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Car-Free Day on a University Campus: Determinants of Participation and Potential Impacts on Sustainable Travel Behavior

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Abstract: This research investigates the potential of inducing willingness to travel less by car with a Car-Free Day campaign and reveals under which circumstances it could be more effective. An online survey was conducted after the event, wherein questions about attitudes toward the campaign, participation and intention of traveling less by car, as well as sociodemographic attributes and travel features were asked. First, the impacts of situational constraints (travel distance, trip chaining and perceived insecurity) on participation were investigated. Secondly, it was examined whether engaging with the campaign increases the intention of traveling less by car after controlling for sociodemographic attributes, attitudes toward the campaign and situational constraints. Logistic regression models have shown that increased travel distance and trip chaining curb participation in the campaign and that the odds of being positively influenced by the campaign is almost four times higher for individuals who engaged with the campaign compared with those who did not participate. This study provides important empirical evidence of a Car-Free Day campaign's potential of fostering a more sustainable travel behavior, which so far has not been systematically investigated. Finally, relevant policy implications and guidelines on the planning and conduction of a Car-Free Day event that could enhance the likelihood of its success were discussed.

Keywords: Car-Free Day; university campus mobility; soft transport policy; travel behavior; logistic regression

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1. Introduction

Intensive car use is associated with serious damage to the environment, human health and the economy. It has a great impact on climate change as passenger cars account for nearly half of the worldwide carbon dioxide emissions from the transport sector [1]. Locally, it is a major source of air pollution—mainly from nitrogen oxides, volatile organic compounds and particulate matter emissions [2], which causes hundreds of thousands premature deaths every year [3]. Moreover, the growing number of cars in urban areas increases congestion and traffic accidents, decreases citizens' quality of life and brings about considerable economic losses [4]. Although recent research has indicated that car use has reached its peak and has begun a downward trajectory [5–8], there are still major concerns about other issues such as improvements in fuel consumption, the pace of electric vehicle adoption and the increasing demand for heavier and more polluting vehicles [9]. More recently, with the onset of the COVID-19 pandemic, tight circulation restrictions significantly reduced the average distance traveled by car [10]. However, post-pandemic trends in car use are uncertain as the combined result of widespread disruptions in public transit, increased substitution of traveling by teleactivities and the rise of active transport remains unclear [11–16].

Despite the aforementioned externalities, traveling by car is usually fast, comfortable and convenient; a mix of advantages that makes it quite attractive when compared with more sustainable alternative modes. As a result, reducing its use entails a great challenge and requires devising efficient travel demand management strategies. Regarding the implementation of such strategies, they can be classified into hard and soft transport policy measures [17]. Hard measures are coercive policies that directly affect the attractiveness of travel either in a physical, an economic or a regulatory way. Implementing bus lanes, urban road pricing and road space rationing (e.g., alternate day travel, no-drive days) are common examples of such policies. These measures are often unpopular as they have limited political feasibility and are sometimes ineffective [4,18]. Alternatively, soft measures are voluntary and founded on behavioral motivations [19–21]. A well-known soft measure is the travel awareness campaign called Car-Free Day. Often carried out by municipal authorities, the event consists of inviting the population to travel without using a car on a specific day of the year [22,23]. These are usually accompanied by gatherings to discuss environmental impacts of car use and to motivate citizens to change their traditional and unsustainable travel habits. Although pioneering experiences date back to the late 1990s, evidence of the effects of Car-Free Days on citizens' behavior are somewhat scarce. Considering this motivation, the present study analyzed the community perception of a Car-Free Day campaign on a Brazilian university campus (http://www.saocarlos.usp.br/mobilidade-sustentavel-dia-sem-automovel-no-campus, access on: 5 February 2022). The issues related to increased car use on college campuses include the same direct and indirect costs as those seen on the city scale such as the costly provision of car parking spaces, congestion and human health impacts [24–26]. Therefore, knowing the circumstances under which these campaigns are likely to succeed is of great interest for better transport policymaking. Accordingly, the aim of the present study is two-fold: First, the impacts of situational constraints (travel distance, trip chaining and perceived insecurity) on participating in the campaign were investigated. Secondly, it was examined whether engaging with the campaign increases the intention of traveling less by car after controlling sociodemographic attributes, attitudes toward the campaign and situational constraints.

The remainder of the text is organized as follows: In Section 2, the underlying behavior theories that explain car use and the empirical research on Car-Free Day campaigns are discussed. Sections 3 and 4 present methodological aspects and a discussion of the results, respectively. Finally, conclusions are drawn and future research is outlined in Section 5.

2. Literature Review

2.1. Behavioral Foundations

Explaining pro-environmental behavior is a challenging task. Many behavioral theories underpin this theoretical endeavor such as the Prospect Theory, the Norm Activation Theory, the Value-Belief-Norm Theory, the Theory of Planned Behavior and the Self-Regulation Theory [27]. Referring specifically to car use, Bamberg et al. [17] state that the most successful approaches are the Theory of Planned Behavior (TPB) and the Norm-Activation Theory (NAT).

TPB evolved from the Attitude Theory [28,29] and postulates that the individual's intention to perform a behavior can be predicted from the attitude toward this behavior (opinion/appraisal), subjective norms (social pressure) and his/her perceived behavioral control. The latter can be interpreted as the recognition of the difficulty to perform an action, which is contingent upon many situational constraints such as the place of residence, workplace and other restrictions on how the trip can be made. Additionally, TPB scholars claim that these three factors are caused by a set of salient beliefs derived from information stimuli the individuals receive throughout their lives.

On a different note, NAT was developed to explain altruistic behavior [30] and was later refined into the Value-Belief-Norm Theory [31] to specifically account for pro-environmental behavior. The rationale behind NAT is that individuals seek to adjust their actions to meet personal norms that are grounded on a set of values and beliefs. The psychological process encompasses the recognition of adverse consequences induced by these actions, the perception of the ability to reduce the resulting threat and the following motivation to implement the behavioral change. It is important to distinguish between subjective and personal norms from TPB and NAT, respectively. The former refers to the expected social pressure of performing (or not performing) certain types of behaviors, whereas the latter is related to the felt obligation of changing the behavior considering the individual's own moral standards. The significance of the theorized relationships between the constructs claimed by both approaches has been widely demonstrated in many studies [32–34].

More recently, theories considering the inertial effects of habits on travel behavior expanded the explanatory power of travel choice models [35–37]. Admittedly, the repetitive nature of travel choices and the cost of searching and evaluating travel alternatives enhance the likelihood of the automaticity of behavior. Empirical studies found that—in relatively stable circumstances—habits moderate the relationship between the antecedents of behavior theorized in TPB and behavior itself [38–40]. An important framework that reconciles TPB and the effects of habits is the Theory of Interpersonal Behavior (TIB), first introduced by [41]. This theory agrees with TPB that intention precedes behavior, but only under new or unfamiliar circumstances [37,42], which requires deliberation to form a conscious decision. However, if this decision setting is regularly faced by an individual, the automaticity of behavior will be increasingly more likely to occur.

2.2. The Car-Free Day Initiative

The first initiatives resembling the current Car-Free Day campaigns were held in Switzerland from January to February 1974 as a reaction to the oil crisis [23]. However, it took two decades for these events to reappear with the kind of motivation they are currently acknowledged. Given the growing concern with the adverse effects of car dependency on the environment, public health and the economy, the municipal government of Reykjavik (Iceland) carried out their first Car-Free Day in June 1996 [22]. From 1997 to 1999, similar campaigns were launched in the United Kingdom, France, the Netherlands and Italy. These events were later centralized and articulated in the context of the European Mobility Week, taking place every 3rd week of September from 2000 onwards. Replicates emerged outside Europe shortly after that such as the Car-Free Days in: Bogotá, Colombia (2000); Chengdu, China (2000); Fremantle, Australia (2000); and Toronto, Canada (2001) [43]. Since then, 22 September has become the official celebration date of World Car-Free Day.

Although two decades of Car-Free Day experiences have passed, research investigating the outcomes of this practice are somewhat limited. Among the existing work, studies concerning the environmental impacts measured on the day of the campaign predominate. By comparing the concentration of pollutants on the day of the event to control periods of time, researchers evaluate whether these differences are statistically significant [44–46]. Overall, expressive reductions in pollutants were observed when the measurements were performed at the site of the event. However, when these emissions were surveyed on a city scale, the counterintuitive result of increased pollution was sometimes noted. Farda and Balijepalli [47] argue that by restricting the circulation of cars on the streets within the event site, persistent drivers will detour from original routes, thereby increasing the average distance traveled; consequently, this additional traffic will likely result in increased pollution outside the event area (sometimes outweighing the reduction in the restricted region).

Beyond these immediate and local effects, more relevant goals of Car-Free Days are to give rise to new habits and promote long-term sustainable behaviors. Considering the rationale from TPB, NAT and TIB frameworks, these campaigns can impact early and middle stages of the decision process (i.e., values, beliefs, norms and attitudes) that activate intentions toward a sustainable behavior. Nonetheless, this kind of investigation is even scarcer in the Car-Free Day literature. It is worth mentioning the work of [48], who found evidence that greater car dependency, measured by frequency of use, implies less acceptability of Car-Free Day initiatives. Similarly, Ref. [49] obtained analogous results by measuring car dependency with the vehicle miles traveled (VMT) indicator. Moreover, both studies observed that the initiative acceptance was higher on weekends than on weekdays.

It is also important to consider the academic context under which the Car-Free Day event under analysis was undertaken. College campuses are often self-contained communities, where people from different backgrounds, incomes and lifestyles interact [24]. Their infrastructure usually comprises classrooms, offices, shopping places, sports facilities, apartments, open spaces and streets, which can be located in a city center, a suburb or a rural area. Due to the proactive behavior of its members, university communities are considered relevant places to test the implementation of sustainable ways of living [24,25]. In fact, after considerable efforts to investigate mobility patterns and gaps within such contexts [26,50], several guidelines for developing sustainable mobility plans in university campuses have been proposed and discussed in the literature [51–53].

