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Impact of Vegetation on Perceived Safety and Preference in City Parks

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Abstract: The aim of this study was to determine the impact of safety-related environmental characteristics in a city park on users' preferences and whether this impact can be explained by perceived safety. The factors examined were physical and visual accessibility as well as the effectiveness of concealment created by plants in various spatial systems. We used 112 photographs taken in city parks for the study. Studies have shown that visual and physical accessibility varies in terms of impact on preferences and safety—as a result, we tested only visual accessibility and effectiveness. Correlation and regression analyses confirmed that vegetation in a park that obstructs views and can offer concealment reduces our sense of safety. In addition, such vegetation has a negative effect on preference. However, mediation analysis showed that this sense of safety or danger means that dense vegetation (low visual accessibility yet highly effective in offering concealment) is less preferred as a landscape feature. After excluding the impact brought to bear by the sense of safety, the studied features of vegetation had no significant impact on preferences. This means that plants and vegetation layouts of varying densities can be used in completely safe parks and this will probably not adversely affect the feelings of the users.

Keywords: fear of crime; danger; prospect–refuge; concealment; accessibility

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1. Introduction

The value of urban green areas, including historical parks, and their importance for the well-being of residents is beyond dispute [1]. That is why it is important to design such parks so that they may be used as effectively as possible. Both positive and negative feelings influence whether and how often parks are visited, as well as their restorative effect. These are in turn dependent on, inter alia, the layout and topography, in particular the vegetation as the basic element. The development of science deepens our understanding of the relationship between the park space and their users. This makes it easier to predict users' feelings and behavior in various situations. In turn, this helps shape the park better by adapting it to the contemporary needs, expectations, and reactions of its users. It should be remembered, however, that these reactions change over time, as do the conditions that shape them. The sense of danger associated with fear of crime is currently a common phenomenon in urban spaces, including parks. It also occurs in historical parks created at a time when this problem did not exist or was marginal in nature. Today, when determining what should be done with historical parks, we must take into account not only the conditions resulting from conservational protection (in the spirit of the Florence Charter [2] and the Document on Historic Urban Public Parks [3]) but also new threats and fears (compared to the times when the parks were created). This is a must if we want historical parks to live on and perform their social functions as well as they possibly can.

Studies have been conducted that confirm the positive influence of greenery, especially of street trees on safety [4–6]. However, users may experience anxiety in larger areas of urban greenery, including urban parks, as a result of the real and present danger of crime or subjectively perceived threat [7–10], especially when such areas are wild-looking urban nature settings [11–13]. Parks that are solely recreational in purpose should not evoke such feelings. The sense of danger increases if the parks are located in dangerous parts of the city (high-crime areas) or in places perceived as dangerous (fear areas) [14]. A feeling of fear curtails any positive effects that recreational areas might otherwise have, and often leads to these areas being used less frequently [15,16].

A number of studies have been conducted that address the impact that the spatial features of plants and plant systems have on our sense of threat [7,11,14,17–19]. The most popular perspective from which research has been conducted in this direction is the Nasar/Fisher model built on Appleton's prospect–refuge theory [20,21]. It assumes that a sense of threat is affected by three spatial factors: prospect, refuge (concealment), and escape (entrapment) [22,23]. A number of subsequent studies on the impact of spatial features on the sense of fear or threat were based on this perspective [24–29]. Researchers confirmed that parks that are accessible and provide a view are perceived as being safer than parks featuring understory and compact tree groups [13].

Knowing that plants that block visibility, obstruct escape and offer a place to hide serve to increase the sense of threat, one would think that it might be a good solution not to use plants that work in this way. Some researchers recommend avoiding low-crowned shrubs and trees in dangerous areas [5,12,30,31]. Kuo and Sullivan [32] also cite examples of action taken to improve safety, which consisted of removing shrubs and trees from park areas. However, designing the whole park according to such recommendations would completely deprive it of any intimate places that provide desired privacy [33]. Research shows that such places are popular despite the threat they evoke [34]. Their complete lack may also lead to spatial monotony and low levels of mystery [35] and diversity [35,36]—factors affecting the preferences people have regarding landscapes. Some studies on the characteristics of plants associated with safety-related environmental characteristics (e.g., plant density) have indicated their positive correlation with preference [37], although other studies have yielded different results (e.g., [11]).

While designing, transforming, and reevaluating parks, and when considering whether and in which situations to design vegetation layouts that may obstruct views, hinder movement, or provide concealment, not only should we ascertain if such layouts evoke a sense of safety, it is also relevant whether they are popular (preferred) and if not, whether low preference is due to the sense of threat they cause, or for other reasons. Although researchers assume that plant characteristics (e.g., their density) are unpopular due to the threat that they evoke [1], there are few studies that test such a mechanism—e.g., by mediation analysis. These include Lis et al. [34], but they are limited to the impact on preferences via perceived danger, exclusively for those plants that make good concealment ("effectiveness of concealment"). Our research has been extended with further features related to other elements of the Nasar/Fisher model—view and escape or, in other words, visual and physical accessibility.

Furthermore, our assumption was to examine impact of plant features and their arrangements on safety in relation to areas where this problem is particularly relevant-parks located in places which the users consider dangerous. That is why respondents evaluating the target variables were informed in the initial part of the survey that the pictures come from such areas.

To summarize, our research aimed to answer two basic questions:

RQ1: How does the visual and physical accessibility and concealment in an urban park which the users consider dangerous influence the perceived safety and preferences of its users?
RQ2: Can the influence of visual and physical accessibility and concealment on preferences be explained by the perceived safety?

We assumed that perceived safety mediates the relationship between visual and physical accessibility and concealment and preference (i.e., there is a relationship of the following nature:

visual accessibility/physical accessibility/concealment → perceived safety → preference).

1.1. Safety-Related Environmental Characteristics and Preferences

Common practices are based on the assumption that preferred park landscapes are those that allow free visual penetration, including trees and groups of trees with minimal understory [35,38–40]. Conventional parks are shaped according to such rules [13]. Such parks are also seen as safe [41]. In contrast, design tendencies promoting ecological trends use natural plant compositions with little human intervention, which often includes dense, wild-looking trees and shrubbery understory. Parks thus shaped are generally perceived as less safe than traditional ones [7,11,42]. This is because they usually contain dense understory that restricts views and offers potential concealment [11,43]. Research on preferences for such parks has not yielded conclusive results. Some have shown that dense woodland with shrubbery understory receives low acceptance from the public [11,42,44], while open spaces are positively correlated with preferences [45]. In studies evaluating the impact of enclosure space on three aesthetic preference factors (i.e., coherence, complexity, and legibility) [46], the participants rated legibility and complexity for physically enclosed scenes lower than for physically open scenes.

In contrast, other studies have shown that dense vegetation is strongly preferred [37]. The reasons why people might prefer landscapes with dense vegetation can differ. Such landscapes are characterized by a greater sense of mystery [47], which is one of the predictors of preference [35]. Wild-looking areas also have higher ecological values [48], and this can translate into stronger preferences [49–51]—especially among people with an ecological orientation [39,52,53].

As may be observed, research on the relationship between park features such as plant density or prospect and preference differ significantly. They include studies showing that people enjoy dense vegetation and ones that claim stronger preferences for open parks with prospect. What is more, research results are ambiguous even when it comes to determining the nature of dependence. Some studies have found curvilinear dependencies. For example, in the regression model for residents' preference, Hoffman and colleagues [54] claimed that extreme (high and low) levels of the canopy closure and prospect were good predictors of preference. Others found the opposite relationship—the respondents declared that they preferred moderately dense scenes the most [38]. There are also studies in which the relation between vegetation density and preference was described not as quadratic but as a power curve [55,56]. However, it should be noted that the above studies concerned various types of landscapes. For example, the studies by Suppakittpaisarn et al. [56] referred to streets where the density of greenery was relatively minor. It is understandable that the appearance of greenery in such scenery was more preferred, especially at the beginning. The situation is different, for example, in forests where the density of greenery is great and may cause a reduction in preferences if excessive—in this case the dependence may be quadratic [38]. There are also studies in which no statistically significant relationship between vegetation density and preference was found [57]. In addition, most studies on the effects of plant forms on preference have been conducted in Europe and the USA [58]. Therefore, it is unclear whether the results of previous studies extend to individuals who live in different countries and are from different cultural backgrounds [45]. Recent cross-cultural studies conducted by Lis et al. in three countries—Poland, Latvia, and China [59]—showed that the impact of the researched forms of vegetation on preferences differs for respondents from different countries.

1.2. Features of Space Studied

We adopted three features as independent variables in the study: "effectiveness of concealment", visual accessibility, and physical accessibility. These features are connected with three elements of the Nasar/Fisher model—concealment, prospect, and refuge, respectively.

