure was linked to an increase in domestic and international leisure travel emissions, whereas gray exposure was positively associated with both emissions (Figure 7).

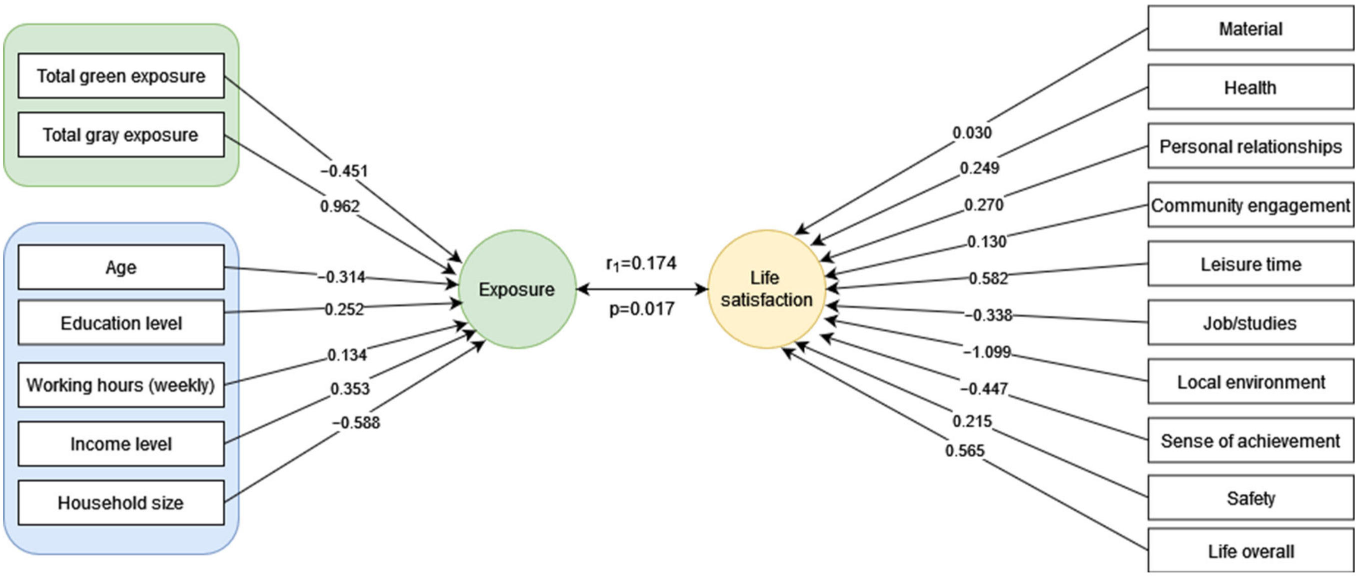

Figure 7. Standardized canonical correlation coefficients for Variate 4-1 in Model 4. Green group is exposure variables, blue group is socio-demographic variables.

Previous studies have also indicated the importance of people's attitudes to leisure travel behavior [17]. The canonical correlation analysis showed two statistically significant canonical correlation variates when attitudinal factors were controlled for (Table 12).

Firstly, when accounting for attitudinal variables, exposure is not very important in explaining travel emissions. In the first variate, education level, working hours, household size, cosmopolitan attitude, and preference for urban leisure travel seem more important in relation to travel emissions (Table 12). Secondly, however, it appears that exposure is a more important variable in relation to domestic travel, alongside climate awareness, pro-environmental attitude, and a preference for urban leisure travel (Table 12). Variate 5-1 did not show a strong relationship between exposure and travel emissions, but Variate 5-2 did. Therefore, here we present the standardized coefficients for Variate 5-2 only (Figure 8).

Table 12. Canonical loadings for statistically significant variates in Model 5.

	Variate 5-1	Variate 5-2
Correlation coefficient	0.376	0.289
Sig.	<0.001	<0.001
Canonical loadings		
Independents Exposure		
Total green exposure	−0.141	−0.436
Total gray exposure	−0.160	−0.404
Socio-economic background		
Age	0.293	0.262
Education level	−0.364	0.272
Working hours (weekly)	−0.300	0.222
Income level	−0.253	−0.116
Household size	0.516	0.030
Attitudinal variables		
Pro-environmental attitude	−0.059	0.008
Climate awareness	−0.108	0.305
Cosmopolitan attitude	−0.656	0.376
Preference for urban leisure travel	0.330	0.596
Dependents Travel emissions		
Domestic	−0.601	−0.799
International	−0.818	0.575

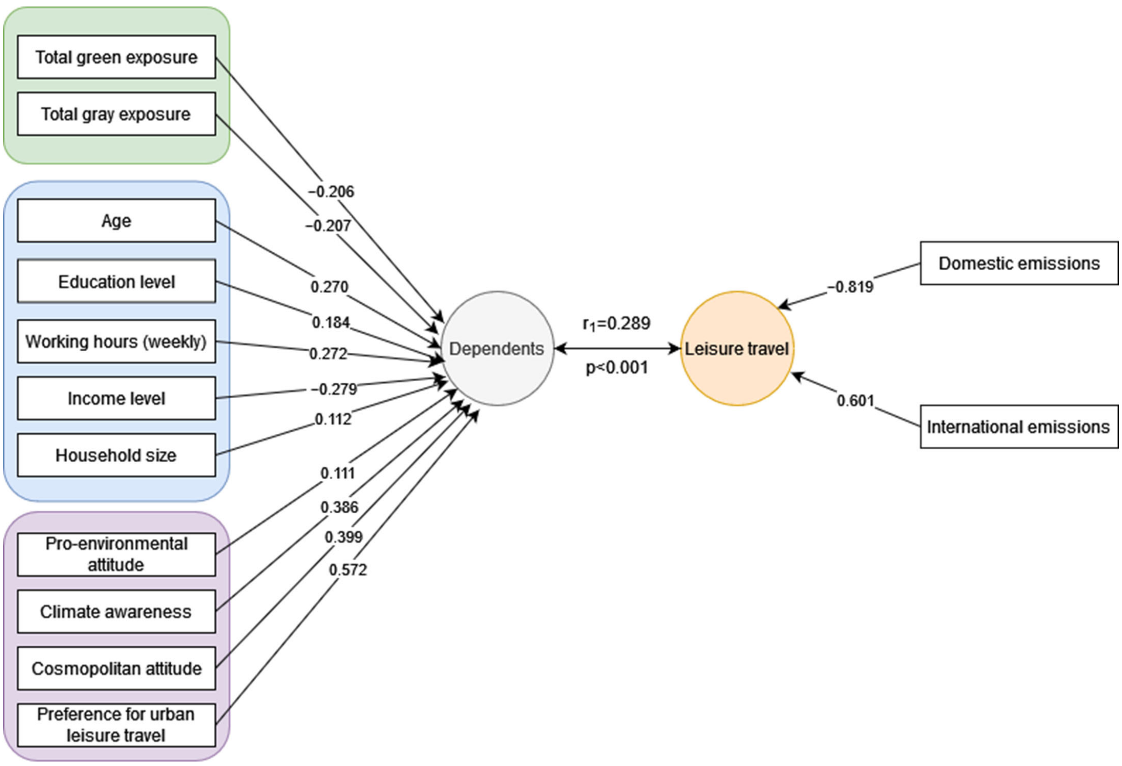

Figure 8. Standardized canonical correlation coefficients in Model 5 for Variate 5-2. Green group is exposure variables, blue group is socio-demographic variables, purple group is attitudinal variables.