For campuses inside urban areas, mobility issues are mainly related to aspects of walking, cycling, parking management and public transport [50]. Regarding the active travel modes, the most salient problems are: safety at intersections (e.g., lack of speed limitation zones, absence of signage and road marks), personal security (e.g., increased vulnerability to crime) and insufficient pedestrian and cycling networks (e.g., poor infrastructure, lack of street connectivity and proximity) [24,50,54–60]. In response, some of these studies list promising policies for encouraging active travel (mainly walking) [51–53,59,60]:

- Awareness-raising activities;
- Creation of pedestrian route maps;
- Establishment of walking ambassador communities;
- Improvement of amenities, sidewalks, lightning conditions, suitable signage and access routes;
- Increased surveillance on walkways;
- Enhancing safety measures at crossings.

Considering this background, two hypotheses are tested in the present study:

Hypothesis 1 (H1). *Perceived insecurity, travel distance and trip chaining curb participation in the Car-Free Day initiative.*

Hypothesis 2 (H2). *Engagement in the Car-Free Day campaign nurtures intentions of traveling less by car.*

Hypothesis H1 is aimed at verifying whether situational factors influence the likelihood of engaging in the campaign. The three situational factors analyzed were: perceived insecurity, travel distance and trip chaining. For perceived insecurity, having witnessed violence en route to the campus and the sense of security when circulating in the vicinity of the campus were used. In fact, considering a preceding mobility study at the São Carlos campus of the University of São Paulo (USP-SC), it was found that walking trip routes are highly associated with occurrences of violence and an elevated perceived insecurity [60,61] (a problem that has also been ascertained in other university campuses [55,56]). Knowing which constraints impact more event participation can be useful to establish an effective implementation of future editions.

Hypothesis H2 is the focus of the present study, given the lack of such research in the literature. In line with TPB, attitude is an antecedent of intention, which is measured here by the opinion of the individuals on the Car-Free Day initiative. Regarding habits, the weekly frequency of travel was used as a surrogate for its strength. Although repetition alone might be an imperfect proxy for the constitution of an automatic behavior [62], it is usually highly correlated with a more broad psychological construct of habit [37,63].

3. Materials and Method

The present study aims at expanding the current knowledge on the circumstances under which these campaigns can be successful and whether this initiative can generate an intention of commuting less by car. The present work addresses these questions by analyzing the results of a virtual survey conducted after a Car-Free Day campaign on a Brazilian university campus. Although the results are presented for a single university campus, its structure is very similar to other Brazilian and worldwide campuses. The conclusions are drawn in a post hoc fashion, given that the questionnaire was not designed for the underscored purposes. A descriptive modeling approach was carried out [64] to capture important associations preconized in the literature on car use. Thus, although no causal relationships were claimed among the factors analyzed, this paper provides evidence that might endorse those theorized causal relationships in the context of Car-Free Day campaigns.

3.1. The São Carlos Campus of the University of São Paulo (USP-SC)

The system under study is the academic community of the São Carlos campus at the University of São Paulo (USP-SC). The town of São Carlos is located in the state of São Paulo, Brazil, and has an estimated population of 254,584 inhabitants [65]. The USP-SC is divided into two areas, namely Area 1 and Area 2 (as shown in the map in Figure 1), whereby 23 undergraduate courses and 19 graduate programs are offered. The academic community comprises 9179 students (5121 undergraduates and 4058 graduate students), 557 academic staff (faculty only) and 1030 non-academic staff [66]. Area 1 concentrates most of the teaching, research and administrative infrastructure of the campus. It can be accessed through six entrances (E1 to E6), but only three of them allow for vehicle access (E1, E2 and E4). When the study was carried out, Area 2 only had a single entrance, which could be accessed by any travel mode.

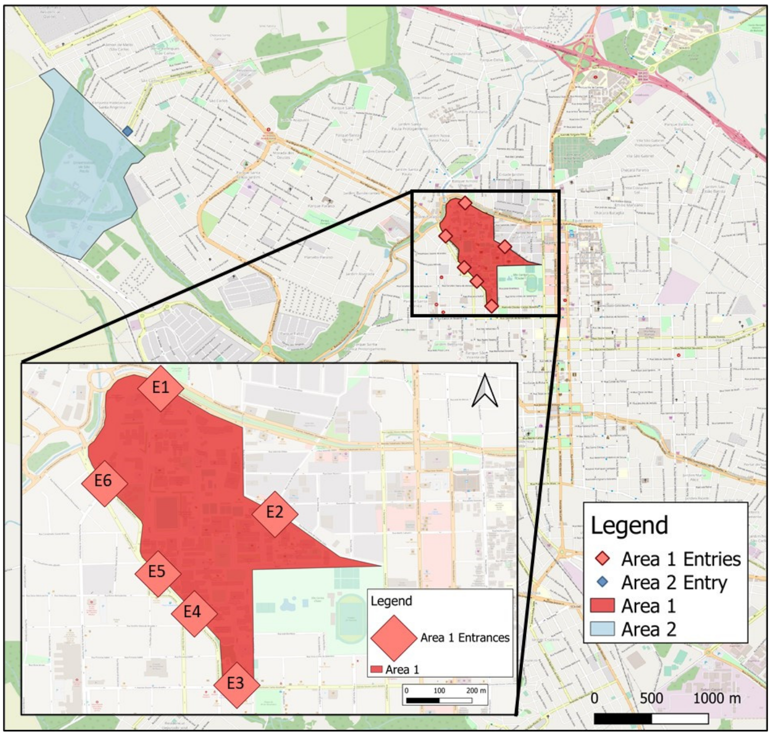

Figure 1. The São Carlos campus at the University of São Paulo (Source: [67]).

The main campus area (Area 1) is located near to the city center, having high connectivity to the whole street network and an adequate provision of regular bus lines. However, this does not imply a balanced modal split among the university community members, as individual motorized choices are becoming increasingly dominant [57]. Therefore, besides adding to the existing traffic flow in the São Carlos street network, this situation increases competition for the limited space in the existing parking lots of the campus.

3.2. The Car-Free Day Campaign Survey

The 2019 edition of the Car-Free Day at the USP-SC was held on October 22. In the week before the event, the academic community was invited to voluntarily commute without a car on the proposed date. The invitation message contained a motivational text stressing the impacts of car use and the importance of traveling more sustainably. Shortly after the event, a virtual survey was sent to the whole community to evaluate the impressions about the campaign. The collected data consisted of sociodemographic attributes (gender, age and university affiliation), travel features (origin, destination entry, frequency of travel, trip chaining, mode choice and perceived safety) and general perceptions about the campaign (opinion, participation and impact on behavior).

The items concerning the perceptions about the campaign and their response alternatives can be seen in Table 1. Items 1, 2 and 3 are used as attitudes toward the campaign, participation in the Car-Free Day and intention of traveling less by car, respectively, which are key to evaluating the hypotheses of the present study.

Table 1. Items concerning the perceptions about the campaign.

Item	(1) What Is Your Opinion about the Car-Free Day in Our Campus?	(2) Did You Participate in the Car-Free Day?	(3) What Is the Impact of the Campaign on Your Behavior?
Alternatives	(A) Great initiative and should be done more often. (B) Good initiative, that would be even better if promoted earlier. (C) Good initiative, but should be done occasionally. (D) Indifferent. (E) Bad initiative, given the disturbances it has caused.	(A) Yes, I made other arrangements previously to travel by other transport modes (B) Yes, but I do not usually use a car on a daily basis. (C) No, I was not aware of the campaign. (D) No, I was not motivated to engage in it/it would cause me too much trouble.	(A) It motivated me to radically change my travel habits. As a consequence, I intend to travel less by car to the campus. (B) It motivated me to occasionally walk or cycle/offer someone a car ride to the campus. (C) It made me think about my habits, but did not motivate me to change. (D) It did not influence me at all.

3.3. Method

Besides the data collection, the methodological procedure encompassed a data processing stage, an exploratory data analysis, the calibration of the logistic regression models and the discussion of results. In the exploratory data analysis step, bivariate plots and hypothesis tests were performed in order to infer preliminary relationships in the dataset. Two logistic regression models were proposed to assess the research hypotheses. Both models were adjusted for the individuals who travel using non-sustainable mode choices, i.e., those who traveled by car (as a driver or carpooling) or by motorcycle. In addition, individuals who were not aware about the campaign were also not considered. In practice, it means that those who answered levels B (not a car user in the daily routine) or C (not aware of the campaign) of the variable participation were disregarded from the sample. As the main objective is to know the effectiveness of the Car-Free Day campaign, these individuals were not the focus of the study.

3.3.1. Model 1: Participation

The first model enabled the investigation of hypothesis H1. The features of the dependent and independent variables used are shown in Table 2. A binomial logistic regression was adjusted to this data, considering the binary response of participating (alternative A) or not participating (alternative D) from item 2 of Table 1. Sociodemographic variables (gender and university affiliation) were included in the model to measure group differences. Age was not included in the model to avoid multicollinearity issues due to its high association with university affiliation (younger individuals are strongly associated with the student categories).

Table 2. Variables from Model 1.