We took "effectiveness of concealment" from Lis et al. [60], who defined it as characteristics of shrubs and trees that determine their effectiveness as a potential hiding place for a person or a group of people.

Visual and physical accessibility are concepts in literature that are routinely used and distinguished [34,47,54,61,62]. Visual accessibility means the high visual permeability of a site [54] and is also sometimes called visibility [63,64], openness [65,66], spaciousness [67], or enclosure [68]. It is often used as a predictor of preference (e.g., [68,69]). Physical accessibility describes the possibility of entering a site [54], and is also used as a predictor variable in preference studies (e.g., [66,70]).

We assumed that plants are the basic building material of the park and that they have different features distributed in different spatial systems that influence these three variables. While moving along a park path, the user perceives the space in a way that is largely dependent on the features and spatial arrangement of the plants. We decided, for various spatial arrangements, to examine the influence of safety-related environmental properties adopted as predictor variables on perceived safety and preference. For this study, we used a carefully selected set of photographs to show situations varied in terms of the predictor variables tested. Next, we wanted to use mediation analysis to check whether the impact of visual and physical accessibility and concealment on preferences could be explained by the sense of safety/threat that these attributes evoke.

2. Methods

2.1. Participants

We employed a within-subjects design in which participants evaluated a set of 112 photographs depicting various green environments on perceived environmental safety and preference and on physical accessibility, visual accessibility, and effectiveness of concealment.

Participants were volunteers recruited from among students of the Wrocław University of Environmental and Life Sciences. The request to participate in the study was conveyed via persons conducting didactic classes in various fields of study, and 247 students agreed to participate. We randomly selected 115 participants from this group (75 males and 40 females, $M_{\text{age}} = 22.17$, $SD_{\text{age}} = 1.88$, age range = 19–26 years). To avoid spurious correlations between the appraisals of individual variables, like other researchers using a similar research method (e.g., [28,62,65,71]) we divided participants randomly into five groups of 23 participants each. Each group evaluated only one of the five variables.

2.2. Stimuli

The settings consisted of 112 color photos of urban park environments. The photographs were selected from a large sample (approximately 460 photographs taken in 21 city parks in Wrocław (Figure 1, Table S1). We took all the photos between May and September 2018. The sample was selected to include a significant variety of predictor variables—effectiveness of concealment, visual accessibility, and physical accessibility. For each of the variables we chose photos to present a low or high value of a given variable. At the same time, we tried to limit the impact of other important but uncontrolled factors. Therefore, no settings contained any people or animals. Paths, which are a regular feature of each photo, did not differ significantly in terms of width or surface. There were no photos showing damaged or degraded areas, or plants particularly distinguished in terms of their ornamentation (e.g., spectacular flowers). All photos were taken in the summer or late spring. The weather conditions were favorable (no extreme cloud cover or precipitation). All slides were oriented horizontally.

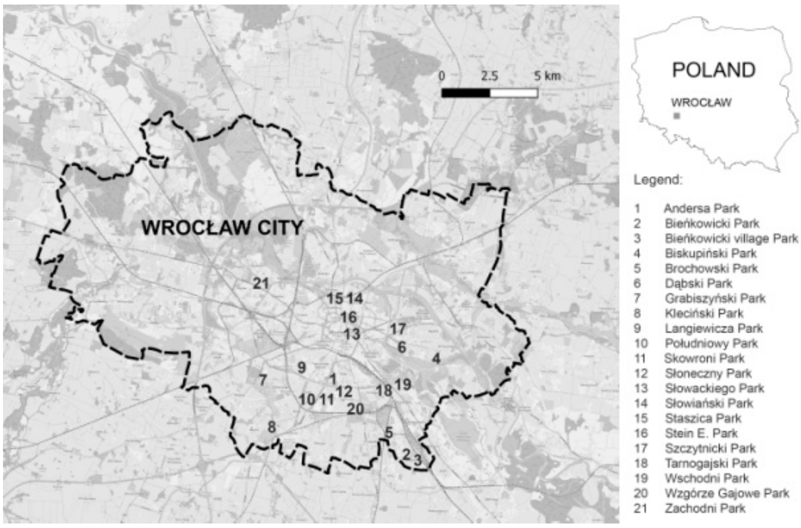

Figure 1. Wroclaw parks where the photos used in the research were taken.

The appropriate level of a given predictor variable was achieved by choosing the right kind of spatial situation created by plant elements. We took into account, in particular, four characteristic forms of vegetation popular in the areas of urban parks:

- Trees with a high crown (over 90 cm)—e.g., the small-leaved lime (*Tilia cordata* (Mill.)), European ash (*Fraxinus excelsior* (L.)), Scots pine (*Pinus sylvestris* (L.)).
- Trees with a low crown (below 90 cm)—e.g., northern white-cedar *(Thuja occidentalis* (L.)), weeping beech 'Pendula' *(Fagus sylvatica* var. *pendula* (Lodd.)), Young's weeping birch, (*Betula pendula 'Youngii'*).
- Shrubs that allow a potential attacker to hide (width 50 cm, minimum height 90 cm, non-see-through) or trees with a thick trunk (over 50 cm in diameter)—e.g., rhododendrons (*Rhododendron* sp.), yew (*Taxus baccata* (L.)), London plane (*Platanus acerifolia* (Aiton) (Willd.)).
- Shrubs that cannot hide a potential attacker (low, narrow, or see-through) and high herbaceous vegetation making it difficult to move—e.g., Tamarisk (*Tamarix tetrandra* (*Pall. ex M.Bieb.)*), Rocky Mountain juniper 'Skyrocket' (*Juniperus scopulorum* 'Skyrocket'), shrubby cinquefoil (*Potentilla fruticosa* (L.)).

The above plant elements can create different situations in terms of the variables studied. The collation of such situations creates a matrix in which each sub-category is represented by 14 slides (Table 1). Figure 2 shows the difference in variables for sample situations built by characteristic plant forms. Figure 3 shows a sample set of photos selected for the study.

Table 1. Distribution of photographs into groups (subcategories) designated by the level of safety-related environmental properties.

Effectiveness of Concealment	High Effectiveness of Concealment		Low Effectiveness of Concealment	
Physical accessibility Visual accessibility	Low physical accessibility	High physical accessibility	Low physical accessibility	High physical accessibility
Low visual accessibility	14 slides	14 slides	14 slides	14 slides
High visual accessibility	14 slides	14 slides	14 slides	14 slides