Model 5 shows that when socio-economic and attitudinal variables are accounted for, exposures to both green and gray spaces have a positive correlation with domestic leisure travel emissions and a negative relationship with international leisure travel emissions (Figure 8). With less exposure to both green and gray spaces, domestic leisure travel emissions are smaller. However, less green exposure, and less gray exposure during daily mobility, were connected to higher international leisure travel emissions. Higher climate awareness, pro-environmental attitude, and a preference for urban leisure travel were associated with lower domestic leisure travel emissions and higher international leisure travel emissions.

4. Discussion and Conclusions

The aim of the study was to examine how exposure to green and gray spaces in an urban area during regular commutes is related to people's life satisfaction and leisure travel GHG emissions. The study analyzed softGIS survey results of about 670 respondents from Reykjavík, Iceland. In this section, we will discuss the findings of the study in the context of the prior literature. First, the relationship between exposure and life satisfaction will be discussed. Second, the relationship between exposure and travel emissions will be explored. Lastly, the limitations, suggestions for future research, and policy implications of the study will be presented.

4.1. Exposure and Wellbeing

The canonical correlation analysis showed that exposure to both green and gray spaces is important for overall life satisfaction, but other socio-economic factors are more dominant in relation to the examined life satisfaction sub-categories. A positive correlation was observed between exposure to green spaces and satisfaction with one's job/studies, sense of achievement, the local environment, and life overall and a negative relationship with satisfaction with leisure time availability. The latter might be a sign of an inverse causality, since people who are dissatisfied with how much free time they have might visit green spaces less frequently. Exposure to gray spaces had the opposite relationships with the abovementioned life satisfaction categories. The findings are similar to those of previous studies, wherein a positive relationship has been found between exposure to green spaces and satisfaction with the local environment [80,81] and life overall [41–43]. Similarly, negative relationships have been found between gray spaces (or lack of greenness) and life satisfaction as well [46,47]. There could be an underlying reason related to residential sorting of people with similar socio-economic statuses [82]. For example, people with a lower socio-economic status might live in a less central and less green area, thus having lower exposure to green spaces. In addition, due to their lower socio-economic status, they might also have lower life satisfaction levels and travel less for leisure. Our data set captures a snippet of people's socio-economic status, but this could be expanded in future studies to include wealth, migrant status, job type, etc.

It has been suggested that investigations of urban green spaces could help researchers go beyond GDP in understanding happiness unrelated to economic growth [50]. Within our study, which is conducted in a country with a higher GDP, we see that socio-economic factors still play an important role in people's life satisfaction, to a somewhat greater extent than exposure. A possible explanation is the overall low greenery in Iceland due to the sub-arctic tundra-like conditions. The ratio of green space among the total activity spaces of people was very low. Another possible reason is the predominant car-oriented lifestyle and built environment [15], which means that people could be less exposed to the greenery during daily commutes [83] or feel less of a positive feeling from it due to the short exposure duration [78,79]. In addition, there could be other underlying reasons connecting life satisfaction and daily mobility, such as accessibility [24,84], commuting-related stress [33], or companionship [27], that overshadow exposure impacts but are not captured in our data.

4.2. Exposure and Travel

Even when socio-economic background was included, the canonical correlation analysis showed that having less exposure to green spaces during daily mobility was correlated with higher domestic and international travel emissions. In addition, more exposure to gray spaces was positively correlated with domestic and international leisure travel emissions. However, exposure becomes less significant when attitudinal variables are added, and the results indicate something different. As exposure overall goes up, so do emissions, which could indicate that people who are highly mobile and busy in their day-to-day also travel more for leisure, or conversely, exposure does not matter much in decision making. High mobility levels could stem from mobility due to residential location or socio-economic status or from a general disposition toward being mobile. In addition, exposure to gray and green spaces during daily mobility could affect attitudinal variables, such as feeling it is necessary to take a break from urban life or the preference for spending weekends in the city rather than in wilderness areas. Prior studies have also indicated the significance of a cosmopolitan attitude, i.e., a desire to experience new things and different cultures, in long-distance leisure travel behavior, especially in the case of international and air travel [11,12,33].

Although not captured within our models, it is possible that there is a connection between exposure and wellbeing via engagement in leisure travel, as studies have shown the positive impact of leisure travel on life satisfaction from the trip experience itself [28–30]. A lack of green spaces has been linked to increased leisure travel [48] and is a theme also covered in the travel behavior literature in the form of the compensation or escape hypothesis, which hints that people travel to escape negative or limited aspects of the urban environment [18].

It is important to note that both wellbeing and travel are complex topics, as they depend heavily on human behavior, which is difficult to model accurately. Humans are emotional and social beings, which leads to uncertainties and unpredictability in such studies. Therefore, studies like this can only capture a portion of the patterns related to wellbeing and travel.

4.3. Policy Implications

Considering the significant climate impact of urban settlements and transportation [85], cities are vital to climate change mitigation efforts [2,3]. As the study was based on a single case study of Reykjavík, Iceland, strong and generalizable policy suggestions cannot be made. However, there are broader implications for urban planning that could be considered for the benefit of wellbeing and climate. Urban areas in their form and land use can impact the wellbeing of the residents living there [37,38]. At the same time, GHG emission reduction targets in high-income countries such as Iceland could be more ambitious, as they could also support wellbeing [86]. There are many ways in which urban planning can meet the needs of residents and help with climate mitigation targets, especially considering that people tend to adjust their behaviors to the environment they live in [35].

In this study, we found that being more exposed to gray spaces during daily mobility could lead to more emissions from long-distance leisure travel. Since we spend a lot of our time commuting, efforts should be made to make the commuting experience more pleasant by transport mode [22–24,87] and by increasing accessibility through public and active travel modes and reducing distances [23,24,88]. This could be achieved by transforming the already-built infrastructure [89–92] but also by enabling more remote or co-working opportunities (while considering the environmental impacts of co-working versus on-site work) [93]. Reykjavík, specifically, has been criticized for being car oriented and having a sprawled urban form with long daily commuting distances for many [15,94].

Local policy should take a people-oriented approach by creating mixed-use neighborhoods that support walkability [95,96], which could benefit both people's wellbeing and the climate. The creation of walkable neighborhoods should be combined with improved public transport. The City of Reykjavík is currently working on a bus rapid transit system, although the plan has received criticism due to the slow speed of implementation. Usage of public transport could be encouraged by both governmental and employer incentives as well as by disincentivizing car use through, e.g., reduced parking spaces and increased costs, and by improving the time-competitiveness of public transport with lane space allocation. However, planning needs to consider seasonal and diurnal changes that may affect the usability of the urban environment [97], particularly in rapidly changing Arctic weather conditions like those in Reykjavík. For public transport, schedules should be frequent, and pavilions should withstand heavy wind and rain or snow, to reduce discomfort due to weather during the daily commute.