Variable	Role	Type	Levels
Participation in the campaign (Item 2, Table 1)	Dependent	Binary	A and D (Reference Level: D)
Attitude toward the campaign (Item 1, Table 1)	Independent	Nominal	A, B, C, D and E (Reference Level: E)
Travel distance	Independent	Numeric (*continuous*)	-
Travel frequency to Area 1	Independent	Numeric (*discrete*)	0, 0.5 *, 1, 2, 3, 4, 5, 6 and 7 days/week
Attends Area 2 at least once a week	Independent	Binary	Yes or No (Reference level: No)
Trip chaining (*frequency of intermediate stops when traveling to campus*)	Independent	Nominal	Never, Occasionally and Often (*Reference Level: Never*)
Witnessed violence on the trip to campus	Independent	Binary	Yes or No (Reference Level: No)
Sense of security	Independent	Nominal	Safe, Partially Safe and Unsafe (Reference Level: Unsafe)
Gender	Independent	Binary	Male and Female (Reference Level: Female)
University affiliation	Independent	Nominal	Undergrad student, Grad student, Academic staff and Non-academic staff (Reference Level: Undergrad student)

* once every two weeks.

To compute individual travel distances to campus, the origins and destinations of the displacements were asked in the survey to infer their routes. All the geoprocessing and the network analyses were carried out in the Python programming language. The respondents informed their origins by indicating either the full address or the nearest corner to their residences (i.e., naming the crossing streets that form this corner). Then, the address was geocoded to obtain the origin coordinate using the OSMnx package [68]. The destination was collected by asking which entry the respondent used most frequently to access the campus. A person may attend both Areas, therefore the travel distance variable was calculated for the most visited Area by comparing the travel frequency variables for both Areas (Table 2). Having the coordinates of the origins and destinations, the route lengths of each individual were calculated using the shortest path algorithm of the NetworkX package [69]. The algorithm was computed using the nodes and links of the street network of São Carlos, generated by the transformation of the OpenStreetMap geodata into a street graph with the OSMnx package. It is worth mentioning that students who live on the campus had their travel distances assigned to zero.

Having settled all the variables, the binomial logistic regression, represented by Equation 1, was adjusted in R programming language:

$$\log \frac{P(Y=1)}{P(Y=0)} = \beta_0 - (\beta_1 X_1 + \ldots + \beta_p X_p) \tag{1}$$

where $Y \in \{0,1\}$ is the binary dependent variable corresponding to the participation in the campaign, which was regressed on the $X_1, \ldots X_p$ independent variables for the estimation of their respective $\beta_1, \ldots, \beta_p$ coefficients and an intercept β_0. The model fit was evaluated by computing McFadden's pseudo-R^2, which was a value in the range of 0.2–0.4 that was considered an appropriate fit in the context of travel behavior [70]. Model assumptions of multicollinearity, linearity with logit(p) for the numerical variables and influential values were also assessed. Multicollinearity was checked by computing the Generalized Variance Inflation Factor $GVIF^{1/df}$ proposed by [71], linearity with logit(p) was verified graphically and influential values were investigated via Cook's distance metric [72].

3.3.2. Model 2: Intention toward Traveling Less by Car

The second model was conceived to assess the main hypothesis (H2). The model's variables are shown in Table 3 that was also limited to the subgroup of the sample that answered levels A or D of the variable participation. Given that the dependent variable is measured in an ordered fashion, an ordinal logistic regression was adjusted to the data.

Table 3. Variables from Model 2.

Variable	Role	Type	Levels
Intention of traveling less by car (Item 3, Table 1)	Dependent	Ordinal	D, C, B and A (increasing order of intention)
Participation in the campaign(Item 2, Table 1)	Independent	Binary	A and D (Reference Level: D)
Attitude toward the campaign (Item 1, Table 1)	Independent	Nominal	A, B, C, D and E (Reference Level: E)
Travel distance	Independent	Numeric (*continuous*)	-
Travel frequency to Area 1	Independent	Numeric (*discrete*)	0, 0.5 *, 1, 2, 3, 4, 5, 6 and 7 days/week
Attend Area 2 at least once a week	Independent	Binary	Yes or No (Reference level: No)
Trip chaining (*frequency of intermediate stops when traveling to campus*)	Independent	Nominal	Never, Occasionally and Often (*Reference Level: Never*)
Witnessed violence in the trip to campus	Independent	Binary	Yes or No (*Reference Level: No*)
Sense of security	Independent	Nominal	Safe, Partially Safe and Unsafe (*Reference Level: Partially safe*)
Gender	Independent	Binary	Male and Female (Reference Level: Female)
University affiliation	Independent	Nominal	Undergrad student, Grad student, Academic staff and Non-academic staff (Reference Level: Undergrad student)

* once every two weeks.

The definition of the ordinal logistic regression considers the effect of p independent variables $(X_1,\ X_2,\ \ldots X_p)$ on a Y dependent variable with J categories, in which $j = 1, 2, \ldots, J$. For each $j = 1, \ldots, J-1$ level, the following log odds equation can be formulated:

$$\log \frac{P(Y \leq j)}{P(Y > j)} = \beta_{j0} - \left(\beta_{j1} X_1 + \ldots + \beta_{jp} X_p\right),\ \ \forall\, j = 1, \ldots, J-1 \quad (2)$$

Since the resulting number of parameters to be estimated can be considerably large, with a value of $(p+1) \times (J-1)$, it is possible to resort to the proportional odds assumption [73], which states that the β coefficient for a specific independent variable is the same for all $J-1$ equations:

$$\log \frac{P(Y \leq j)}{P(Y > j)} = \beta_{j0} - \left(\beta_1 X_1 + \ldots + \beta_p X_p\right),\ \ \forall\, j = 1, \ldots, J-1 \quad (3)$$

Thus, the number of parameters to be estimated is reduced to $p + J - 1$. The proportional odds assumption was tested by running the omnibus goodness-of-fit test proposed by [74]. This procedure collectively investigates whether the β_{jk} coefficients from Equation (1) statistically differ from the correspondent β_k from Equation (2), for all $k = 1, 2, \ldots, p$. Besides the verification of the proportional odds assumption, McFadden's pseudo-R^2 was also computed to assess the quality of the fit. Similar to Model 1, multicollinearity was also assessed. This model was also fitted in R programming language using the polr function of the MASS package [75], which uses maximum likelihood estimation to compute the model parameters.

4. Results and Discussion

4.1. Statistical Summary of the Sample

Three weeks after its release, the survey was concluded with 499 unique respondents out of nearly 9571 individuals from the academic community (roughly 5.2% of the total). From this amount, 326 respondents' origins were geocoded (almost 2/3 of the total). All these 326 individuals visited Area 1, whereas only 200 of them attended Area 2 (at least once every two weeks). With respect to Area 1, 203 individuals traveled to campus by car (178 as a driver and 25 carpooling), 15 by motorcycle, 82 by walking, 19 by bicycle, 1 by bus and 7 did not respond. From the 200 individuals that visited Area 2, 145 reached the campus by car (125 as a driver and 20 carpooling), 9 by motorcycle, 2 by walking, 6 by bicycle, 32 by bus and 6 did not respond. The geographical distribution of these individuals' origins and their respective travel mode choices to both Area 1 and Area 2 are shown in the maps of Figures 2 and 3.

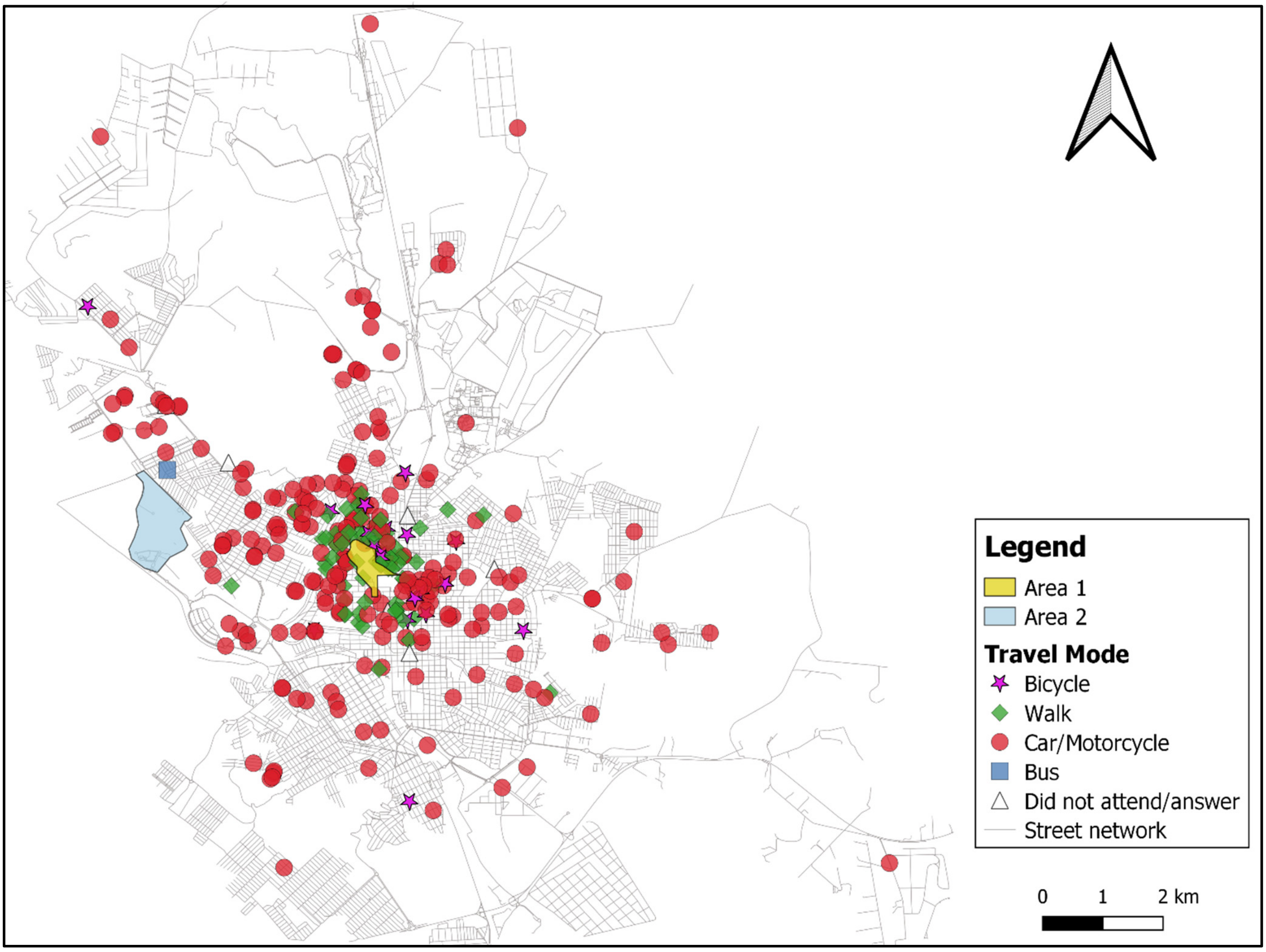

Figure 2. Spatial distribution of the modal choices when the individuals traveled to Area 1.