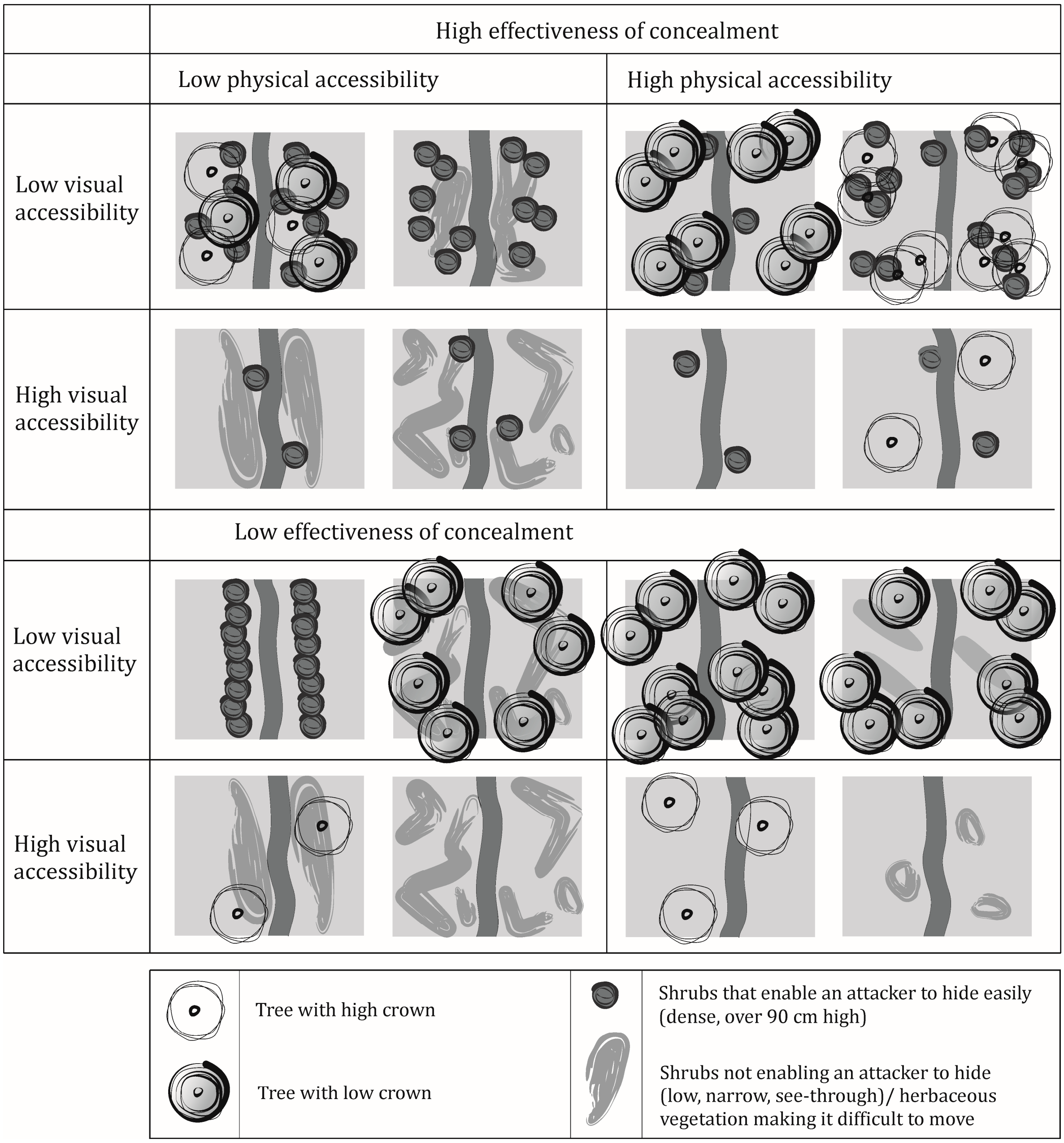

Figure 2. Examples of spatial situations for each subcategory.

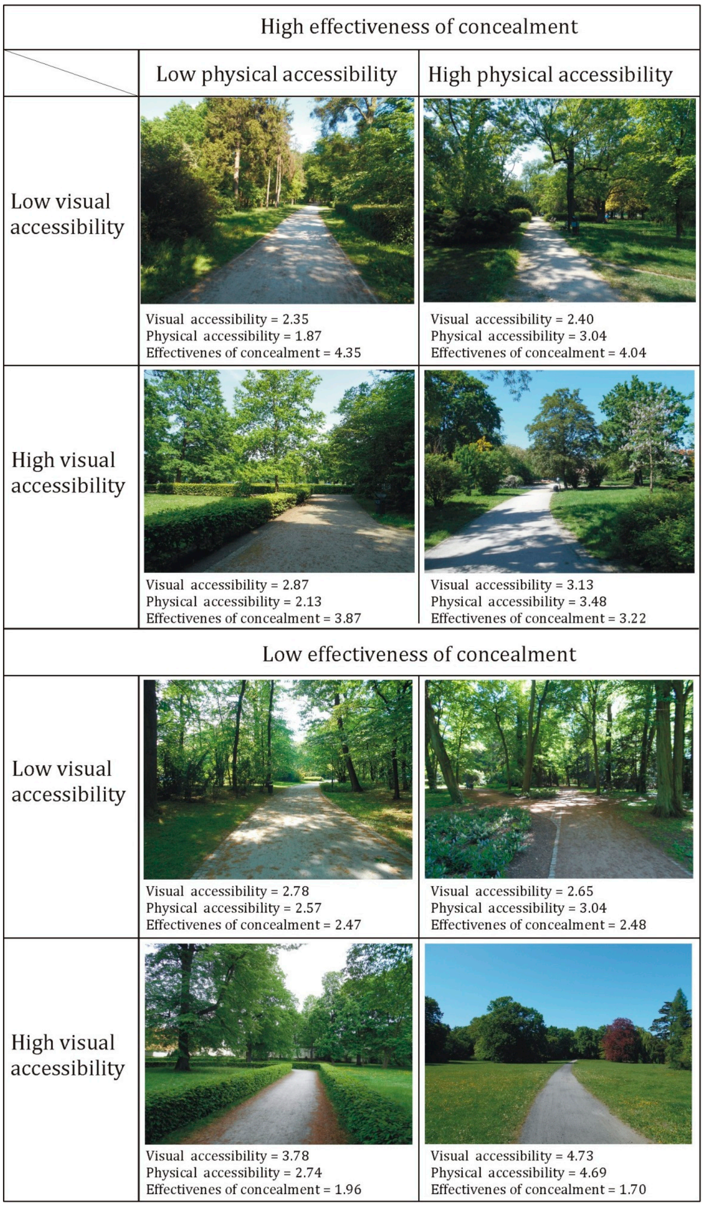

Figure 3. Sample photos for each subcategory.

2.3. Procedure

We constructed the study in the following way. We divided the participants into five groups of equal number (23 participants each), each of which assessed a different variable as to reduce spurious correlations between the various evaluations (e.g., [72]). The study was conducted in three classrooms simultaneously. First, three groups answered questions (each in a different room), followed by two more groups. As a result, the study participants had no contact with each other to exchange information on the course of the study.

The order of the pictures in each set was random. All ratings used a 5-point scale ranging from 5 (highest possible rating) to 1 (lowest possible rating).

There were two target variables: environmental safety and preference. The definitions of preference was taken from Herzog and colleagues (e.g., [73,74]). The question regarding "preference" was thus phrased: "How much do you like the setting? This is your own personal degree of liking for the setting, and you don't have to worry about whether you're right or wrong or whether you agree with anybody else". The definitions of environmental safety were taken from van Rijswijk et al. [27,28]. The question was: "How safe or unsafe do you judge this environment to be?" We adopted the definition of the effectiveness of concealment variable from Lis et al. [34,59]. The question about this variable was as follows: "Please imagine that you or someone else may hide behind the shrubs or trees that you can see. How do you rate such a hiding place in terms of effectiveness?" Definitions of physical and visual access were taken from Lis et al. [34]. For the variable "visual accessibility" the question was as follows: "Assess to what extent the place from which you are looking is visible from the outside, for people standing or passing nearby. To what extent can you see people at a certain distance or can you be seen by those people?" The question about physical accessibility read: "Evaluate how easy it is to enter the place from which you looking, from outside, from around the path? Take into account any barriers and inconveniences".

The participants answered questions in the exercise rooms. The photos were presented using a 800 × 600 SVGA projector in 4:3 format and a diagonal image of 121 inches. While the respondents were evaluating the target variables (safety, preference), they were asked to imagine, with each photo, that the surroundings shown were located in a dangerous area of a city, and that they were walking along a path there. At the beginning of the study, twenty randomly selected photos were presented to the participants to familiarize them with the material that would be subject to evaluation and allow them to form an opinion on the evaluation criteria and practice carrying out the instructions for the task. The participants then evaluated all 112 photos. The photos were grouped four to a slide to help participants with their evaluation and reduce task completion time. It took 40 seconds to view each slide. During this time, the participants indicated their answers. As a result, the actual study took about 18 minutes.

2.4. Data Analysis

All analyses were based on setting as the units of analysis and setting scores as raw scores. A setting score is the mean score for each setting based on all the participants who completed one of the rating tasks. Thus, for each rated variable, each of the 112 settings displayed on the slides had a setting score. Internal consistency reliability coefficients (Cronbach's alpha), based on settings as cases and participants as items, ranged from 0.889 to 0.974 ($\alpha_{\text{physical accessibility}} = 0.973$, $\alpha_{\text{visual accessibility}} = 0.973$, $\alpha_{\text{effectiveness of concealment}} = 0.974$, $\alpha_{\text{safety}} = 0.967$, $\alpha_{\text{preference}} = 0.889$) indicating satisfactory agreement among the raters. So, it was appropriate to use aggregated scores in our analyses.

In order to answer the research questions and to test the hypotheses, statistical analyses were carried out using IBM SPSS Statistics 24 software. An analysis of basic descriptive statistics was conducted together with Kolmogorov–Smirnov tests (to test the assumption about the compliance of the distributions of measured quantitative variables with the normal distribution), and one-way analysis of variance for independent samples (to check whether the categories defined by the researchers significantly differentiate statistically similar assessments of study participants), correlation analysis with Pearson correlation coefficient r and two multivariate linear regression analyses (to evaluate the spatial factors studied as predictors of preference and sense of danger). To check the mediating effects, two mediation analyses were carried out with PROCESS macro version 2.16.2 by Hayes (2013). Statistical significance in this section was considered to be $\alpha = 0.05$.