Increases in densification and less exposure to greenness can have negative implications on human health [98,99]. Urban planning should promote the establishment of parks and other public spaces with free-to-use amenities, which could provide an attractive alternative to frequent leisure travel away from the city [89,100–102]. In general, having more free time, even if it is spent at home on weekends with activities to do locally, has shown benefits for wellbeing [29]. Furthermore, several studies have noted the importance of the accessibility and usability of parks and green spaces for the residents [103–105]. Urban planning should make sure that parks are accessible to all residents, regardless of socio-demographic background or physical ability, and that a car is not a necessity to reach urban green spaces. Green spaces and infrastructure have also shown positive impacts in reducing air and noise pollution, limiting the urban heat island effect, and increasing urban biodiversity [90,92]. Therefore, policies supporting urban green space establishment, maintenance, and usability could yield many benefits for climate change mitigation as well as for people's wellbeing. Aside from greenery, the city could support creating colorful buildings and street art, which could improve the satisfaction of commuters [106] and encourage the use of active transport modes [83,107].

In addition to local-level policies and planning, reductions in long-distance leisure travel emissions need to occur to meet climate mitigation targets [108]. People are more likely to change their travel destination choice than the mode of transport [109], which could be an incentive to provide more diverse leisure opportunities both within the city and domestically to reduce travel distances. Furthermore, national policies should aim to reduce work-related air travel, as it is less likely to impact wellbeing [110].

4.4. Limitations and Future Research

This study has several limitations that invite future research. Firstly, the low greenery in Iceland, due to its sub-arctic nature, is reflected in Reykjavík. Our dataset captures land use typology but does not account for street-level greenery or private yards, potentially affecting the findings related to green space exposure and wellbeing or travel behavior. Furthermore, the study area is relatively low in density. Future studies could benefit from more detailed datasets, and similar studies could be conducted in urban areas that are greener or denser.

Secondly, the cross-sectional design limits the ability to infer causality, making the observed relationships correlational. Longitudinal studies are needed to understand causal pathways and dynamics over time. While canonical correlation analysis is suitable for exploring the relationships between multidimensional variables, it assumes linear relationships, which may not capture the complexity of human behavior and environmental interactions.

The use of softGIS data, although generally a strength, also has limitations. The self-reported nature of the survey data may introduce biases such as social desirability bias. While previous research indicates generally satisfactory quality in softGIS data [111], the spatial accuracy of markings can be variable, introducing biases to the modeling. The lack of a temporal dimension is another limitation [112]. The availability of temporal information could enhance exposure assessment quality. Although we tried to mitigate this by incorporating the frequency of visits and travel speeds into exposure estimations, future studies would benefit from including temporal data to further improve exposure estimation.

The current data capture a snapshot of environmental exposure at a specific time, without accounting for seasonal or daily variations. Future studies should incorporate temporal data for a more dynamic understanding. Additionally, expanding the age range of participants to include older adults could provide insights into how different age groups perceive and are influenced by urban green and gray spaces, enhancing the generalizability of the findings. What is more, using diverse and complementary measures for urban greenness could enhance the understanding of the connections between urban greenness and wellbeing [113].

Investigating exposure to environmental pollution such as air and noise pollution in relation to life satisfaction and travel behavior could be valuable. Given Reykjavík's car-oriented urban form, understanding how pollution exposure affects residents' wellbeing and travel choices would be beneficial. Comparative studies across different urban contexts, both within and outside Iceland, could help assess the generalizability of the findings, considering variations in urban form, climate, and socio-economic conditions.

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Data Availability Statement: An anonymized quantitative data file (SPSS) can be obtained on request from Jukka Heinonen, email: heinonen@hi.is.

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Appendix A

Table A1. Overview of means of exposure variables (independent group) split by socio-demographic variables used in the study.

		Distance to Nearest Water Body		Avg. Exposure to Green Spaces		Avg. Exposure to Gray Spaces		Avg. Exposure to Green Spaces (%)		Avg. Exposure to Gray Spaces (%)	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Gender	Male	501.121	290.469	0.204	0.108	0.223	0.107	5.518%	0.018	21.464%	0.051
	Female + other	476.758	291.130	0.200	0.104	0.221	0.109	5.464%	0.019	22.162%	0.050
Education level	Low	495.424	298.260	0.198	0.111	0.220	0.113	5.408%	0.019	21.449%	0.050
	Medium	491.008	269.872	0.197	0.103	0.220	0.105	5.440%	0.018	21.515%	0.054
	High	479.284	308.143	0.209	0.102	0.227	0.108	5.577%	0.017	21.974%	0.048

Table A1. *Cont.*

		Distance to Nearest Water Body		Avg. Exposure to Green Spaces		Avg. Exposure to Gray Spaces		Avg. Exposure to Green Spaces (%)		Avg. Exposure to Gray Spaces (%)	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Income level	Low	544.046	326.688	0.238	0.139	0.270	0.152	4.981%	0.017	22.971%	0.056
	Medium	504.554	300.300	0.209	0.132	0.223	0.115	5.507%	0.021	21.880%	0.050
	High	488.359	289.942	0.207	0.103	0.232	0.120	5.355%	0.018	21.498%	0.051
	Very high	474.470	280.260	0.190	0.083	0.211	0.087	5.646%	0.018	21.712%	0.051
Working hours (weekly)	Less than 30	481.886	315.855	0.206	0.129	0.220	0.103	5.035%	0.018	21.902%	0.061
	30 to 35	439.014	248.051	0.197	0.090	0.214	0.082	5.558%	0.024	20.550%	0.054
	35 to 40	451.310	284.596	0.214	0.111	0.234	0.115	5.489%	0.016	21.528%	0.056
	40 to 45	514.885	293.640	0.197	0.105	0.219	0.113	5.707%	0.017	22.141%	0.047
	More than 45	494.639	291.222	0.200	0.096	0.222	0.103	5.367%	0.019	21.587%	0.047

Table A2. Overview of means of wellbeing and travel emissions (dependent group) split by socio-demographic variables used in the study.

		Wellbeing (Composite Variable)		Domestic Travel Emissions ($kgCO_2$-eq/Year)		International Travel Emissions ($kgCO_2$-eq/Year)	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Gender	Male	7.206	1.608	258.138	324.847	2505.281	2771.526
	Female + other	6.787	1.951	287.407	465.862	2552.323	3076.891
Education level	Low	6.454	2.160	259.696	514.761	2034.321	2297.518
	Medium	6.935	1.704	269.195	312.789	2525.530	2825.838
	High	7.476	1.510	271.557	376.143	2880.535	3328.625
Income level	Low	6.292	2.432	182.115	208.699	2141.180	3426.075
	Medium	6.610	1.799	270.708	320.842	2487.501	3103.035
	High	7.078	1.524	230.749	300.472	2639.344	2794.357
	Very high	7.425	1.645	296.969	458.530	2620.648	2578.710
Working hours (weekly)	Less than 30	6.087	2.250	261.726	402.914	1757.590	2289.656
	30 to 35	7.195	1.832	305.100	452.878	2347.284	3207.163
	35 to 40	6.867	1.943	259.208	504.747	2516.713	2488.361
	40 to 45	7.322	1.517	254.943	322.462	2605.024	2557.517
	More than 45	7.023	1.649	282.888	341.830	2834.138	3706.349

Table A3. Comparison of means between socio-demographic groups for variables used in the study. Non-parametric testing was performed to identify whether there were significant differences between the groups.