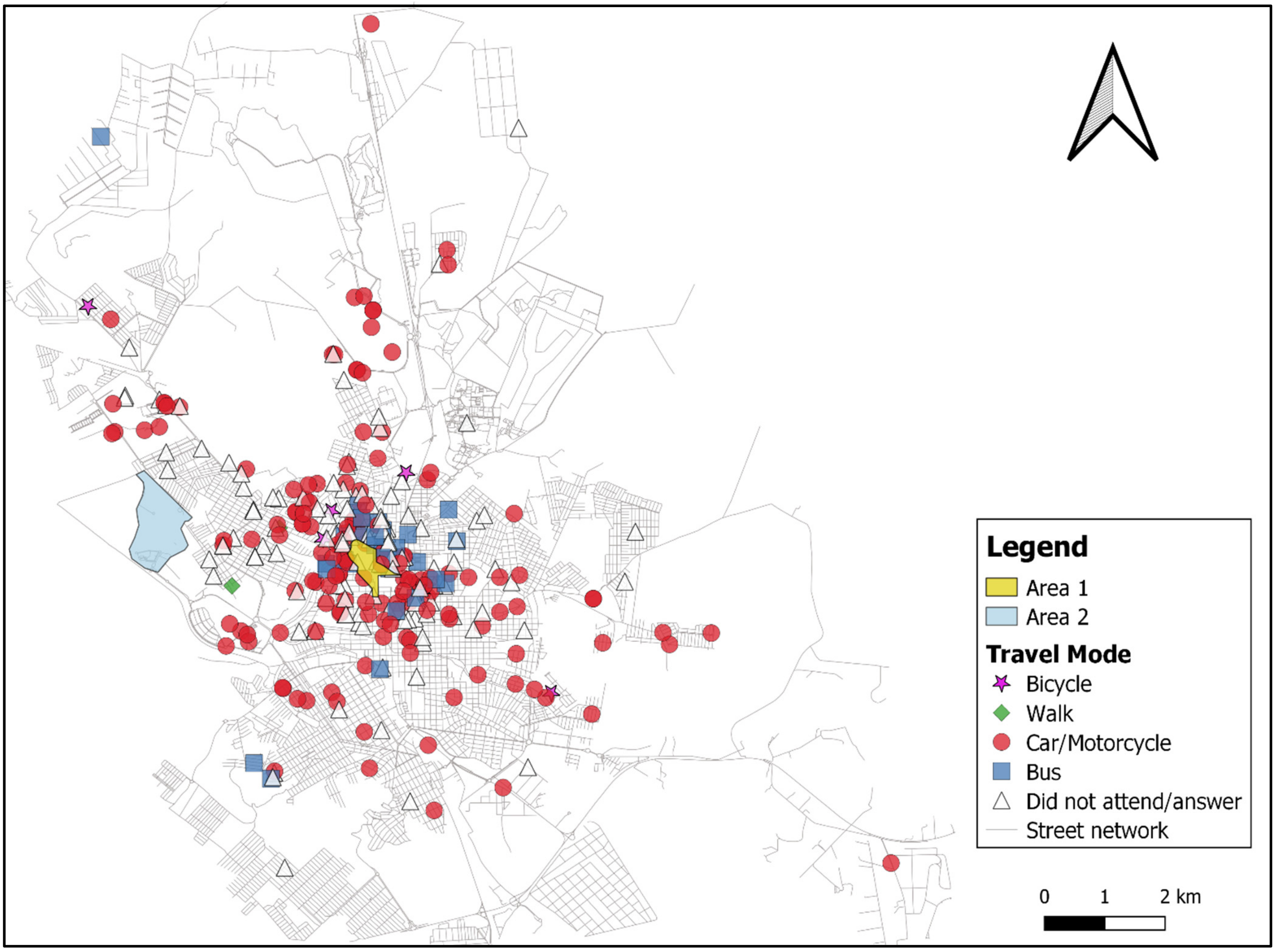

Figure 3. Spatial distribution of the modal choices when the individuals traveled to Area 2.

Regarding Area 1, there was a clear spatial trend of individual motorization (red dots in Figure 2) the further the individuals' origins were from the campus. Indeed, most origins of non-motorized individuals were concentrated around the campus (depicted by the green diamonds and the purple star symbols). For the individuals who attended Area 2, only eight of them traveled by an active mode, with a predominance of university members who traveled mainly by car or by motorcycle (154). At least two reasons can explain the fact that the individuals tend to walk more to Area 1 than to Area 2. First, Area 2 is located in the city outskirts, whereas Area 1 lies in the vicinity of the city center. Secondly, and probably as a consequence of the first factor, there are more students living next to Area 1 than to Area 2. It can also be noticed that few university members use a bicycle to travel to Area 2, which is possibly due to the considerable elevation gain to reach this campus. Interestingly, from the 32 individuals that traveled by bus to Area 2 (blue dots), 28 of them walked or rode a bicycle when they traveled to Area 1.

As mentioned in the methodological section, the proposed logistic regression models were adjusted in a subset of the sample, consisting of 208 individuals who traveled either by car or by motorcycle and who were aware of the initiative. Descriptive statistics of the variables measured in the survey with respect to this subsample are summarized in Table 4. It is noteworthy that almost 80% of these individuals belong to the university staff, which is explained by the fact that most people from the student group do not use a car when traveling to campus (more than 70%, when considering trips to Area 1). Age is highly associated with the type of university affiliation ($\chi^2 = 271.55$, $p = 0.0005$), therefore individuals older than age 30 dominated the sample (more than 3/4 of the total). Important associations can also be found relating travel distance to travel mode choice as indicated by the Kruskal–Wallis rank sum test ($\chi^2 = 16.38$, $p = 0.0009$). Testing pairwise differences among mode choices with a Wilcoxon rank sum test revealed that travel distances are significant between walking and the private car ($p = 0.0012$) and between walking and the motorcycle ($p = 0.0013$). This result can be clearly observed from the values of average ($\overline{d}_w = 453.4$ m, $\overline{d}_c = 2444.4$ m, $\overline{d}_m = 3304.8$ m), minimum ($d_{min,w} = 72.0$ m, $d_{min,c} = 0.0$ m, $d_{min,m} = 558.3$ m) and maximum ($d_{max,w} = 1317.9$, $d_{max,c} = 11,328.6$ m, $d_{max,m} = 10,082.7$ m) for each group.

Table 4. Summary statistics for motorized individuals aware of the Car-Free Day campaign.

***n* = 208**					
Variable (Numeric)	**Average**	**Median**	**Std. Deviation**	**Minimum**	**Maximum**
Travel distance (km)	2.116	1.479	1.988	0	15.670
Travel Frequency—Area 1 (days/week)	5.031	5.000	1.075	0	7.000
Variable (categorical)	**Level (frequency)**				
Age	18–24 (13.9%) 25–30 (6.7%) 31–39 (19.7%) 40–49 (28.8%) 50-59 (18.8%) more than 60 (12.0%)				
Gender	Female (42.8%); Male (61.4%)				
Affiliation	Undergraduate student (12.5%) Graduate student (9.1%) Academic staff (20.2%) Non-academic staff (57.2%)				
Witnessed violence when traveling to campus	Yes (22.6%) No (77.4%)				
Attended Area 2 at least once a week	Yes (17.8%) No (82.2%)				
Trip chaining (*frequency of intermediate stops when traveling to campus*)	Never (21.6%) Occasionally (20.7%) Often (57.7%)				
Sense of security (in the morning)	Safe (64.7%) Partially safe (26.1%) Unsafe (9.2%)				
Sense of security (in the afternoon)	Safe (55.3%) Partially safe (33.5%) Unsafe (11.2%)				
Attitude toward the campaign	(A) Great initiative and should be done more often (24.5%) (B) Good initiative that would be even better if promoted earlier (19.7%) (C) Good initiative, but should be done occasionally (23.3%) (D) Indifferent (22.1%) (E) Bad initiative given the disturbances it has caused (9.1%)				
Participation in the campaign	(A) Yes, I made other arrangements previously to travel by other transport modes (38.9%) (D) No, I was not motivated to engage in it/it would cause me too much trouble (61.3%)				
Intention of traveling less by car	(A) It motivated me to radically change my travel habits. As a consequence, I intend to travel less by car to the campus (3.4%) (B) It motivated me to occasionally walk or cycle/offer someone a car ride to the campus (26.4%) (C) It made me think about my habits, but did not motivate me to change (34.6%) (D) It did not influence me at all (35.6%)				

As a downside of the campaign effectiveness, 60% of these individuals did not engage in the Car-Free Day campaign and more than 70% were not motivated to change their travel habits (levels C and D of the third item of Table 1). These results contrast with the figures of attitude toward the campaign, given that nearly 3/4 of the individuals think it is a great/good initiative (levels A, B and C of the first item of Table 1). Nonetheless, from the viewpoint of the research goal, this outcome was important to test the main hypotheses of the study as it enabled the identification of relevant factors related to the differences among groups of participation and intentions. Indeed, from those not motivated by the campaign, 76% did not even participate in the event. On the other hand, among those who claimed to be positively influenced, 74% complied with the Car-Free Day initiative. Thus, there appears to be a sign that engaging in the Car-Free Day event could nurture intention of traveling less by car (to be adequately tested in Model 2).