3. Results

3.1. Basic Descriptive Statistics of the Quantitative Variables Measured

In order to check whether the assumption regarding the conformity of the distributions of the measured quantitative variables with the normal distribution was met, an analysis of the basic descriptive statistics was carried out first, together with a Kolmogorov–Smirnov test. As it turned out, the test results were statistically insignificant for the majority of the measured variables (non-statistically significant distributions from the Gauss curve). Only in the case of preferences was the result statistically significant. Nevertheless, the skewness did not exceed the contractual absolute value of 1.0, which means that the distribution was not significantly asymmetrical [75]. There were no outliers. In connection with the above, we decided to perform some parametric tests. Collectively, the results of all the calculated descriptive statistics, together with the normality test for the distribution, are presented in Table 2.

Table 2. Basic descriptive statistics of quantitative scales together with the Kolmogorov–Smirnov test.

	M	*Mdn.*	*SD*	*Sk.*	*Kurt.*	*Min.*	*Max.*	*D*	*p*
Safety	2.99	3.04	0.85	−0.19	−0.59	1.09	4.70	0.06	0.200
Preferences	3.24	3.35	0.55	−0.22	−0.58	1.78	4.52	0.09	0.037
Visual Accessibility	3.00	2.96	0.92	0.08	−0.49	1.04	4.83	0.07	0.200
Physical Accessibility	3.12	3.09	0.88	−0.02	−0.85	1.17	4.74	0.06	0.200
Effectiveness of Concealment	3.00	2.96	1.05	0.05	−1.08	1.09	5.00	0.08	0.096

Note. *M*—average; *Mdn.*—median; *SD*—standard deviation; *Sk.*—skewness; *Kurt.*—kurtosis; *D*—Kolmogorov–Smirnov test statistic; *p*—significance.

3.2. Manipulation Check

In order to check whether the categories defined by the researchers (low vs. high visual accessibility, physical accessibility, and effectiveness of concealment) differentiated in a statistically significant way from the analogical assessments of the study participants in terms of visual and physical accessibility as well as effectiveness of concealment, we performed three Student's *t*-tests for independent trials. Each of the quantitative variables was differentiated in a statistically significantly way, depending on the category that we allocated. The result was significant both in the case of visual access [$t(110) = 9.11$; $p < 0.001$; $d = 1.72$; 95% CI [0.94; 1.47]; $M_{low} = 2.39$; $SD = 0.66$ vs. $M_{high} = 3.60$; $SD = 0.74$], physical accessibility [$t(110) = 5.37$; $p < 0.001$; $d = 1.01$; 95% CI [0.5; 1.1]; $M_{low} = 2.72$; $SD = 0.81$ vs. $M_{high} = 3.52$; $SD = 0.77$] and effectiveness of concealment [$t(110) = -11.1$; $p < 0.001$; $d = 2.1$; 95% CI [−1.79; −1.25]; $M_{low} = 2.24$; $SD = 0.72$ vs. $M_{high} = 3.76$; $SD = 0.73$]. The photos from the landscape category with low visual and physical accessibility as well as effectiveness of concealment were actually lower rated on these quantitative scales in comparison to the photos from the category of high accessibility and effectiveness of concealment.

3.3. Correlations between Safety, Preferences, Physical Accessibility, Visual Accessibility, and Effectiveness of Concealment

In the next step, we correlated the quantitative variables used in this study. All the calculated Pearson r correlation coefficients were statistically significant. It turns out that along with an increase in the security assessment, preferences in relation to the landscape also grew (medium–strong correlation) as well as the assessment of physical and visual accessibility, while the assessment of the effectiveness of concealment (strong correlations) decreased. Preferences, on the other hand, corresponded positively with moderate strength with physical and visual access, while they correlated weakly and negatively with the assessment of the effectiveness of concealment. In addition, the lower the visual and physical accessibility of the landscape was assessed to be, the higher the effectiveness of concealment was evaluated. Collectively, the results are presented in Table 3.

Table 3. Pearson correlation between the assessment of physical and visible accessibility, security, effectiveness of concealment, and preferences.

		Safety	Preferences	Vis. Access.	Phys. Access.
Preferences	Pearson's r	0.41	-	-	-
	Significance	<0.001			
Visual Accessibility	Pearson's r	0.89	0.35	–	–
	Significance	<0.001	<0.001		
Physical Accessibility	Pearson's r	0.82	0.33	0.91	
	Significance	<0.001	<0.001	<0.001	
Effectiveness of Concealment	Pearson's r	−0.69	−0.23	−0.80	−0.79
	Significance	<0.001	0.015	<0.001	<0.001

3.4. Assessment of Accessibility and Effectiveness of Concealment as Predictors of Preferences and Sense of Safety

Next, we expanded the results obtained in the analysis of the correlation with two regression analyses in which the explanatory variables were preferences and sense of safety. As predictors, we introduced an assessment of visual and physical accessibility as well as the effectiveness of concealment. However, due to the occurrence of a threateningly high collinearity between the two types of accessibility (the variance inflation factor (VIF) factor for visual accessibility is 6.25 while it is 6.04 for physical accessibility), we decided to introduce only visual accessibility to the model. The analysis showed that for the dependent variable in the form of preferences, the model was statistically significant and explained 11% of the variance, but the only relevant predictor was visual accessibility (Table 4). In its presence, effectiveness of concealment did not significantly affect the variability in the assessment of landscape preferences.

Table 4. Visual accessibility and effectiveness of concealment as predictors of preferences.

	b	SE_b	β	R^2	SEE	F	p
(Permanent)	2.20	0.48					
Visual Accessibility	0.28	0.09	0.46 **	0.11	0.52	8.12	0.001
Effectiveness of Concealment	0.07	0.08	0.14				

Note. b—unstandardized regression coefficient; SEb—standard error of b; β—standardized regression coefficient; SEE—standard error of estimation; F—ANOVA test statistic; p—significance; ** $p < 0.01$.

Similarly, in the case of the dependent variable in the form of assessment of safety, only visual accessibility was a statistically significant predictor. However, the entire model was statistically significant and explained up to 80% of the variance in terms of safety (Table 5).

Table 5. Visual accessibility and effectiveness of concealment as predictors of sense of perceived safety.

	b	SE_b	β	R^2	SEE	F	p
(Permanent)	0.28	0.35					
Visual Accessibility	0.86	0.07	0.94 ***	0.80	0.38	214.00	<0.001
Effectiveness of Concealment	0.05	0.06	0.06				

Note. b—unstandardized regression coefficient; SEb—standard error of b; β—standardized regression coefficient; SEE—standard error of estimation; F—ANOVA test statistic; p—significance; *** $p < 0.001$.

3.5. Assessment of Sense of Safety as a Mediator in the Relationship between Visual Accessibility and the Effectiveness of Concealment and Preferences

In the last part of the analyses, we performed two mediation analyses to check whether sense of safety mediated the relationship between visual accessibility and effectiveness of concealment and preferences. In the first of these (Table 6, Figure 4), it appears that an increase in visual accessibility was associated with an increase in sense of safety, and then an increase in sense of safety boosted preferences in relation to the assessed landscape. The statistically significant and positive relationship between visual accessibility and preferences became statistically insignificant after the introduction of the sense of safety mediator. This indicates the occurrence of total mediation in accordance with the classic approach of Baron and Kenny [76]. The indirect effect was statistically significant, as indicated by the Sobel test result and the 95% confidence interval made on the basis of the bootstrap method with a random sampling of n = 5000 samples with no value of 0.

Table 6. The mediating effect of sense of safety in the relationship between visual accessibility and preferences.

				Bootstrap 95% *CI* (n = 5000)	
	Indirect Effect	***SE***	***Z***	***LL***	***UL***
Mediating Effect of Sense of Safety	−0.25	0.10	2.40 *	0.04	0.48

Note. *SE*—standard error; *Z*—Sobel test; 95% *CI*—confidence interval; *LL*—lower limit; *UL*—upper limit; * $p < 0.05$.

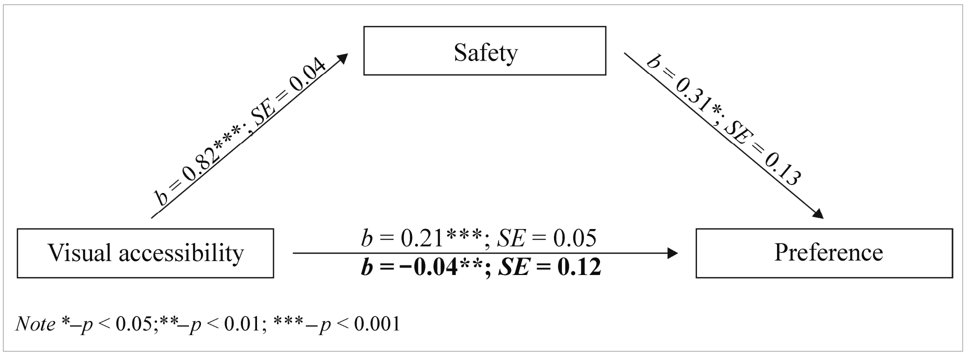

Figure 4. Unstandardized ratios of regression analysis demonstrating sense of security as a mediator in the relationship between visual accessibility and preferences (direct effect of X on Y in boldface).