		Distance to Nearest Water Body	Avg. Exposure to Green Spaces	Avg. Exposure to Gray Spaces	Avg. Exposure to Green Spaces (%)	Avg. Exposure to Gray Spaces (%)	Wellbeing (Composite)	Domestic Leisure Travel Emissions	International Leisure Travel Emissions
Gender	Mann–Whitney U	48,370.500	49,582.000	49,767.000	49,761.000	47,498.000	46,469.500	49,634.000	51,518.000
	Z	−1.413	−0.905	−0.828	−0.830	−1.779	−2.212	−0.866	−0.094
	Sig.	0.158	0.365	0.408	0.406	0.075	0.027	0.376	0.925
Education level	Kruskal–Wallis H	1.303	4.802	1.631	1.622	7.037	7.325	7.343	6.522
	df	2	2	2	2	4	3	2	2
	Sig.	0.521	0.091	0.442	0.444	0.134	0.062	0.025	0.038
Working hours (weekly)	Kruskal–Wallis H	6.395	4.430	4.366	1.278	5.517	3.03	1.894	11.398
	df	4	4	4	2	4	3	4	4
	Sig.	0.172	0.351	0.359	0.528	0.238	0.387	0.755	0.022
Income level	Kruskal–Wallis H	2.025	4.573	4.911	31.517	22.072	37.321	2.331	7.439
	df	3	3	3	2	4	3	3	3
	Sig.	0.567	0.206	0.178	<0.001	<0.001	<0.001	0.507	0.059

Table A4. Full statistical overview of life satisfaction variables used in the study.

How Satisfied Are You with. . .?	N	Mean	Median	SD	Min	Max	Skewness		Kurtosis		Shapiro–Wilk		Percentiles		
							Skewness	SE	Kurtosis	SE	W	p	25th	50th	75th
your life as a whole these days	667	7.348	8	2.205	0	10	−1.307	0.095	1.503	0.189	0.865	<0.001	7	8	9
your material standard of living	667	6.675	7	2.525	0	10	−0.947	0.095	0.322	0.189	0.905	<0.001	5	7	8
your current state of health	667	6.993	8	2.468	0	10	−1.023	0.095	0.420	0.189	0.892	<0.001	6	8	9
your personal relationships	667	7.565	8	2.306	0	10	−1.319	0.095	1.306	0.189	0.849	<0.001	7	8	9
feeling part of your community	667	6.843	8	2.590	0	10	−1.038	0.095	0.409	0.189	0.886	<0.001	6	8	9
the quality of your local environment	667	6.025	6	2.628	0	10	−0.490	0.095	−0.581	0.189	0.947	<0.001	4	6	8
your main occupation such as job or studies	667	7.087	8	2.394	0	10	−1.231	0.095	1.109	0.189	0.869	<0.001	6	8	9
things you are achieving in life	667	7.286	8	2.107	0	10	−1.311	0.095	1.779	0.189	0.873	<0.001	7	8	9
the amount of time you have to do things you like doing	667	6.916	7	2.357	0	10	−1.150	0.095	0.956	0.189	0.884	<0.001	6	7	8
how safe you feel	667	7.853	8	2.226	0	10	−1.588	0.095	2.339	0.189	0.812	<0.001	7	8	9

Table A5. Canonical correlation variates (1–7) between exposure (X) and life satisfaction (Y) for Model 1a.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.240	0.061	0.858	1.438	70.000	3796.935	0.010
2	0.190	0.037	0.911	1.139	54.000	3324.056	0.227
3	0.154	0.024	0.945	0.933	40.000	2844.797	0.591
4	0.124	0.016	0.968	0.772	28.000	2355.847	0.798
5	0.097	0.009	0.983	0.637	18.000	1850.277	0.873
6	0.077	0.006	0.992	0.528	10.000	1310.000	0.871
7	0.046	0.002	0.998	0.353	4.000	656.000	0.842

H0 for Wilks test is that the correlations in the current and following rows are zero.

Table A6. Canonical correlations between exposure (X) and travel emissions (Y) for Model 2a.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.175	0.031	0.955	2.209	14.000	1316.000	0.006
2	0.124	0.016	0.985	1.714	6.000	659.000	0.115

H0 for Wilks test is that the correlations in the current and following rows are zero.

Table A7. Canonical correlations between exposure (X) and life satisfaction (Y), repeated with only relevant exposure variables, for Model 1b.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.221	0.052	0.922	2.705	20.000	1310.000	0.000
2	0.174	0.031	0.970	2.270	9.000	656.000	0.017

H0 for Wilks test is that the correlations in the current and following rows are zero.

Table A8. Canonical correlations between exposure (X) and leisure travel emissions, repeated with only relevant exposure variables, for Model 2b.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.147	0.022	0.974	4.315	4.000	1326.000	0.002
2	0.064	0.004	0.996	2.711	1.000	664.000	0.100

H0 for Wilks test is that the correlations in the current and following rows are zero.

Table A9. Canonical correlation variates between exposure, socio-demographic background (independent), and life satisfaction (dependent) for Model 3.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.465	0.277	0.572	4.815	70.000	3347.952	0.000
2	0.344	0.134	0.730	3.461	54.000	2931.431	0.000
3	0.259	0.072	0.827	2.787	40.000	2509.161	0.000
4	0.243	0.063	0.887	2.517	28.000	2078.220	0.000
5	0.169	0.029	0.942	1.921	18.000	1632.488	0.011
6	0.151	0.023	0.970	1.765	10.000	1156.000	0.062
7	0.084	0.007	0.993	1.038	4.000	579.000	0.387

H0 for Wilks test is that the correlations in the current and following rows are zero.

Table A10. Canonical correlation variates between exposure, socio-demographic background (independent), and leisure travel emissions (dependent) for Model 4.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.257	0.071	0.918	3.648	14.000	1162.000	0.000
2	0.132	0.018	0.983	1.720	6.000	582.000	0.114

H0 for Wilks test is that the correlations in the current and following rows are zero.

Table A11. Canonical correlation variates between exposure, socio-demographic background, attitudes (independent), and leisure travel emissions (dependent) for Model 5.

Variate Nr.	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	Sig.
1	0.376	0.165	0.787	5.205	22.000	898.000	0.000
2	0.289	0.091	0.916	4.107	10.000	450.000	0.000

H0 for Wilks test is that the correlations in the current and following rows are zero.