By looking at the association of attitudes toward the campaign and sociodemographic factors, the significance of the relationship with gender is noticeable ($\chi^2 = 16.26$, $p = 0.003$); actually, more than 80% of females tend to approve the Car-Free Day initiative (levels A, B and C from the first item of Table 1), whereas less than 60% of males do. Nevertheless, no significant association (considering $\alpha = 0.05$) was encountered in the relationship of attitude with university affiliation ($\chi^2 = 26.53$, $p = 0.153$) or age ($\chi^2 = 18.62$, $p = 0.110$).

Relationships of participation and intention with situational factors can be seen in the bivariate plots of Figures 4 and 5, respectively. At an exploratory level, the most remarkable findings are the negative correlations of travel distance and trip chaining on participation in the Car-Free Day initiative. Regarding intention, there is a graphical indication that people who feel safer when circulating in the surroundings of the campus in the morning and with less trip chaining are more willing to change their travel habits.

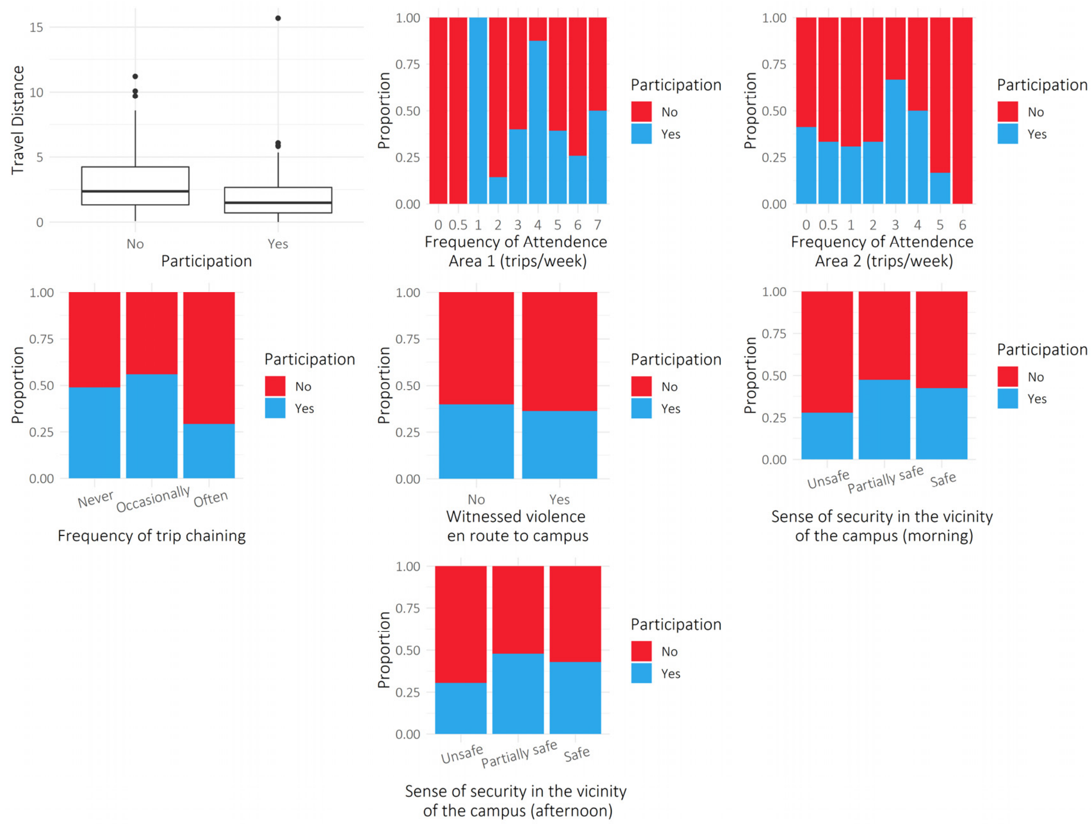

Figure 4. Bivariate plots of situational factors with participation in the Car-Free Day campaign.

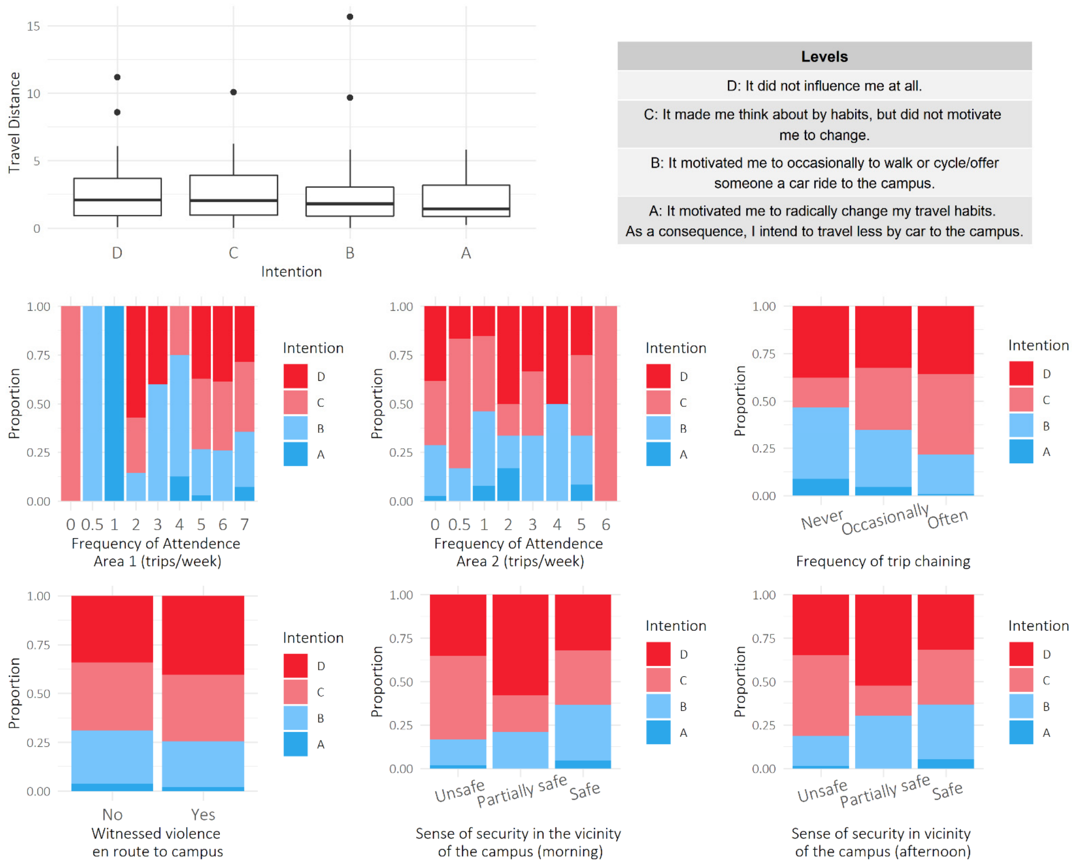

Figure 5. Bivariate plots of situational factors with intention of traveling less by car.

Another important observation is that the distributions of the sense of security in the morning and in the afternoon are similar. Indeed, roughly 85% of the respondents felt the same level of security for both periods, thereby resulting in high association between these variables ($\chi^2 = 273.15$, $p = 0.000$). Likewise, witnessing violence en route to campus is significantly associated with the sense of security in the morning ($\chi^2 = 29.822$, $p = 0.000$) and in the afternoon ($\chi^2 = 36.791$, $p = 0.000$). Therefore, to avoid multicollinearity issues associated with these variables in the modeling procedure, only the sense of security in the morning was used in both models.

4.2. Model 1: Participation

The results of the binomial logistic regression (Model 1) are summarized in Table 5, with significant ($p < 0.05$) and marginally significant ($p < 0.1$) coefficients written in bold. An interaction term of the frequency of attendance to Area 1 (numeric) and the attendance to Area 2 (binary) was included. This proved to be relevant to infer the effect of increased complexity of traveling during the week (the necessity and intensity of displacing to both Areas) on participation. The model yielded a satisfactory fit, with a McFadden's pseudo-R^2 of 0.330. Model assumptions were also met, with the absence of multicollinearity (except for the ones involved in the interaction term, the larger $GVIF^{1/df}$ was equal to 2.517), acceptable linearity with logit(p) and Cook's distance less than 0.5 for all residuals.

As shown in Table 5, a positive attitude toward the campaign favors participation in the Car-Free Day event. The odds of participating for those who think the initiative is positive can be from 6.882 to 44.479 times as high as the odds of participating for the individuals who think the opposite. This result is in line with a Car-Free Day study conducted by [76], who found that the event image correlates positively with the intention of participating in future editions. Additionally, living far from the campus diminishes the chances of engagement as the odds ratio of participating is reduced by nearly 17%

with every additional kilometer observed in travel distance. By looking at the relationship between logit(p) and travel distance within each level of attitude toward the campaign (Figure 6), one can see that travel distance did not seem to make a difference for those who oppose it (levels E and D) or for those who have only a limited positive view of the campaign (level C). For any distance in the observed domain, the odds of participating are nearly zero in these cases. On the other hand, for levels B and A, the negative impact of travel distance becomes increasingly clearer.