Analogous results were observed when we examined the impact of effectiveness of concealment on preferences. According to the respondents, the more effective the hiding place was, the lower the sense of safety was rated, and this reduced sense of safety caused a decrease in preferences. After introducing the mediator to the model, the significant relationship between effectiveness of concealment and preferences became statistically insignificant. The significance test of the ratio between the independent variable and the mediator as well as the mediator and the dependent variable was statistically significant at $p < 0.001$. The results of the significant indirect effect were also confirmed by the built-in confidence interval not including a value of 0. The results are presented in Table 7 and Figure 5.

Table 7. Mediating effect of sense of safety in the relationship between effectiveness of concealment and preferences.

				Bootstrap 95% *CI* (n = 5000)	
	Indirect Effect	***SE***	***Z***	***LL***	***UL***
Mediating effect of sense of safety	−0.17	0.05	−3.66 ***	−0.28	−0.08

Note. *SE*—standard error; *Z*—Sobel test; *95% CI*—confidence interval; *LL*—lower limit; *UL*—upper limit; *** $p < 0.001$.

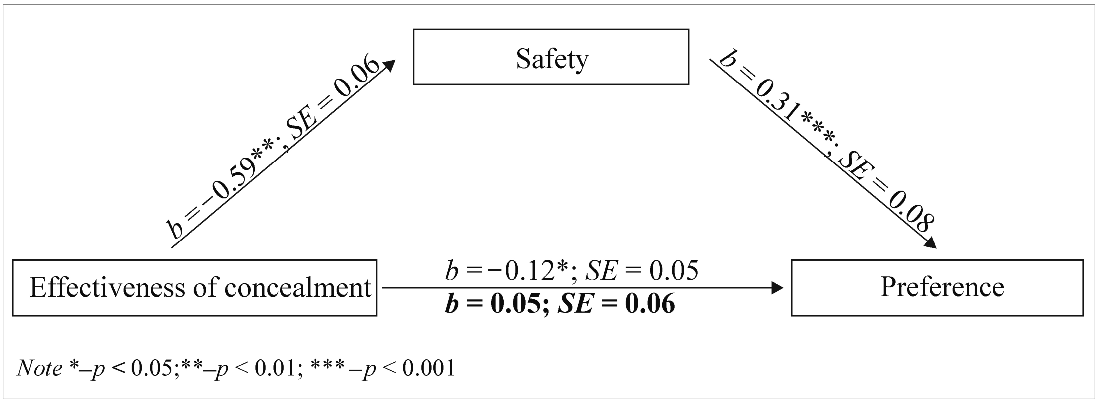

Figure 5. Non-standardized regression coefficients demonstrating sense of security as a mediator in the relationship between effectiveness of concealment and preferences (direct effect of X on Y in boldface).

4. Discussion

4.1. Spatial Arrangements and the Variables Studied

In studies where the variables are spatial features, the researchers often play up the influence of the predictors by selecting images depicting extreme situations. As a result, differences in results that could be negligible for real-life situations are amplified. This facilitates inference and increases the probability of obtaining statistically significant results. On the other hand, as Rijswijk points out [27,28], this runs the risk of over- or underestimating the influence of the predictors and therefore, hampers the generalization of research findings to real-world situations. We decided that the practical significance of the research topic is very important; therefore, in order to maintain ecological validity, the selection of the scenes to be studied should be limited to commonly encountered situations. So, we only chose photos that represented typical landscapes from green urban spaces. At the same time, in order to ensure the appropriate variation of predictor variables, we made a factorial selection of photos based on grouping the scenes into particular levels of a given variable (e.g., Andrews et al. [63]) and building the resultant categories from these levels (e.g., [22,77]). We defined eight categories created by combinations of three predictor variables in a dual low–high system. Theoretical models of spatial situations were subordinated to these categories (Figure 2). The categories were not the basis for the statistical analysis of the study—the assessment of the respondents (judges) was used to determine the level of safety-related environmental characteristics and their impact on safety and preferences. The situations described by the environmental characteristics only served as a basis for the selection of a suitably diverse sample of photographs. We did, however, take pains to avoid photos presenting extreme or rare situations that could reduce the ecological validity of the study. Tests carried out (Student's *t*) showed that the categories we defined were in line with the respondents' assessments. We have already carried out further analyses of the relationships between the variables based on the respondents' assessments.

4.2. The Impact of Environmental Characteristics on Perceived Safety and Preferences

Correlation analysis revealed a strong relationship between all independent variables. In our study, plants that created spatial situations clearly constituted forms and "multifunctional" arrangements while simultaneously obscuring views, making it difficult to move around and offering concealment. Other researchers also dealt with a similar problem—the three safety-related environmental characteristics occurring in the Nasar/Fisher model tend to have a strong correlation (e.g., [59,73]) and multicollinearity as a result [27,28]. Rijswijk et al. [27] note that the high correlation between predictive variables can indicate that his environmental characteristics covary naturally in real world. A lower level of correlation between predictors could be achieved by systematically manipulating (e.g., using a computer) the photographs and thus creating scenes better suited to specific categories (e.g., [59,78]).

However, photos thus constructed would not necessarily reflect real problems occurring in the parks by over-visualization in the analysis of rare situations. Our selection of photos, though, was factorial in nature (the photos were selected in terms of categories) but were selected from a group of photos taken in existing, typical city parks, without any manipulation.

Despite the high level of correlation between our predictor variables, the VIF factor showed that the multicollinearity problem only occurred between the two types of accessibility (visual and physical). This probably resulted from the fact that it is difficult to find real-life situations where, for example, vegetation limits views but does not restrict movement. Attention should also be paid to the fact that the scenes we studied were park landscapes with paths of similar surface. In some studies [73,74], visual accessibility and variables similar to physical accessibility (movement ease, entrapment) predicted the target variables (perceived danger, preference) independently. However, these studies were conducted in forests without paths, which make it easier to navigate—where physical accessibility is largely determined by land covered with low vegetation, which does not obscure the view.

Due to the multicollinearity of the regression models predicting the level of perceived safety and preferences on the basis of predictor variables, we included only one of the two collinear variables—visual accessibility—along with the variable effectiveness of concealment.

As we suspected, regression analysis showed that both predictor variables accurately forecasted the level of perceived safety by explaining a 80% of the total variance. This result is in line with previous studies showing that these variables are significant safety-related environmental characteristics (e.g., [22,24,26,29]). In addition, the high correlation of both variables with perceived safety (for concealment $r = -0.69$, for visual accessibility $r = 0.89$) is consistent with the results of research conducted by Lis et al. [34] regarding, like our studies, parks located in dangerous areas of a city. Similarly high results were obtained by researchers in relation to within-forest settings [47,73]. For example, Herzog and Bryce [47] found a correlation between visual access and danger at a level of $r = 0.96$.

Analysis of the correlation between visual accessibility and effectiveness of concealment and preference showed that dense vegetation obstructing views and offering opportunity for concealment reduced preferences. These results confirm previous studies (e.g., [11,62,71]), although some other studies have produced different results. For example, Harris et al. [37] indicated that dense vegetation had a positive impact on preferences. However, Lis et al. [59] did not find any statistically significant correlations between visual accessibility and preference. However, it should be taken into account that studies on the impact of plants on preferences were conducted for various types of land (woodlands, parks, city streets), where the impact of plant characteristics and their arrangements on preferences could be different. In addition, the research differed in terms of the level of variables studied—in particular, they were conducted in areas with different visual accessibility. These differences could have a significant impact on the test results. This is confirmed by the studies of Herzog and Bryce [47] comparing the impact of various environmental qualities on perceived danger and preference within two types of within-forest settings: high and low visual accessibility. It turned out that the impact of visual accessibility on preferences differed depending on the type of landscape: in the high-accessibility category, preference was uncorrelated with visual accessibility, and in the low-accessibility category, preference positively correlated with visual accessibility. Therefore, the results of both our and previous studies on the impact of plant characteristics obstructing visual accessibility and offering the opportunity of concealment on preferences should be interpreted with caution, particularly when comparing research results.

It should be emphasized that the causes and conditions of the relationships between the characteristics of plants and their spatial systems with sense of safety is a very important and still insufficiently researched issue. Safety/threat is not the only factor that affects this relationship. For example, Herzog and Kropscott [73] found that visual accessibility interacted with legibility in predicting preferences—the relationship between preference and visual accessibility was strongest and positive at low values of legibility. Research on this issue should be continued and extended.