References

1. Wei, T.; Wu, J.; Chen, S. Keeping Track of Greenhouse Gas Emission Reduction Progress and Targets in 167 Cities Worldwide. *Front. Sustain. Cities* **2021**, *3*, 696381. [CrossRef]
2. Bai, X.; Dawson, R.J.; Ürge-Vorsatz, D.; Delgado, G.C.; Barau, A.S.; Dhakal, S.; Dodman, D.; Leonardsen, L.; Masson-Delmotte, V.; Roberts, D.C.; et al. Six research priorities for cities and climate change. *Nature* **2018**, *555*, 7694. [CrossRef]
3. Calvin, K.; Dasgupta, D.; Krinner, G.; Mukherji, A.; Thorne, P.W.; Trisos, C.; Romero, J.; Aldunce, P.; Barrett, K.; Blanco, G.; et al. *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*; Core Writing Team, Lee, H., Romero, J., Eds.; Intergovernmental Panel on Climate Change (IPCC): Geneva, Switzerland, 2023. [CrossRef]
4. UN-Habitat. Urbanization and development: Emerging futures. In *World Cities Report*; no. 2016; UN-Habitat: Nairobi, Kenya, 2022.
5. Yan, Z.-W.; Wang, J.; Xia, J.-J.; Feng, J.-M. Review of recent studies of the climatic effects of urbanization in China. *Adv. Clim. Change Res.* **2016**, *7*, 154–168. [CrossRef]
6. Khurshid, A.; Khan, K.; Saleem, S.F.; Cifuentes-Faura, J.; Calin, A.C. Driving towards a sustainable future: Transport sector innovation, climate change and social welfare. *J. Clean. Prod.* **2023**, *427*, 139250. [CrossRef]
7. Foster, S.; Giles-Corti, B.; Bolleter, J.; Turrell, G. Denser habitats: A longitudinal study of the impacts of residential density on objective and perceived neighbourhood amenity in Brisbane, Australia. *Cities* **2023**, *143*, 104565. [CrossRef]

8. Monteiro, J.; Sousa, N.; Coutinho-Rodrigues, J.; Natividade-Jesus, E. Challenges Ahead for Sustainable Cities: An Urban Form and Transport System Review. *Energies* **2024**, *17*, 409. [CrossRef]
9. Hall, P. *Cities of Tomorrow: An Intellectual History of Urban Planning and Design Since 1880*, 4th ed.; Wiley Blackwell: Hoboken, NJ, USA, 2014; Available online: https://www.researchgate.net/publication/311558291_Cities_of_tomorrow_an_intellectual_history_of_urban_planning_and_design_since_1880 (accessed on 13 September 2020).
10. Lohrey, S.; Creutzig, F. A "sustainability window" of urban form. *Transp. Res. Part D Transp. Environ.* **2016**, *45*, 96–111. [CrossRef]
11. Muñiz, I.; Calatayud, D.; Dobaño, R. The compensation hypothesis in Barcelona measured through the ecological footprint of mobility and housing. *Landsc. Urban Plan.* **2013**, *113*, 113–119. [CrossRef]
12. Næss, P. Built environment, causality and urban planning. *Plan. Theory Pract.* **2016**, *17*, 52–71. [CrossRef]
13. Strandell, A.; Hall, C.M. Impact of the residential environment on second home use in Finland—Testing the compensation hypothesis. *Landsc. Urban Plan.* **2015**, *133*, 12–23. [CrossRef]
14. Næss, P. Urban form and travel behavior: Experience from a Nordic context. *JTLU* **2012**, *5*, 21–45. [CrossRef]
15. Heinonen, J.; Czepkiewicz, M.; Árnadóttir, Á.; Ottelin, J. Drivers of Car Ownership in a Car-Oriented City: A Mixed-Method Study. *Sustainability* **2021**, *13*, 619. [CrossRef]
16. Czepkiewicz, M.; Ottelin, J.; Ala-Mantila, S.; Heinonen, J.; Hasanzadeh, K.; Kyttä, M. Urban structural and socioeconomic effects on local, national and international travel patterns and greenhouse gas emissions of young adults. *J. Transp. Geogr.* **2018**, *68*, 130–141. [CrossRef]
17. Czepkiewicz, M.; Árnadóttir, Á.; Heinonen, J. Flights Dominate Travel Emissions of Young Urbanites. *Sustainability* **2019**, *11*, 6340. [CrossRef]
18. Czepkiewicz, M.; Heinonen, J.; Ottelin, J. Why do urbanites travel more than do others? A review of associations between urban form and long-distance leisure travel. *Environ. Res. Lett.* **2018**, *13*, 073001. [CrossRef]
19. Ryan, R.M.; Deci, E.L. On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annu. Rev. Psychol.* **2001**, *52*, 141–166. [CrossRef]
20. Veenhoven, R. How do we assess how happy we are? Tenets, implications and tenability of three theories. In *Happiness, Economics and Politics: Towards a Multi-Disciplinary Approach*; Edward Elgar Publishing: Cheltenham, UK, 2009; pp. 45–69.
21. Höysniemi, S.; Salonen, A.O. Towards Carbon-Neutral Mobility in Finland: Mobility and Life Satisfaction in Day-to-Day Life. *Sustainability* **2019**, *11*, 5374. [CrossRef]
22. Friman, M.; Gärling, T.; Ettema, D.; Olsson, L.E. How does travel affect emotional well-being and life satisfaction? *Transp. Res. Part A Policy Pract.* **2017**, *106*, 170–180. [CrossRef]
23. Mouratidis, K. Compact city, urban sprawl, and subjective well-being. *Cities* **2019**, *92*, 261–272. [CrossRef]
24. Zhu, J.; Fan, Y. Daily travel behavior and emotional well-being: Effects of trip mode, duration, purpose, and companionship. *Transp. Res. Part A Policy Pract.* **2018**, *118*, 360–373. [CrossRef]
25. Chatterjee, K.; Chng, S.; Clark, B.; Davis, A.; De Vos, J.; Ettema, D.; Handy, S.; Martin, A.; Reardon, L. Commuting and wellbeing: A critical overview of the literature with implications for policy and future research. *Transp. Rev.* **2020**, *40*, 5–34. [CrossRef]
26. Guillen-Royo, M. Flying less, mobility practices, and well-being: Lessons from the COVID-19 pandemic in Norway. *Sustain. Sci. Pract. Policy* **2022**, *18*, 278–291. [CrossRef]
27. Ramanathan, S.; O'Brien, C.; Faulkner, G.; Stone, M. Happiness in Motion: Emotions, Well-Being, and Active School Travel. *J. Sch. Health* **2014**, *84*, 516–523. [CrossRef] [PubMed]
28. Chen, C.-C.; Petrick, J.F.; Shahvali, M. Tourism Experiences as a Stress Reliever: Examining the Effects of Tourism Recovery Experiences on Life Satisfaction. *J. Travel Res.* **2016**, *55*, 150–160. [CrossRef]
29. De Bloom, J.; Nawijn, J.; Geurts, S.; Kinnunen, U.; Korpela, K. Holiday travel, staycations, and subjective well-being. *J. Sustain. Tour.* **2017**, *25*, 573–588. [CrossRef]
30. Su, L.; Tang, B.; Nawijn, J. Eudaimonic and hedonic well-being pattern changes: Intensity and activity. *Annu. Tour. Res.* **2020**, *84*, 103008. [CrossRef]
31. Sirgy, M.J.; Kruger, P.S.; Lee, D.-J.; Yu, G.B. How Does a Travel Trip Affect Tourists' Life Satisfaction? *J. Travel Res.* **2011**, *50*, 261–275. [CrossRef]
32. Kumar, A.; Killingsworth, M.A.; Gilovich, T. Waiting for Merlot: Anticipatory Consumption of Experiential and Material Purchases. *Psychol. Sci.* **2014**, *25*, 1924–1931. [CrossRef]
33. Raudsepp, J.; Árnadóttir, Á.; Czepkiewicz, M.; Heinonen, J. Long-Distance Travel and the Urban Environment: Results from a Qualitative Study in Reykjavik. *Urban Plan.* **2020**, *6*, 257–270. [CrossRef]
34. Næss, P. Are Short Daily Trips Compensated by Higher Leisure Mobility? Environ. *Plan. B Plan. Des.* **2006**, *33*, 197–220. [CrossRef]
35. Van de Coevering, P.; Maat, K.; Kroesen, M.; van Wee, B. Causal effects of built environment characteristics on travel behaviour: A longitudinal approach. *Eur. J. Transp. Infrastruct. Res.* **2016**, *16*, 674–697. [CrossRef]
36. Nieuwenhuijsen, M.J. Urban and transport planning pathways to carbon neutral, liveable and healthy cities; A review of the current evidence. *Environ. Int.* **2020**, *140*, 105661. [CrossRef] [PubMed]
37. Badland, H.; Foster, S.; Bentley, R.; Higgs, C.; Roberts, R.; Pettit, C.; Giles-Corti, B. Examining associations between area-level spatial measures of housing with selected health and wellbeing behaviours and outcomes in an urban context. *Health Place* **2017**, *43*, 17–24. [CrossRef] [PubMed]