Table 5. Summary of the coefficients of Model 1 (Participation).

Variable	β	Odds Ratio (95% CI)
Intercept	−2.846	0.058 (0.002–1.680)
Attitude toward the campaign (ref. level = E—bad initiative)		
D—Indifferent	−0.002	0.998 (0.150–8.791)
C—Good initiative, but should be less frequent	1.945 *	6.997 (1.321–57.901)
B—Good initiative, deserving better promotion	2.776 **	16.050 (3.123–131.099)
A—Good initiative, should be done more often	3.814 ***	45.328 (8.756–378.200)
Travel distance	−0.189 +	0.828 (0.665–1.005)
Travel freq. to Area 1 (TFA1)	0.151	1.163 (0.699–1.968)
Attend Area 2 (AA2)	1.035	2.815 (0.079–105.979)
Interaction term (TFA1 × AA2)	0.452	1.572 (0.490–5.160)
Trip chaining (ref. level = Never)		
Occasionally	0.452	1.572 (0.490–5.160)
Often	−1.464 **	0.231 (0.083–0.608)
Sense of security—morning (ref. level = Part. safe)		
Unsafe	1.140	3.128 (0.727–14.483)
Safe	0.572	1.772 (0.727–4.449)
Gender (ref. level = Female)		
Male	−0.584	0.558 (0.245–1.234)
University affiliation (ref. level = Undergraduate student)		
Graduate student	0.044	1.045 (0.203–5.518)
Academic staff	1.330 +	3.780 (0.955–15.916)
Non-academic staff	0.575	1.777 (0.511–6.437)

Significance codes: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. McFadden's pseudo-R^2 = 0.328.

Trip chaining is also a significant factor, whereby the odds of participating when people often make intermediate stops are nearly 23% of the odds of those who never do. Travel frequency and violence did not seem to be relevant factors for engaging in the campaign, although these factors could be significant for long-term travel habits. Finally, with respect to sociodemographic factors, there is slight evidence that faculty members attended the campaign more than undergraduate students.

4.3. Model 2: Intention

The coefficients of the ordinal logistic regression (Model 2) are summarized in Table 6, with significant ($p < 0.05$) and marginally significant ($p < 0.10$) also written in bold. Likewise, the interaction term of attendance to both Areas was included. Model assumptions were also met, with the absence of multicollinearity (excepting the frequencies involved in the interaction term, the larger $GVIF^{1/df}$ was equal to 7.374). The proportional odds assumption was met with these set of variables, whereby the p-value of the omnibus goodness-of-fit of the Brant test equals 0.30. Additionally, McFadden's pseudo-R^2 of 0.237 endorses a sound model fit.

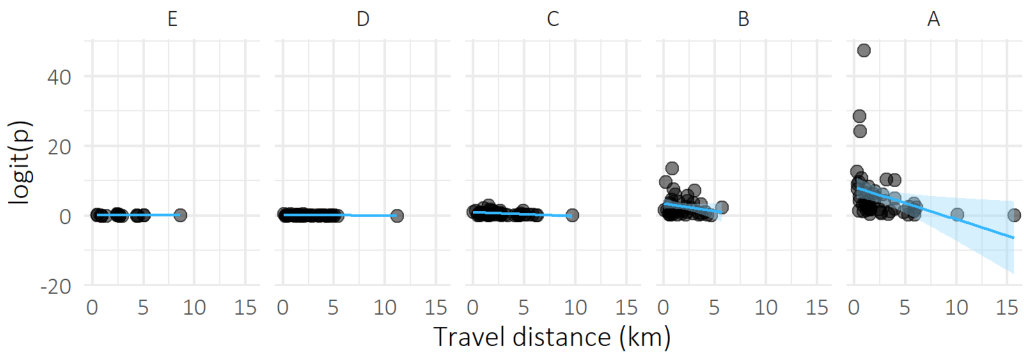

Figure 6. Scatterplots of $logit(p)$ vs. travel distance for each level of attitude toward the campaign ((**E**): Bad initiative; (**D**): Indifferent; (**C**): Good initiative, but should be less frequent; (**B**): Good initiative, deserving better promotion; (**A**): Good initiative, should be done more often).

Table 6. Summary of the coefficients of Model 2 (Intention).

Variable	β	Odds Ratio (95% CI)
Thresholds		
D—Did not influence C—Made me think, but did not change	2.984	-
C—Made me think, but did not change B—Motivated me to occasionally change	5.317	-
B—Motivated me to occasionally change A—Motivated me to radically change	8.489	-
Participation in the campaign (ref. level = No)		
Yes	1.357 ***	3.885 (1.926–7.834)
Attitude toward the campaign (ref. level = E—bad initiative)		
D—Indifferent	0.600	1.822 (0.472–7.045)
C—Good initiative, but should be less frequent	2.429 ***	11.348 (2.923–43.079)
B—Good initiative, deserving better promotion	2.846 ***	17.219 (4.339–68.383)
A—Good initiative, should be done more often	3.531 ***	34.158 (8.318–140.275)
Travel distance	0.005	1.005 (0.866–1.165)
Travel freq. to Area 1 (TFA1)	0.286	1.331 (0.895–1.979)
Attend Area 2 (AA2)	3.486 *	32.655 (2.049–520.011)
Interaction term (TFA1× AA2)	−0.592 *	0.553 (0.318–0.963)
Trip chaining (ref. level = Never)		
Occasionally	−0.602	0.548 (0.220–1.365)
Often	−0.874 *	0.417 (0.187–0.931)
Sense of security—morning (ref. level = Part. Safe)		
Unsafe	−1.046 +	0.351 (0.106–1.168)
Safe	−0.165	0.848 (0.434–1.658)
Gender (ref. level = Female)		
Male	0.086	1.090 (0.589–2.016)
University affiliation (ref. level = Undergraduate student)		
Graduate student	0.655	1.925 (0.560–6.626)
Academic staff	0.415	1.514 (0.501–4.578)
Non-academic staff	0.479	1.614 (0.610–4.271)

Significance codes: $^{+}$ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. McFadden's pseudo-R^2 = 0.237.

In line with the results of other soft transport policies [17], positive attitudes toward the Car-Free Day campaign are associated with the intention of performing a sustainable travel behavior. Indeed, the odds of intending to travel less by car when the attitude toward the campaign is a positive range from 11.348 to 34.158 times as high as when the individuals oppose the initiative. A remarkable finding is that the odds of being positively influenced by the Car-Free Day when individuals engage in it are almost four times larger than the odds of when they do not participate.

Unlike the results from Model 1, travel distance did not appear to be a relevant factor for the intention of traveling less by car. However, trip chaining still matters as the odds of being positively influenced by the campaign for those who often make intermediate stops when traveling is almost 40% of the odds of those who never stop when going to campus. Although attending only Area 2 implies more intentions of traveling less by car, the need of displacing to both Areas decreases the odds of abandoning the car passenger. This outcome can be construed as a growing difficulty of planning trips with more sustainable modes when the displacements are more chained.

Although the perceived insecurity did not influence participation in the campaign, it has a potential effect on changing the habit of car travel. In fact, the odds of intending to switch to more sustainable modes for individuals that feel unsafe when walking in the vicinity of the campus is roughly 35% of the odds of those who feel partially safe (though this effect is only marginally significant).

As a final note, it is important to distinguish some sociodemographic differences between the individuals who are used to walking to campus and those private car/motorcycle users that intend to change their behavior (responses B and A). Although no gender associations were found ($\chi^2 = 0.262,\ p = 0.609$), specific discrepancies on university affiliation ($\chi^2 = 41.16,\ p = 2.491 \times 10^{-8}$) were found. In fact, in the group of pedestrians, 35.3% are undergraduate students and 43.9% are graduate students, whereas those who want to travel less by car are essentially non-academic staff (49.2%) and faculty members (22.0%).

4.4. Discussion and Policy Implications

The campaign results of low engagement and reduced willingness to travel more sustainably might seem to be frustrating at first glance, but a closer look on the data reveals great opportunities for the planning of the next Car-Free Day editions. Two aspects are relevant: (i) the important association between participating in the campaign and the intention of traveling less by car, and (ii) the role of positive attitudes in the decision-making process are key to guide new interventions. The first is a novel result in the literature of travel behavior associated with Car-Free Day initiatives, as only the individual's acceptance of the event and its determinants have been evaluated so far [48,49,76]. The latter is in line with the TPB literature [28,29], given that it posits that attitudes precede intentions, thereby presenting important opportunities for intervention. Accordingly, better and well-anticipated publicity of the campaign should be taken as seriously as the execution of the event itself. Information about environmental and social impacts associated with car use should have better exposure, i.e., exploring data visualization tools such as infographics, interactive dashboards, animated videos and similar multimedia resources. To broaden the reach of the message, diverse media should be used, including email, social media, campus billboards, notice boards, etc. Stimulating communication within internal communities such as student unions, departmental meetings, junior enterprises and other groups should also be considered. Finally, running workshops on the day of the event are important to reinforce the message and provide additional stimulus to activate pro-environmental norms in agreement with the findings of the NAT literature [30,31]. The non-significant result of the impact of habits on the intention of traveling less by car—as measured by the weekly travel frequency—can also be seen as a positive result as a strong habit of traveling by car is known to reduce the effect of intentions on behavior [37]. However, this claim is somewhat limited as habit strength should be more carefully measured as a psychological construct beyond a sheer frequency of travel [63].