4.3. The Mediating Role of Safety in the Relationship between Environmental Characteristics and Preference

Our key research question was whether the impact of visual and physical accessibility and concealment on preferences can be explained by perceived safety. After reducing three predictor variables to two, mediation analyses confirmed the mediating role that sense of safety plays in how these variables influence preferences. Preference studies usually test for direct effects that include the impact of environmental characteristics on preference (e.g., [38,57,74]) or on the factors that build such a preference. For example, in the Liu and Schroth [46] study testing the impact of physical and visual accessibility (as components of the situations defining permeability of enclosure) on preferences, this effect was measured on three variables that belong to the basic determinants of preferences [35]: coherence, complexity, and legibility.

As we mentioned in the Introduction, researchers—explaining that people do not like dense vegetation that creates hiding places and opportunities for concealment—have often speculated that the underlying cause is sense of danger or insecurity (e.g., [1]). However, studies that confirm this phenomenon are rare. Although Gobster and Westphal [61] confirmed this role that safety plays in the influence of concealment on preferences, there has been no test to see if a similar mechanism occurs in the case of accessibility. The results of our research, although they require some development due to the limitations indicated above, stand as an important confirmation of the explanation of users' preferences for scenes with vegetation that does not obstruct views or impede movement, based on the impact of safety.

4.4. Limitations

In addition to those previously described, these studies have additional limitations. First of all, in our study we did not control a range of important variables that may influence safety and preferences, such as site maintenance or ornamental plant characteristics. Admittedly, when choosing photos, we avoided plants with extremely distinctive features, such as spectacular flowers. We also excluded neglected or damaged areas from the research. However, in spite of this, we may still recognize that apart from the features researched, there are others that influenced the results of the study.

Secondly, parks are spaces that change drastically over time (time of day, year, weather conditions, etc.) and these changes are also associated with a large variation in predicted user ratings for both dimensions tested (preferences and perceived safety). In our study we opted to obtain ratings for scenes showing parks at a fixed, specified time of year (late spring and summer), during the day and in good weather conditions. We can assume that these are optimal conditions for sense of safety, which may significantly decrease in other conditions. Further research taking this variability into account would certainly be an interesting continuation of this issue.

Thirdly, these results, which are not consistent with those of some previous studies (the nature of the correlation of predictors with preference), should be treated with caution. These results depend to a large extent on the selection of photos for the sample. Despite a large and representative sample (112 photos), significantly greater than the limited set of locations used in existing research, it cannot be ruled out that the resources did not contain, for example, unusual situations characterized by a different relationship of predictors with preference than confirmed in our study. Our photos depicted typical park landscapes. The results indicated that, excluding the impact of the sense of safety, the density of vegetation did not affect preferences. However, the results may be different for other types of green areas (e.g., forest areas, which may be characterized by significant vegetation density). It is possible that a large vegetation density, which is unusual for parks, lowers preferences. Similarly, for areas characterized by a scarcity of vegetation, its increase may have an impact on an increase in preferences. This is evidenced by, inter alia, research by Suppakittpaisarn et al. [56] concerning streets, which confirmed this. To sum up: we can expect that the relationship between the independent variables studied by us depends on the type of landscape and its characteristics, and therefore the results of our research cannot be applied to all green urban areas. It should also be added that the photo resource used in this study resulted from our decision about which environments to include in the set—future research may study the issue using random sampling methods, thereby enhancing the ecological validity.

Fourthly, the study group consisted of students. This is a common research practice in similar studies (e.g., [34,59,66,73]). However, the researchers are not in agreement as to whether such a sample may be applicable to the general population ([79], but also [80,81]). In addition, our research did not take into account other important factors that determine people's feelings, such as place of residence and its particularities, attachment to this place, social situation, and experience of the respondents differentiating their vulnerability, etc. In our study, we focused primarily on identifying the general mechanisms involved in various phenomena (the mediating role of safety in the relationship between spatial factors and preference). These mechanisms may vary in strength over the population as a whole as well as for selected groups, although it can be assumed that their character will remain the same. However, further research is needed—particularly among those whose anxiety in certain situations is relatively higher than in others (i.e., women and the elderly) [82,83].

Finally, we assumed that the feelings of people in parks that are considered dangerous are of particular interest. To obtain answers in line with our assumption, in the introduction to the survey we added a suggestion that the photos show such parks. This suggestion might have meant that the study participants paid more attention to safety than they would have otherwise. However, the large diversity of ratings (using the entire scale available) indicates that the respondents were unlikely to attribute excessive characteristics of danger to the parks.

5. Summary and Practical Conclusions

Despite these limitations, practical conclusions can be drawn on the basis of the study's results:

1. This research confirmed that park vegetation that obstructs views and offers concealment reduced sense of safety. The high (in comparison with research so far) value of the observed correlations indicates that this relationship might be particularly strong for parks in areas that are considered dangerous, which were involved in our research. It is also particularly important for such areas, because these are problem areas that often require transformation or extremely careful planning to reduce the sense of fear and danger for their users. Our research confirms current recommendations for such areas—that the vegetation should be designed in such a way as to ensure visibility of the surroundings and that plants which may offer concealment for a potential attacker should not be planted near where people walk. The research results also indicate that physical accessibility has a similar effect on safety as visual accessibility (high collinearity of variables). This means that factors that reduce this accessibility should be taken into account when designing parks, including historical ones. In practice, they are primarily associated with the maintenance of parks. Low physical accessibility most often results from the uncontrolled growth of herbaceous vegetation in the undergrowth layer, which hinders movement, including possible escape.

2. Dense vegetation obstructing views and offering concealment reduced preferences for the settings in which it occurred. Analysis of mediation factors revealed that dense vegetation was not popular because of the sense of danger (low sense of safety) that it evoked—without this sense of threat, the extent to which vegetation obstructs views and offers concealment would not affect preferences. This suggests that in parks where we feel completely safe, features of space such as vegetation density do not directly affect whether we like the park or its impact is insignificant compared to other factors. This has implications for shaping park space. The results confirm the mediating role of sense of safety on the impact of the spatial features researched on preferences, leading to the possible conclusion that areas where the users do not feel threatened (e.g., private, fenced, monitored, etc.) may feature vegetation and plant layouts of varying density, and this will probably not adversely affect users'

feelings. In such situations, there is also no need to remove existing dense greenery, which often has measurable compositional or historical value.

3. Work on historic parks should be undertaken with the utmost care for the preservation of historical and compositional values. Any decision to remove trees and shrubs to improve safety in such parks should be thought out with particular consideration. In some cases involving old trees or important elements of a historical layout, it is not possible. Then other measures should be taken to improve the park's safety. For example, one might focus on increasing the degree of social control associated with the presence of numerous users in the space. Deserted, rarely visited areas of the park should be particularly carefully analyzed for the potential reduction of nearby forms that may constitute places of concealment or limit accessibility. Conversely, zones containing places of concealment and hiding that cannot be removed could be modified to increase social control. This can be done, for example, by creating new means of activity bringing together potential observers and monitors by creating through traffic (major pedestrian and bicycle routes) in this area. Another possible option is to increase the flow of connections between hazardous areas and numerous places or routes by removing barriers and obstacles to movement, increasing the convenience of paths, introducing new entrances to the area, etc.

To sum up: the current recommendations for safe parks (using only trees with high crowns, avoiding shrubs that can provide concealment or obstruct views) cannot be applied to historical parks under protection. Therefore, basic attempts to increase the safety of such parks should focus on their proper maintenance, in particular the maintenance of paths, lawns, and other forms that can facilitate movement and possibility to escape. Regardless, other measures and systems to improve park safety (lighting, monitoring, space activation in zones where people feel less safe, etc.) can not only increase the convenience of use associated with reducing the sense of danger, but also improve the overall reception of the park. Interesting compositions creating numerous interiors, spatial fragmentation creating mysterious corners—especially characteristic of romantic parks—are only popular today when people perceive them as safe. The results confirming the mediating role of the sense of security in the impact of the studied features of space on preferences allow us to suppose that in areas where users do not feel threat (e.g., private, fenced, monitored, etc.) plants and plant systems of different density can be used and this will probably not adversely affect users' feelings. In such situations, there is also no need to remove existing dense greenery, which often has measurable compositional or historical value.

Supplementary Materials: The following are available online at http://www.mdpi.com/2071-1050/11/22/6324/s1. Table S1: The proportion of plant forms that make up the spatial situations studied.