38. Olsen, J.R.; Nicholls, N.; Mitchell, R. Are urban landscapes associated with reported life satisfaction and inequalities in life satisfaction at the city level? A cross-sectional study of 66 European cities. *Soc. Sci. Med.* **2019**, *226*, 263–274. [CrossRef] [PubMed]
39. Kyttä, M.; Broberg, A.; Haybatollahi, M.; Schmidt-Thomé, K. Urban happiness: Context-sensitive study of the social sustainability of urban settings. *Environ. Plan. B Plan. Des.* **2016**, *43*, 34–57. [CrossRef]
40. Ram, B.; Limb, E.S.; Shankar, A.; Nightingale, C.M.; Rudnicka, A.R.; Cummins, S.; Clary, C.; Lewis, D.; Cooper, A.R.; Page, A.S.; et al. Evaluating the effect of change in the built environment on mental health and subjective well-being: A natural experiment. *J. Epidemiol. Community Health* **2020**, *74*, 631–638. [CrossRef]
41. Bakolis, I.; Hammoud, R.; Smythe, M.; Gibbons, J.; Davidson, N.; Tognin, S.; Mechelli, A. Urban Mind: Using Smartphone Technologies to Investigate the Impact of Nature on Mental Well-Being in Real Time. *BioScience* **2018**, *68*, 134–145. [CrossRef]
42. Bonaiuto, M.; Chiozza, V. Environmental impacts of quality of life via environmental psychology. In *Handbook of Quality of Life Research: Place and Space Perspectives*; Edward Elgar Publishing: Cheltenham, UK, 2024; pp. 45–59.
43. Lebrasseur, R. Linking human wellbeing and urban greenspaces: Applying the SoftGIS tool for analyzing human wellbeing interaction in Helsinki, Finland. *Front. Environ. Sci.* **2022**, *10*, 950894. [CrossRef]
44. Mouratidis, K. Urban planning and quality of life: A review of pathways linking the built environment to subjective well-being. *Cities* **2021**, *115*, 103229. [CrossRef]
45. Roe, J.J.; Thompson, C.W.; Aspinall, P.A.; Brewer, M.J.; Duff, E.I.; Miller, D.; Mitchell, R.; Clow, A. Green Space and Stress: Evidence from Cortisol Measures in Deprived Urban Communities. *Int. J. Environ. Res. Public Health* **2013**, *10*, 4086–4103. [CrossRef]
46. Brown, Z.S.; Oueslati, W.; Silva, J. Links between urban structure and life satisfaction in a cross-section of OECD metro areas. *Ecol. Econ.* **2016**, *129*, 112–121. [CrossRef]
47. Hrehorowicz-Gaber, H. Effects of transformations in the urban structure on the quality of life of city residents in the context of recreation. *Bull. Geogr. Socio-Econ. Ser.* **2013**, *21*, 61–68. Available online: https://www.ceeol.com/search/article-detail?id=125898 (accessed on 21 March 2024). [CrossRef]
48. Sijtsma, F.J.; de Vries, S.; van Hinsberg, A.; Diederiks, J. Does "grey" urban living lead to more "green" holiday nights? A Netherlands Case Study. *Landsc. Urban Plan.* **2012**, *105*, 250–257. [CrossRef]
49. Neale, C.; Hoffman, J.; Jefferson, D.; Gohlke, J.; Boukhechba, M.; Mondschein, A.; Wang, S.; Roe, J. The impact of urban walking on psychophysiological wellbeing. *Cities Health* **2022**, *6*, 1053–1066. [CrossRef]
50. Kwon, O.-H.; Hong, I.; Yang, J.; Wohn, D.Y.; Jung, W.-S.; Cha, M. Urban green space and happiness in developed countries. *EPJ Data Sci.* **2021**, *10*, 1–13. [CrossRef]
51. Ambrey, C.L.; Daniels, P. Happiness and footprints: Assessing the relationship between individual well-being and carbon footprints. *Environ. Dev. Sustain.* **2017**, *19*, 895–920. [CrossRef]
52. Vita, G.; Ivanova, D.; Dumitru, A.; García-Mira, R.; Carrus, G.; Stadler, K.; Krause, K.; Wood, R.; Hertwich, E.G. Happier with less? Members of European environmental grassroots initiatives reconcile lower carbon footprints with higher life satisfaction and income increases. *Energy Res. Soc. Sci.* **2020**, *60*, 101329. [CrossRef]
53. Lucas, R.E.; Diener, E.; Suh, E. Discriminant validity of well-being measures. *J. Pers. Soc. Psychol.* **1996**, *71*, 616–628. [CrossRef]
54. Diener, E.; Emmons, R.A.; Larsen, R.J.; Griffin, S. The Satisfaction With Life Scale. *J. Pers. Assess.* **1985**, *49*, 71–75. [CrossRef]
55. Huta, V.; Waterman, A.S. Eudaimonia and Its Distinction from Hedonia: Developing a Classification and Terminology for Understanding Conceptual and Operational Definitions. *J. Happiness Stud.* **2014**, *15*, 1425–1456. [CrossRef]
56. Statistics Iceland. Population by Municipality, Sex, Citizenship and Quarters 2010–2023. Available online: https://px.hagstofa.is/pxen/pxweb/en/Ibuar/Ibuar__mannfjoldi__1_yfirlit__arsfjordungstolur/MAN10001.px/table/tableViewLayout2/ (accessed on 3 December 2023).
57. Saneinejad, S.; Roorda, M.J.; Kennedy, C. Modelling the impact of weather conditions on active transportation travel behaviour. *Transp. Res. Part D Transp. Environ.* **2012**, *17*, 129–137. [CrossRef]
58. Kristinsdóttir, J.G. Dagsljós í Stækkandi Borgarlandslagi á 64N. BS Ritgerð, Landbúnaðarháskóli Íslands, Hvanneyri, Ísland. 2023. Available online: https://skemman.is/bitstream/1946/44834/1/Dagslj%C3%B3s%20%C3%AD%20st%C3%A6kkandi%20borgarlandslagi%20%C3%A1%2064N_LOKASKIL_vol.MAX_J%C3%B3naG.Kristins.pdf (accessed on 22 March 2024).
59. Logadóttir, Á.; Guðmundsson, L.S.; Hjálmarsson, Ó. Þétting Byggðar—Lýðheilsa og Lífsgæði. *Kjarninn*. Available online: https://kjarninn.is/skodun/2020-10-30-thetting-byggdar-lydheilsa-og-lifsgaedi/ (accessed on 22 March 2024).
60. Pálsdóttir, I.Þ. "Þetta er Svolítið Búið að Vera Villta Vestrið". *Morgunblaðið*. Available online: https://www.mbl.is/frettir/innlent/2022/08/13/thetta_er_svolitid_buid_ad_vera_villta_vestrid/ (accessed on 22 March 2024).
61. Reynisson, J.T. Skuggaborgin: Margföld Þétting Byggðar. *Heimildin*. Available online: https://stundin.is/grein/15217/ (accessed on 22 March 2024).
62. Ragnarsson, J.Í. Spyr Hvort Aka Þurfi á Barn Svo Eitt-Hvað Verði Gert—Vísir. *Visir.is*. Available online: https://www.visir.is/g/20242541093d/spyr-hvort-aka-thurfi-a-barn-svo-eitt-hvad-verdi-gert (accessed on 22 March 2024).
63. Brown, G.; Kyttä, M. Key issues and research priorities for public participation GIS (PPGIS): A synthesis based on empirical research. *Appl. Geogr.* **2014**, *46*, 122–136. [CrossRef]
64. Czepkiewicz, M.; Jankowski, P.; Zwoliński, Z. Geo-questionnaire: A spatially explicit method for eliciting public preferences, behavioural patterns, and local knowledge—An overview. *Quaest. Geogr.* **2018**, *37*, 177–190. Available online: http://yadda.