Intuitively, situational constraints [27] also seem to be impairing advances in sustainable travel behavior within the community, similar to that which has been found in other Car-Free Day studies [48,49]. Longer travel distances were associated with lower engagement with the Car-Free Day event; albeit no effect was found on the intention of traveling less by car. Nonetheless, this issue should be adequately addressed given that more participation in the campaign significantly increases the odds of perceiving a positive influence of the initiative. Moreover, trip chaining and the need to travel to both

Areas imply more complex trips throughout the week (and probably more vehicle kilometers traveled), thereby diminishing the propensity of not using the car. These difficulties could be tackled with initiatives such as: (a) the formation of carpooling social networks, (b) improvement in the dissemination of transit information and of the ticketing system with the help of information and communication technologies, (c) the redesign of bus routes to increase network density and bus frequency, and (d) the implementation of personalized travel plans focusing on mode transitions to public transit associated with walking. Finally, perceived insecurity appears to be shying people away from walking in the surroundings of the campus— an important finding endorsed from previous research [60]. This issue is more complex to be solved as it demands policymaking knowledge outside the scope of the present research. However, communicating effectively with the local security authority in light of the analyzed data in order to find the most appropriate solutions should be done more often by the university administration. For example, previous studies have indicated that increased surveillance on walkways could be a promising initiative to encourage people to walk [59,60].

Overcoming the impedances of long travel distances, complex routing and violence exposure will be important measures to increase individual perceived behavioral control (as postulated in the Theory of Planned Behavior). It adds to the early mentioned efforts of increasing awareness that could further contribute to enhance sustainable mobility behaviors on the campus.

5. Conclusions

This study presented relevant correlational evidence of the effectiveness of a Car-Free Day initiative, which has not been systematically addressed in the literature so far. In line with the behavioral literature on car use reduction, it was demonstrated that attitude toward the campaign increases the likelihood of participation in the campaign and intention of traveling less by car. Additionally, engaging with the initiative demonstrated to be critical to promote intention of traveling more sustainably. Situational constraints such as perceived insecurity on walking routes, longer travel distances and trip chaining should be addressed with well-designed interventions to improve the effectiveness of the campaign. These are important findings for guiding practitioners on the planning and the conduction of this kind of initiative.

Important limitations of the study include: the absence of a behavior variable measurement (e.g., frequency of car trips after the event) and a merely unidimensional account of the psychological constructs such as attitude, intention and habit strength (where a multi-item factor solution should be more appropriate). Future work should focus on long-term effects of the Car-Free Day, since research so far has only been conducted with data from surveys carried out shortly after the event day. Furthermore, when implementing these studies on an international level, peculiarities regarding the campus location (rural, suburban or in the city center) and the characteristics of the transportation system of the city itself should be adequately addressed.

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Institutional Review Board Statement: For this type of non-interventional study, which involves voluntary participation, ethical approval is not required by the Ministry of Health—National Council of Health. In any case, the anonymity of all participants was assured; they were fully informed why the research was being conducted and that no personal risks were associated with the survey.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. IEA Transport-Improving the Sustainability of Passenger and Freight Transport. Available online: https://www.iea.org/topics/transport (accessed on 23 April 2021).
2. EPA Smog, Soot, and Other Air Pollution from Transportation. Available online: https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-local-air-pollution (accessed on 23 April 2021).
3. Anenberg, S.; Miller, J.; Henze, D.; Minjares, R. *A Global Snapshot of the Air Pollution-Related Health Impacts of Transportation Sector Emissions in 2010 and 2015*; International Council on Clean Transportation: Washington, DC, USA, 2019.
4. Gärling, T.; Schuitema, G. Travel demand management targeting reduced private car use: Effectiveness, public acceptability and political feasibility. *J. Soc. Issues* **2007**, *63*, 139–153. [CrossRef]
5. Webb, J. The future of transport: Literature review and overview. *Econ. Anal. Policy* **2019**, *61*, 1–6. [CrossRef]
6. Wittwer, R.; Gerike, R.; Hubrich, S. Peak-Car Phenomenon Revisited for Urban Areas: Microdata Analysis of Household Travel Surveys from Five European Capital Cities. *Transp. Res. Rec.* **2019**, *2673*, 686–699. [CrossRef]
7. Bastian, A.; Börjesson, M.; Eliasson, J. Explaining "peak car" with economic variables. *Transp. Res. Part A Policy Pract.* **2016**, *88*, 236–250. [CrossRef]
8. Bussière, Y.D.; Madre, J.L.; Tapia-Villarreal, I. Will peak car observed in the North occur in the South? A demographic approach with case studies of Montreal, Lille, Juarez and Puebla. *Econ. Anal. Policy* **2019**, *61*, 39–54. [CrossRef]
9. IEA Global Car Sales by Key Markets, 2005–2020. Available online: https://www.iea.org/data-and-statistics/charts/global-car-sales-by-key-markets-2005-2020 (accessed on 23 April 2021).
10. IEA Changes in Transport Behaviour during the COVID-19 Crisis. Available online: https://www.iea.org/articles/changes-in-transport-behaviour-during-the-covid-19-crisis (accessed on 23 April 2021).
11. Molloy, J.; Schatzmann, T.; Schoeman, B.; Tchervenkov, C.; Hintermann, B.; Axhausen, K.W. Observed impacts of the COVID-19 first wave on travel behaviour in Switzerland based on a large GPS panel. *Transp. Policy* **2021**, *104*, 43–51. [CrossRef]
12. Shibayama, T.; Sandholzer, F.; Laa, B.; Brezina, T. Impact of covid-19 lockdown on commuting: A multi-country perspective. *Eur. J. Transp. Infrastruct. Res.* **2021**, *21*, 70–93. [CrossRef]
13. Nguyen, M.H. Factors influencing home-based telework in Hanoi (Vietnam) during and after the COVID-19 era. *Transportation* **2021**, *48*, 3207–3238. [CrossRef]
14. Hiselius, L.W.; Arnfalk, P. When the impossible becomes possible: COVID-19′s impact on work and travel patterns in Swedish public agencies. *Eur. Transp. Res. Rev.* **2021**, *13*, 1–10. [CrossRef]
15. Beck, M.J.; Hensher, D.A.; Wei, E. Slowly coming out of COVID-19 restrictions in Australia: Implications for working from home and commuting trips by car and public transport. *J. Transp. Geogr.* **2020**, *88*, 102846. [CrossRef]
16. Irawan, M.Z.; Belgiawan, P.F.; Joewono, T.B.; Bastarianto, F.F.; Rizki, M.; Ilahi, A. Exploring activity-travel behavior changes during the beginning of COVID-19 pandemic in Indonesia. *Transportation* **2021**. [CrossRef] [PubMed]
17. Bamberg, S.; Fujii, S.; Friman, M.; Gärling, T. Behaviour theory and soft transport policy measures. *Transp. Policy* **2011**, *18*, 228–235. [CrossRef]
18. Jones, P.M. Acceptability of Road User Charging: Meeting the Challenge. *Accept. Transp. Pricing Strateg.* **2003**, 27–62. [CrossRef]
19. Cairns, S.; Sloman, L.; Newson, C.; Anable, J.; Kirkbride, A.; Goodwin, P. Smarter choices: Assessing the potential to achieve traffic reduction using "Soft measures". *Transp. Rev.* **2008**, *28*, 593–618. [CrossRef]
20. Jones, P.M.; Sloman, L. Encouraging Behavioural Change Through Marketing and Management: What can be achieved? In Proceedings of the Moving through Nets: The Physical and Social Dimensions of Travel: 10th International Conference on Travel Behaviour Research, Lucerne, Switherland, 10–15 August 2003; pp. 1–35.
21. Taylor, M.A.P.; Ampt, E.S. Travelling smarter down under: Policies for voluntary travel behaviour change in Australia. *Transp. Policy* **2003**, *10*, 165–177. [CrossRef]
22. Badiozamani, G. Car-free days: A shift in the planning paradigm? *Nat. Resour. Forum* **2003**, *27*, 300–303. [CrossRef]
23. McKibbin, D. Car Free Days: A Literature Review. Available online: http://nia1.me/2cf (accessed on 20 January 2022).
24. Balsas, C.J.L. Sustainable transportation planning on college campuses. *Transp. Policy* **2003**, *10*, 35–49. [CrossRef]
25. Tolley, R. Green campuses: Cutting the environmental cost of commuting. *J. Transp. Geogr.* **1996**, *4*, 213–217. [CrossRef]
26. Papantoniou, P.; Vlahogianni, E.; Yannis, G.; Attard, M.; Valero-Mora, P.; Campos-Díaz, E.; Tormo-Lancero, M.T. Investigating mobility gaps in university campuses. *Adv. Intell. Syst. Comput.* **2019**, *879*, 378–385. [CrossRef]