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References

1. Rouquette, J.R.; Holt, A.R. The Benefits to People of Trees Outside Woods (TOWs). Report for the Woodland Trust. Natural Capital Solutions. 2017. Available online: https://www.woodlandtrust.org.uk (accessed on 20 September 2019).
2. ICOMOS-IFLA. The Florence Charter. 1982. Available online: https://www.icomos.org/en/newsletters-archives/179-articles-en-francais/ressources/charters-and-standards/158-the-florence-charter (accessed on 24 October 2019).
3. ICOMOS-IFLA. The Document on Historic Urban Public Parks. Available online: https://www.icomos.org/images/DOCUMENTS/General_Assemblies/19th_Delhi_2017/Working_Documents-First_Batch-August_2017/GA2017_6-3-2_HistoricUrbanPublicParks_EN_final20170730.pdf (accessed on 24 October 2019).

4. Burden, D. *Urban Street Trees, 22 Benefits Specific Applications*, 1st ed.; Glatting Jackson and Walkable Communities Inc.: High Springs, FL, USA, 2006; p. 21. Available online: http://www.walkable.org (accessed on 20 September 2019).
5. Donovan, G.H.; Prestemon, J.P. The effect of trees on crime in Portland, Oregon. *Environ. Behav.* **2012**, *44*, 3–30. [CrossRef]
6. Troy, A.; Morgan Grove, J.; O'Neil-Dunne, J. The relationship between tree canopy and crime rates across an urban–rural gradient in the greater Baltimore region. *Landsc. Urban Plan.* **2012**, *106*, 262–270. [CrossRef]
7. Jorgensen, A.; Anthopoulou, A. Enjoyment and fear in urban woodlands—Does age make a difference? *Urban For. Urban Green.* **2007**, *6*, 267–278. [CrossRef]
8. Koskela, H.; Pain, R. Revisiting fear and place: Women's fear of attack and the built environment. *Geoforum* **2000**, *31*, 269–280. [CrossRef]
9. Michael, S.E.; Hull, R.B. *Effects of Vegetation on Crime in Urban Parks: Interim Report for the U.S.*; Forest Service and the International Society of Arboriculture: Blacksburg, VA, USA, 1994; p. 49.
10. Michael, S.N.; Hull, R.B.; Zahm, D.L. Environmental Factors Influencing Auto Burglary: A Case Study. *Environ. Behav.* **2001**, *33*, 368–388. [CrossRef]
11. Jorgensen, A.; Hitchmough, J.; Calvert, T. Woodland spaces and edges: Their impact on perception of safety and preference. *Landsc. Urban Plan.* **2002**, *60*, 135–150. [CrossRef]
12. Schroeder, H.W.; Anderson, L.M. Perception of personal safety in urban recreation sites. *J. Leis. Res.* **1984**, *16*, 178–194. [CrossRef]
13. Yang, B.; Li, S.; Elder, B.R.; Wang, Z. Community-planning approaches and residents' perceived safety: A landscape analysis of park design in the Woodlands, Texas. *J. Architect. Plan. Res.* **2013**, *30*, 311–327.
14. Lis, A.; Krzemińska, A.; Dzikowska, A.; Anwajler, K. *Spatial Determinants of Safety in a City Park as Exemplified by Jan III Sobieski Park in Wałbrzych (Poland)*; I-BIS Publishing: Wrocław, Poland, 2014.
15. Burgess, J.; Harrison, C.M.; Limb, M. People, parks and the urban green: A study of popular meanings and values for open spaces in the city. *Urban Stud.* **1988**, *25*, 455–473. [CrossRef]
16. Foster, S.; Giles-Corti, B.; Knuiman, M. Does fear of crime discourage walkers? A social-ecological exploration of fear as a deterrent to walking in new suburbs. *Environ. Behav.* **2014**, *46*, 698–717. [CrossRef]
17. Mambretti, I.M. Urban Parks between Safety and Aesthetics. Exploring Urban Green Space Using Visualisation and Conjoint Analysis Methods. Ph.D. Thesis, Eidgenössische Technische Hochschule, Zürich, Switzerland, 2007. [CrossRef]
18. Madge, C. Public parks and the geography of fear. *Tijdschr. Voor Econ. Soc. Geogr.* **1997**, *88*, 237–250. [CrossRef]
19. Maruthaveeran, S. A Socio-Ecological Exploration of Fear of Crime in Urban Green Spaces: A Case in Kuala Lumpur, Malaysia. Ph.D. Thesis, University of Copenhagen, Copenhagen, Denmark, 21 March 2015.
20. Appleton, J. *The Experience of Landscape*; John Wiley: London, UK, 1975.
21. Appleton, J. Prospect and refuge re-visited. *Landsc. J.* **1984**, *3*, 91–103. [CrossRef]
22. Fisher, B.; Nasar, J.L. Fear of crime in relation to three exterior site features: Prospect, refuge, and escape. *Environ. Behav.* **1992**, *24*, 35–65. [CrossRef]
23. Nasar, J.L.; Fisher, B.; Grannis, M. Proximate physical cues to fear of crime. *Landsc. Urban Plan.* **1993**, *26*, 161–178. [CrossRef]
24. Haans, A.; de Kort, Y.A.W. Light distribution in dynamic street lighting: Two experimental studies on its effects on perceived safety, prospect, concealment, and escape. *J. Environ. Psychol.* **2012**, *32*, 342–352. [CrossRef]
25. Nasar, J.; Jones, K. Landscapes of fear and stress. *Environ. Behav.* **1997**, *29*, 291–323. [CrossRef]
26. Park, A.; Clare, J.; Spicer, V.; Brantingham, P.L.; Calvert, T.; Jenion, G. Examining context-specific perceptions of risk: Exploring the utility of "human-in-the-loop" simulation models for criminology. *J. Exp. Criminol.* **2012**, *8*, 29–47. [CrossRef]
27. Van Rijswijk, L.; Rooks, G.; Haans, A. Safety in the eye of the beholder: Individual susceptibility to safety-related characteristics of nocturnal urban scenes. *J. Environ. Psychol.* **2016**, *45*, 103–115. [CrossRef]
28. Van Rijswijk, L.; Haans, A. Illuminating for safety: Investigating the role of lighting appraisals on the perception of safety in the urban environment. *Environ. Behav.* **2018**, *50*, 889–912. [CrossRef] [PubMed]
29. Wang, K.; Taylor, R.B. Simulated walks through dangerous alleys: Impacts of features and progress on fear. *J. Environ. Psychol.* **2006**, *26*, 269–283. [CrossRef]