icm.edu.pl/yadda/element/bwmeta1.element.ojs-issn-2081-6383-year-2018-volume-37-issue-3-article-17417 (accessed on 28 November 2021). [CrossRef]
65. Hasanzadeh, K.; Ikeda, E.; Mavoa, S.; Smith, M. Children's physical activity and active travel: A cross-sectional study of activity spaces, sociodemographic and neighborhood associations. *Child. Geogr.* **2023**, *21*, 287–305. [CrossRef]
66. Marwa, W.L.; Radley, D.; Davis, S.; McKenna, J.; Griffiths, C. Exploring factors affecting individual GPS-based activity space and how researcher-defined food environments represent activity space, exposure and use of food outlets. *Int. J. Health Geogr.* **2021**, *20*, 34. [CrossRef]
67. Hasanzadeh, K.; Laatikainen, T.; Kyttä, M. A place-based model of local activity spaces: Individual place exposure and characteristics. *J. Geogr. Syst.* **2018**, *20*, 227–252. [CrossRef]
68. Hasanzadeh, K.; Broberg, A.; Kyttä, M. Where is my neighborhood? A dynamic individual-based definition of home ranges and implementation of multiple evaluation criteria. *Appl. Geogr.* **2017**, *84*, 1–10. [CrossRef]
69. OpenStreetMap Contributors. OpenStreetMap Iceland Data. Geofabrik GmbH. Available online: https://download.geofabrik.de/europe/iceland-180101-free.shp.zip (accessed on 19 February 2024).
70. Geofabrik Download Server. Available online: https://download.geofabrik.de/europe/iceland.html# (accessed on 16 June 2024).
71. Hasanzadeh, K. IASM: Individualized activity space modeler. *SoftwareX* **2018**, *7*, 138–142. [CrossRef]
72. Chester, M.V.; Horvath, A. Environmental assessment of passenger transportation should include infrastructure and supply chains. *Environ. Res. Lett.* **2009**, *4*, 024008. [CrossRef]
73. U.S. Environmental Protection Agency. *Direct Emissions from Mobile Combustion Sources*; US Environmental Protection Agency Office of Air and Radiation: Washington, DC, USA, 2008; Available online: http://large.stanford.edu/courses/2013/ph240/cabrera2/docs/epa-430-k-08-004.pdf (accessed on 28 June 2024).
74. VTT. LIPASTO—A Calculation System for Traffic Exhaust Emissions and Energy Consumption in Finland. Available online: http://lipasto.vtt.fi/ (accessed on 9 December 2016).
75. Aamaas, B.; Borken-Kleefeld, J.; Peters, G.P. The climate impact of travel behavior: A German case study with illustrative mitigation options. *Environ. Sci. Policy* **2013**, *33*, 273–282. [CrossRef]
76. Hotelling, H. Relations Between Two Sets of Variates. *Biometrika* **1936**, *28*, 321. [CrossRef]
77. Thompson, B. *Canonical Correlation Analysis: Uses and Interpretation*; SAGE: Thousand Oaks, CA, USA, 1984.
78. Ayala-Azcárraga, C.; Diaz, D.; Zambrano, L. Characteristics of urban parks and their relation to user well-being. *Landsc. Urban Plan.* **2019**, *189*, 27–35. [CrossRef]
79. Yang, W.; Yang, R.; Li, X. A Canonical Correlation Analysis Study on the Association Between Neighborhood Green Space and Residents' Mental Health. *J. Urban Health* **2023**, *100*, 696–710. [CrossRef] [PubMed]
80. Çelik, F.; Jaiyeoba, E.B. The Contributions of the Green Areas in Residence Immediate Environment on Quality of Urban Life. *SAGE Open* **2023**, *13*, 21582440231220092. [CrossRef]
81. Douglas, O.; Russell, P.; Scott, M. Positive perceptions of green and open space as predictors of neighbourhood quality of life: Implications for urban planning across the city region. *J. Environ. Plan. Manag.* **2019**, *62*, 626–646. [CrossRef]
82. Næss, P. Tempest in a teapot: The exaggerated problem of transport-related residential self-selection as a source of error in empirical studies. *J. Transp. Land Use* **2014**, *7*, 57–79. [CrossRef]
83. Stefansdottir, H.; Næss, P.; Heinonen, J.; Czepkiewicz, M. The role of aesthetic quality in urban spaces to influence use of active transport modes. *J. Urban. Int. Res. Placemaking Urban Sustain.* **2024**, 1–26. [CrossRef]
84. Ettema, D.; Gärling, T.; Olsson, L.E.; Friman, M. Out-of-home activities, daily travel, and subjective well-being. Transportation ransp. *Res. Part A Policy Prac.* **2010**, *44*, 723–732. [CrossRef]
85. Crippa, M.; Guizzardi, D.; Pisoni, E.; Solazzo, E.; Guion, A.; Muntean, M.; Florczyk, A.; Schiavina, M.; Melchiorri, M.; Hutfilter, A.F. Global anthropogenic emissions in urban areas: Patterns, trends, and challenges. *Environ. Res. Lett.* **2021**, *16*, 074033. [CrossRef]
86. Sugiawan, Y.; Kurniawan, R.; Managi, S. Are carbon dioxide emission reductions compatible with sustainable well-being? *Appl. Energy* **2019**, *242*, 1–11. [CrossRef]
87. Friman, M.; Olsson, L.E.; Ståhl, M.; Ettema, D.; Gärling, T. Travel and residual emotional well-being. *Transp. Res. Part F Traffic Psychol. Behav.* **2017**, *49*, 159–176. [CrossRef]
88. De Vos, J.; Schwanen, T.; Van Acker, V.; Witlox, F. Travel and Subjective Well-Being: A Focus on Findings, Methods and Future Research Needs. *Transp. Rev.* **2013**, *33*, 421–442. [CrossRef]
89. Bertolini, L. From "streets for traffic" to "streets for people": Can street experiments transform urban mobility? *Transp. Rev.* **2020**, *40*, 734–753. [CrossRef]
90. Kayhanian, M.; Weiss, P.T.; Gulliver, J.S.; Khazanovich, L. The Application of Permeable Pavement with Emphasis on Successful Design, Water Quality Benefits, and Identification of Knowledge and Data Gaps. June 2015. Available online: https://escholarship.org/uc/item/7fp5s5g2 (accessed on 1 April 2024).
91. Semeraro, T.; Scarano, A.; Buccolieri, R.; Santino, A.; Aarrevaara, E. Planning of Urban Green Spaces: An Ecological Perspective on Human Benefits. *Land* **2021**, *10*, 105. [CrossRef]
92. Xie, N.; Akin, M.; Shi, X. Permeable concrete pavements: A review of environmental benefits and durability. *J. Clean. Prod.* **2019**, *210*, 1605–1621. [CrossRef]