27. Gehlert, T.; Dziekan, K.; Gärling, T. Psychology of sustainable travel behavior. *Transp. Res. Part A Policy Pract.* **2013**, *48*, 19–24. [CrossRef]
28. Fishbein, M.; Ajzen, I. Attitudes towards objects as predictors of single and multiple behavioral criteria. *Psychol. Rev.* **1974**, *81*, 59–74. [CrossRef]
29. Ajzen, I.; Fishbein, M. Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychol. Bull.* **1977**, *84*, 888–918. [CrossRef]
30. Schwartz, S.H. Normative influences on altruism. *Adv. Exp. Soc. Psychol.* **1977**, *10*, 221–279. [CrossRef]
31. Stern, P.C. Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues* **2000**, *56*, 407–424. [CrossRef]
32. Dietz, T.; Stern, P.C.; Guagnano, G.A. Social structural and social psychological bases of environmental concern. *Environ. Behav.* **1998**, *30*, 450–471. [CrossRef]
33. Bamberg, S.; Möser, G. Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J. Environ. Psychol.* **2007**, *27*, 14–25. [CrossRef]
34. Gardner, B.; Abraham, C. Psychological correlates of car use: A meta-analysis. *Transp. Res. Part F Traffic Psychol. Behav.* **2008**, *11*, 300–311. [CrossRef]
35. Verplanken, B.A.S. Habit, information acquisition, and the process of making travel mode choices. *Eur. J. Soc. Psychol.* **1997**, *27*, 539–560. [CrossRef]
36. Gärling, T.; Axhausen, K.W. Introduction: Habitual travel choice. *Transportation* **2003**, *30*, 1–11. [CrossRef]
37. Gardner, B. Modelling motivation and habit in stable travel mode contexts. *Transp. Res. Part F Psychol. Behav.* **2009**, *12*, 68–76. [CrossRef]
38. Verplanken, B.; Aarts, H.; Van Knippenberg, A.; Moonen, A. Habit versus planned behaviour: A field experiment. *Br. J. Soc. Psychol.* **1998**, *37*, 111–128. [CrossRef] [PubMed]
39. Klöckner, C.A.; Matthies, E. How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *J. Environ. Psychol.* **2004**, *24*, 319–327. [CrossRef]
40. Bamberg, S.; Ajzen, I.; Schmidt, P. Choice of Travel Mode in the Theory of Planned Behavior: The Roles of Past Behavior, Habit, and Reasoned Action. *Basic Appl. Soc. Psych.* **2003**, *25*, 175–187. [CrossRef]
41. Triandis, H.C. *Interpersonal Behavior*; Brooks: Monterey, KY, USA; Cole Pub. Co.: Hawthorne, CA, USA, 1977; ISBN 9780818501883.
42. Daramy-Williams, E.; Anable, J.; Grant-Muller, S. Car use: Intentional, habitual, or both? Insights from anscombe and the mobility biography literature. *Sustainability* **2019**, *11*, 7122. [CrossRef]
43. WCFN World Car-Free Day (WCD). Available online: https://www.worldcarfree.net/wcfd/ (accessed on 23 March 2021).
44. Gharsheen, S.Z.U.; Haron, Z.; Yahya, K.; Darus, N.; Hezmi, M.A.; Mazlan, A.N. Impact of car free day on foyer building environment. *MATEC Web Conf.* **2018**, *250*, 06008. [CrossRef]
45. Nagy, G.; Merényi, A.; Domokos, E.; Rédey, Á.; Yuzhakova, T. Monitoring of air pollution spread on the car-free day in the city of Veszprém. *Int. J. Energy Environ.* **2014**, *5*, 679–684.
46. Rachman, H.O.; Barus, L.S. Impact of Car-Free Day on air pollution and its multifarious advantages in Sudirman-Thamrin Street, Jakarta. *Int. J. GEOMATE* **2019**, *17*, 167–172. [CrossRef]
47. Farda, M.; Balijepalli, C. Exploring the effectiveness of demand management policy in reducing traffic congestion and environmental pollution: Car-free day and odd-even plate measures for Bandung city in Indonesia. *Case Stud. Transp. Policy* **2018**, *6*, 577–590. [CrossRef]
48. Politis, I.; Gavanas, N.; Pitsiava–Latinopoulou, M.; Papaioannou, P.; Basbas, S. Measuring the Level of Acceptance for Sustainable Mobility in Universities. *Procedia-Soc. Behav. Sci.* **2012**, *48*, 2768–2777. [CrossRef]
49. Anwar, M.; Fujiwara, A.; Silaban, T.A.; Aquitana, V. Evaluating Local People Acceptance towards Car Free Day Program Using Structural Equation Model: Study on Surabaya City of Indonesia. In *Eastern Asia Society for Transportation Studies, Proceedings of the 8th International Conference of Eastern Asia Society for Transportation Studies, Surabaya, Indonesia, 16–19 November 2009*; Eastern Asia Society for Transportation Studies: Tokyo, Japan, 2009; Volume 7, pp. 1–27.
50. Vlahogianni, E.; Papantoniou, P.; Yannis, G.; Attard, M.; Regattieri, A.; Piana, F.; Pilati, F. Analysis of mobility patterns in selected university campus areas. *Adv. Intell. Syst. Comput.* **2019**, *879*, 426–433. [CrossRef]
51. Tormo-Lancero, M.T.; Valero-Mora, P.; Sanmartin, J.; Sánchez-García, M.; Papantoniou, P.; Yannis, G.; Alonso, F.; Campos-Díaz, E. Development of a Roadmap for the Implementation of a Sustainable Mobility Action Plan in University Campuses of Emerging Countries. *Front. Sustain. Cities* **2022**, *3*, 1–13. [CrossRef]
52. Papantoniou, P.; Yannis, G.; Vlahogianni, E.; Attard, M.; Regattieri, A.; Piana, F.; Pilati, F. Developing a Sustainable Mobility Action Plan for University Campuses. *Transp. Res. Procedia* **2020**, *48*, 1908–1917. [CrossRef]
53. Cadena, R.P.; De Andrade, M.O.; Meira, L.H.; De Freitas Dourado, A.B. The pursuit of a sustainable and accessible mobility on university campuses. *Transp. Res. Procedia* **2020**, *48*, 1861–1880. [CrossRef]
54. Ramakreshnan, L.; Fong, C.S.; Sulaiman, N.M.; Aghamohammadi, N. Motivations and built environment factors associated with campus walkability in the tropical settings. *Sci. Total Environ.* **2020**, *749*, 141457. [CrossRef]
55. Memon, I.A.; Kalwar, S.; Sahito, N.; Qureshi, S. Average Index Modelling of Campus Safety and Walkability: The Case Study of University of Sindh. *Sukkur IBA J. Comput. Math. Sci.* **2020**, *4*, 37–44. [CrossRef]
56. Rybarczyk, G.; Gallagher, L. Measuring the potential for bicycling and walking at a metropolitan commuter university. *J. Transp. Geogr.* **2014**, *39*, 1–10. [CrossRef]

57. Stein, P.P.; Rodrigues da Silva, A.N. Barriers, motivators and strategies for sustainable mobility at the USP campus in São Carlos, Brazil. *Case Stud. Transp. Policy* **2018**, *6*, 329–335. [CrossRef]
58. Dehghanmongabadi, A.; Hoşkara, S. Challenges of promoting sustainable mobility on university campuses: The case of Eastern Mediterranean University. *Sustainability* **2018**, *10*, 4842. [CrossRef]
59. Morta, A.R.T.; Castro, J.T. The impact of land use features and transport accessibility in the occurrence of crime in a university campus. In Proceedings of the 12th World Conference on Transportation Research, Lisbon, Portugal, 10–15 July 2010; pp. 11–15.
60. Capasso da Silva, D.; Rodrigues da Silva, A.N. Sustainable modes and violence: Perceived safety and exposure to crimes on trips to and from a Brazilian university campus. *J. Transp. Health* **2020**, *16*, 100817. [CrossRef]
61. Lara, D.V.R.; Rodrigues da Silva, A.N. A Spatial Analysis of Crime Incidence and Security Perception Around a University Campus. *Urban B. Ser.* **2021**, 575–590. [CrossRef]
62. Verplanken, B.; Aarts, H.; van Knippenberg, A.; van Knippenberg, C. Attitude Versus General Habit: Antecedents of Travel Mode Choice. *J. Appl. Soc. Psychol.* **1994**, *24*, 285–300. [CrossRef]
63. Verplanken, B.; Orbell, S. Reflections on Past Behavior: A Self-Report Index of Habit Strength. *J. Appl. Soc. Psychol.* **2003**, *33*, 1313–1330. [CrossRef]
64. Shmueli, G. To Explain or to Predict? *Stat. Sci.* **2010**, *25*, 289–310. [CrossRef]
65. IBGE Brasil | São Paulo | São Carlos. Available online: https://cidades.ibge.gov.br/brasil/sp/sao-carlos/panorama (accessed on 23 April 2021).
66. USP-SC Sobre o Campus da USP em São Carlos. Available online: http://www.saocarlos.usp.br/historia-e-numeros/ (accessed on 23 April 2021).
67. USP Mapas e Aplicativos. Available online: http://www.puspsc.usp.br/mapas-e-aplicativos/ (accessed on 22 February 2022).
68. Boeing, G. OSMnx: New methods for acquiring, constructing, analyzing, and visualizing complex street networks. *Comput. Environ. Urban Syst.* **2017**, *65*, 126–139. [CrossRef]
69. Hagberg, A.; Schult, D.; Swart, P. NetworkX Reference. Available online: https://networkx.org/documentation/stable/_downloads/networkx_reference.pdf (accessed on 23 February 2022).
70. McFadden, D. Quantitative Methods for Analyzing Travel Behaviour of Individuals: Some Recent Developments. *Cowles Found. Discuss. Pap.* 1977. Available online: https://ideas.repec.org/p/cwl/cwldpp/474.html (accessed on 11 February 2022).
71. Fox, J.; Monette, G. Generalized collinearity diagnostics. *J. Am. Stat. Assoc.* **1992**, *87*, 178–183. [CrossRef]
72. Robinson, A.; Cook, R.D.; Weisberg, S. *Residuals and Influence in Regression*; Chapman and Hall: New York, NY, USA, 1984; Volume 147, ISBN 041224280X.
73. McCullagh, P. Regression Models for Ordinal Data. *J. R. Stat. Soc.* **1980**, *42*, 109–142. [CrossRef]
74. Brant, R. Assessing Proportionality in the Proportional Odds Model for Ordinal Logistic Regression. *Biometrics* **1990**, *46*, 1171–1178. [CrossRef]
75. Ripley, B.; Venables, B.; Bates, D.M.; Hornik, K.; Gebhardt, A.; Firth, D. Package "MASS". Available online: http://www.stats.ox.ac.uk/pub/MASS4/ (accessed on 24 April 2021).
76. Hussein, A.S. How Event Awareness, Event Quality and Event Image Creates Visitor Revisit Intention?: A Lesson from Car free Day Event. *Procedia Econ. Financ.* **2016**, *35*, 396–400. [CrossRef]