93. Vaddadi, B.; Pohl, J.; Bieser, J.; Kramers, A. Towards a conceptual framework of direct and indirect environmental effects of co-working. In Proceedings of the ICT4S 2020–7th International Conference on ICT for Sustainability, Bristol, UK, 21–26 June 2020; pp. 27–35. [CrossRef]
94. Dillman, K.; Czepkiewicz, M.; Heinonen, J.; Fazeli, R.; Árnadóttir, Á.; Davíðsdóttir, B.; Shafiei, E. Decarbonization scenarios for Reykjavik's passenger transport: The combined effects of behavioural changes and technological developments. *Sustain. Cities Soc.* **2021**, *65*, 102614. [CrossRef]
95. Calafiore, A.; Dunning, R.; Nurse, A.; Singleton, A. The 20-minute city: An equity analysis of Liverpool City Region. *Transp. Res. Part D Transp. Environ.* **2022**, *102*, 103111. [CrossRef]
96. Tijana, Đ.; Tomić, N.; Tešić, D. Walkability and Bikeability for Sustainable Spatial Planning in the City of Novi Sad (Serbia). *Sustainability* **2023**, *15*, 378. [CrossRef]
97. Willberg, E.; Fink, C.; Toivonen, T. The 15-minute city for all?—Measuring individual and temporal variations in walking accessibility. *J. Transp. Geogr.* **2023**, *106*, 103521. [CrossRef]
98. Tharrey, M.; Klein, O.; Bohn, T.; Malisoux, L.; Perchoux, C. Nine-year exposure to residential greenness and the risk of metabolic syndrome among Luxembourgish adults: A longitudinal analysis of the ORISCAV-Lux cohort study. *Health Place* **2023**, *81*, 103020. [CrossRef]
99. Tharrey, M.; Malisoux, L.; Klein, O.; Bohn, T.; Perchoux, C. Urban densification over 9 years and change in the metabolic syndrome: A nationwide investigation from the ORISCAV-LUX cohort study. *Soc. Sci. Med.* **2023**, *331*, 116002. [CrossRef] [PubMed]
100. Kim, D.; Jin, J. Does happiness data say urban parks are worth it? *Landsc. Urban Plan.* **2018**, *178*, 1–11. [CrossRef]
101. Kingsley, J.; Foenander, E.; Bailey, A. "It's about community": Exploring social capital in community gardens across Melbourne, Australia. *Urban For. Urban Green.* **2020**, *49*, 126640. [CrossRef]
102. Koay, W.I.; Dillon, D. Community Gardening: Stress, Well-Being, and Resilience Potentials. *Int. J. Environ. Res. Public Health* **2020**, *17*, 6740. [CrossRef] [PubMed]
103. De Haas, W.; Hassink, J.; Stuiver, M. The Role of Urban Green Space in Promoting Inclusion: Experiences From the Netherlands. *Front. Environ. Sci.* **2021**, *9*, 618198. [CrossRef]
104. Noël, C.; Landschoot, L.V.; Vanroelen, C.; Gadeyne, S. Social Barriers for the Use of Available and Accessible Public Green Spaces. *Front. Sustain. Cities* **2021**, *3*, 744766. [CrossRef]
105. Reyes-Riveros, R.; Altamirano, A.; De La Barrera, F.; Rozas-Vásquez, D.; Vieli, L.; Meli, P. Linking public urban green spaces and human well-being: A systematic review. *Urban For. Urban Green.* **2021**, *61*, 127105. [CrossRef]
106. Gorzaldini, M.N. The Effects of Colors on the Quality of Urban Appearance. *MJSS* **2016**, *7*, 225. [CrossRef]
107. Fathi, S.; Sajadzadeh, H.; Mohammadi Sheshkal, F.; Aram, F.; Pinter, G.; Felde, I.; Mosavi, A. The Role of Urban Morphology Design on Enhancing Physical Activity and Public Health. *Int. J. Environ. Res. Public Health* **2020**, *17*, 2359. [CrossRef]
108. Wadud, Z.; Adeel, M.; Anable, J. Understanding the large role of long-distance travel in carbon emissions from passenger travel. *Nat. Energy* **2024**, *9*, 1129–1138. [CrossRef]
109. Kamb, A.; Lundberg, E.; Larsson, J.; Nilsson, J. Potentials for reducing climate impact from tourism transport behavior. *J. Sustain. Tour.* **2021**, *29*, 1365–1382. [CrossRef]
110. Guillen-Royo, M.; Nicholas, K.A.; Ellingsen, T.; Koch, M.; Julsrud, T.E. Flight-intensive practices and wellbeing: Current evidence and future research. *Consum. Soc.* **2024**, *3*, 374–394. [CrossRef]
111. Brown, G.; Weber, D.; de Bie, K. Is PPGIS good enough? An empirical evaluation of the quality of PPGIS crowd-sourced spatial data for conservation planning. *Land Use Policy* **2015**, *43*, 228–238. [CrossRef]
112. Fagerholm, N.; Raymond, C.M.; Olafsson, A.S.; Brown, G.; Rinne, T.; Hasanzadeh, K.; Broberg, A.; Kyttä, M. A methodological framework for analysis of participatory mapping data in research, planning, and management. *Int. J. Geogr. Inf. Sci.* **2021**, *35*, 1848–1875. [CrossRef]
113. Van Beek, J.F.; Malisoux, L.; Klein, O.; Bohn, T.; Tharrey, M.; Van Lenthe, F.J.; Beenackers, M.A.; Dijst, M.; Perchoux, C. Longitudinal study of changes in greenness exposure, physical activity and sedentary behavior in the ORISCAV-LUX cohort study. *Int. J. Health Geogr.* **2024**, *23*, 14. [CrossRef]