30. Abrams, G.; Ataov, A.; Courson, W.; Imeokparia, T.; Melsheimer, W.; Nasar, J.L.; Nix, R. *A Community Safety Guide for the City of Columbus*; Precinct Planning; Ohio State University, City and Regional Planning: Columbus, OH, USA, 1993; Volume 851.
31. Westover, T.N. Perceptions of Crime and Safety in Midwestern Parks. *Prof. Geogr.* **1985**, *37*, 410–420. [CrossRef]
32. Kuo, F.E.; Sullivan, W.C. Environment and crime in the inner city: Does vegetation reduce crime? *Environ. Behav.* **2001**, *33*, 343–367. [CrossRef]
33. Altman, I. *The Environment and Social Behavior*; Brooks/Cole: Monterey, CA, USA, 1975.
34. Lis, A.; Anwajler, K.; Iwankowski, P. Why do we choose fear-evoking spots in parks? The role of danger and privacy in the model of dependence between spatial attributes and preference. *Urban For. Urban Green.* **2018**, *38*, 193–204. [CrossRef]
35. Kaplan, R.; Kaplan, S. *The Experience of Nature: A Psychological Perspective*; Cambridge University Press: New York, NY, USA, 1989.
36. Berlyne, D.E. *Studies in the New Experimental Aesthetics: Steps toward an Objective Psychology of Aesthetic Appreciation*; Hemisphere Publishing Corp: Washington, DC, USA, 1974.
37. Harris, V.; Kendal, D.; Amy Hahs, A.K.; Threlfall, C.G. Green space context and vegetation complexity shape people's preferences for urban public parks and residential gardens. *Landsc. Res.* **2018**, *43*, 150–162. [CrossRef]
38. Bjerke, T.; Ostdahl, T.; Thrane, C.; Strumse, E. Vegetation density of urban parks and perceived appropriateness for recreation. *Urban For. Urban Green.* **2006**, *5*, 35–44. [CrossRef]
39. Kaltenborn, B.P.; Bjerke, T. Associations between environmental value orientations and landscape preferences. *Landsc. Urban Plan.* **2002**, *59*, 1–11. [CrossRef]
40. Schroeder, H.W.; Orland, B. Viewer preference for spatial arrangement of park trees: An application of video-imaging technology. *Environ. Manag.* **1994**, *18*, 119–128. [CrossRef]
41. Kuo, F.E.; Bacaicoa, M.; Sullivan, W.C. Transforming inner-city landscapes: Trees, sense of safety, and preference. *Environ. Behav.* **1998**, *30*, 28–59. [CrossRef]
42. Hands, D.E.; Brown, R.D. Enhancing visual preference of ecological rehabilitation sites. *Landsc. Urban Plan.* **2002**, *58*, 57–70. [CrossRef]
43. Jorgensen, A. The social and cultural context of ecological plantings. In *The Dynamic Landscape*, 1st ed.; Dunnett, N., Hitchmough, J., Eds.; E&FN Spon: London, UK, 2004; pp. 293–325.
44. Qiu, L.; Lindberg, S.; Nielsen, A.B. Is biodiversity attractive?—On-site perception of recreational and biodiversity values in urban green space. *Landsc. Urban Plan.* **2013**, *119*, 136–146. [CrossRef]
45. Yao, Y.; Zhu, X.; Xu, Y.; Yang, H.; Wu, X.; Li, Y.; Zhang, Y. Assessing the Visual Quality of Green Landscaping in Rural Residential Areas: The Case of Changzhou, China. *Environ. Monit. Assess.* **2012**, *184*, 951–967. [CrossRef] [PubMed]
46. Liu, M.; Schroth, O. Assessment of Aesthetic Preferences in Relation to Vegetation-Created Enclosure in Chinese Urban Parks: A Case Study of Shenzhen Litchi Park. *Sustainability* **2019**, *11*, 1809. [CrossRef]
47. Herzog, T.R.; Bryce, A.G. Mystery and Preference in Within-Forest Settings. *Environ. Behav.* **2007**, *39*, 779–796. [CrossRef]
48. Fuller, R.; Irvine, K.; Devine-Wright, P.; Warren, P.; Gaston, K. Psychological benefits of greenspace increase with biodiversity. *Biol. Lett.* **2007**, *3*, 390–394. [CrossRef] [PubMed]
49. Jorgensen, A.; Gobster, P.H. Shades of Green: Measuring the Ecology of Urban Green Space in the Context of Human Health and Well-Being. *Nat. Cult.* **2010**, *5*, 338–363. [CrossRef]
50. Lindemann-Matthies, P.; Bose, E. Species richness, structural diversity and species composition in meadows created by visitors of a botanical garden in Switzerland. *Landsc. Urban Plan.* **2007**, *79*, 298–307. [CrossRef]
51. Van den Berg, A.E.; Vlek, C.A.J.; Coeterier, J.F. Group differences in the aesthetic evaluation of nature development plans: A multilevel approach. *J. Environ. Psychol.* **1998**, *18*, 141–157. [CrossRef]
52. Kurz, T.; Baudains, C. Biodiversity in the front yard: An investigation of landscape preference in a domestic urban context. *Environ. Behav.* **2012**, *44*, 166–196. [CrossRef]
53. Zheng, B.; Zhang, Y.; Chen, J. Preference to home landscape: Wildness or neatness? *Landsc. Urban Plan.* **2011**, *99*, 1–8. [CrossRef]
54. Hoffman, M.; Westermann, J.R.; Kowalik, I.; van den Meer, E. Perceptions of parks and urban derelict land by landscape planners and residents. *Urban For. Urban Green.* **2012**, *11*, 303–312. [CrossRef]

55. Jiang, B.; Larsen, L.; Deal, B.; Sullivan, W.C. A dose-response curve describing the relationship between tree cover density and landscape preference. *Landsc. Urban Plan.* **2015**, *139*, 16–25. [CrossRef]
56. Suppakittpaisarn, P.; Jiang, B.; Slavenas, M.; Sullivan, W.C. Does density of green infrastructure predict preference? *Urban For. Urban Green.* **2018**, *40*, 236–244. [CrossRef]
57. Jiang, B. Establishing Dose-Response Curves for the Impact of Urban Forests on Recovery from Acute Stress and Landscape Preference. Ph.D. Thesis, University of Illinois at Urbana-Champaign, Illinois, IL, USA, 2014. Available online: http://hdl.handle.net/2142/46889 (accessed on 24 October 2019).
58. Farahani, L.M.; Maller, C. Perceptions and Preferences of Urban Greenspaces: A Literature Review and Framework for Policy and Practice. *Landsc. Online* **2018**, *61*, 1–22. [CrossRef]
59. Lis, A.; Pardela, Ł.; Can, W.; Katlapa, A.; Rąbalski, Ł. Perceived Danger and Landscape Preferences of Walking Paths with Trees and Shrubs by Women. *Sustainability* **2019**, *11*, 4565. [CrossRef]
60. Lis, A.; Iwankowski, P.; Pardela, Ł.; Haans, A. Are trees and shrubs unsafe hiding places? Impact of plant forms on the perception of danger. *Environ. Behav.* **2019**. (under review).
61. Gobster, P.H.; Westphal, L.M. The human dimensions of urban greenways: Planning for recreation and related experiences. *Landsc. Urban Plan.* **2004**, *68*, 147–165. [CrossRef]
62. Herzog, T.R.; Kirk, K.M. Pathway curvature and border visibility as predictors of preference and danger in forest settings. *Environ. Behav.* **2005**, *37*, 620–639. [CrossRef]
63. Andrews, M.; Gatersleben, B. Variations in perceptions of danger, fear and preference in a simulated, natural environment. *J. Environ. Psychol.* **2010**, *30*, 473–481. [CrossRef]
64. Chiang, J.C.; Nasar, J.; Ko, C.C. Influence of visibility and situational threats on forest trail evaluations. *Landsc. Urban Plan.* **2014**, *125*, 166–173. [CrossRef]
65. Herzog, T.R.; Chernick, K.K. Tranquility and danger in urban and natural environments. *J. Environ. Psychol.* **2000**, *20*, 29–39. [CrossRef]
66. Herzog, T.R.; Leverich, O.L. Searching for Legibility. *Environ. Behav.* **2003**, *35*, 459–477. [CrossRef]
67. Herzog, T.R. A cognitive analysis of preference for urban spaces. *J. Environ. Psychol.* **1992**, *12*, 237–248. [CrossRef]
68. Fischer, M.A.; Shrout, P.E. Children's liking of landscape paintings as a function of their perceptions of prospect, refuge, and hazard. *Environ. Behav.* **2006**, *38*, 373–393. [CrossRef]
69. Hagerhall, C.M. Clustering predictors of landscape preference in the traditional Swedish cultural landscape: Prospect refuge, mystery, age and management. *J. Environ. Psychol.* **2000**, *20*, 83–90. [CrossRef]
70. Gundersen, V.S.; Frivold, L.G. Public preferences for forest structures: A review of quantitative surveys from Finland, Norway and Sweden. *Urban For. Urban Green.* **2008**, *7*, 241–258. [CrossRef]
71. Herzog, T.R.; Barnes, G.J. Tranquility and preference revisited. *Environ. Psychol.* **1999**, *19*, 171–181. [CrossRef]
72. Herzog, T.R.; Flynn-Smith, J.A. Preference and perceived danger as a function of the perceived curvature, length and width of urban alleys. *Environ. Behav.* **2001**, *33*, 655–668. [CrossRef]
73. Herzog, T.R.; Kropscott, L.S. Legibility, mystery, and visual access as predictors of preference and perceived danger in forest settings without pathways. *Environ. Behav.* **2004**, *36*, 659–677. [CrossRef]
74. Herzog, T.R.; Kutzli, G.E. Preference and Perceived Danger in Field/Forest Settings. *Environ. Behav.* **2002**, *34*, 819–835. [CrossRef]
75. George, D.; Mallery, P. *IBM SPSS Statistics 23 Step by Step: A Simple Guide and Reference*, 14th ed.; Routledge: New York, NY, USA, 2016; p. 400.
76. Baron, R.M.; Kenny, D.A. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* **1986**, *51*, 1173–1182. [CrossRef] [PubMed]
77. Blöbaum, A.; Hunecke, M. Perceived danger in urban public space: The impacts of physical features and personal factors. *Environ. Behav.* **2005**, *37*, 465–486. [CrossRef]
78. Boomsma, C.; Steg, L. Feeling safe in the dark: Examining the effect of entrapment, lighting levels, and gender on feelings of safety and lighting policy acceptability. *Environ. Behav.* **2014**, *46*, 193–212. [CrossRef]
79. Balling, J.D.; Falk, J.H. Development of preference for natural environments. *Environ. Behav.* **1982**, *14*, 5–28. [CrossRef]
80. Herzog, T.R.; Herbert, E.J.; Kaplan, R.; Crooks, C.L. Cultural and developmental comparisons of landscape perceptions and preferences. *Environ. Behav.* **2000**, *32*, 323–346. [CrossRef]

81. Stamps, A.E., III. *Psychology and the Aesthetics of the Built Environment*; Kluwer Academic/Plenum: New York, NY, USA, 2000. [CrossRef]
82. Jansson, M.; Fors, H.; Lindgren, T.; Wiström, B. Perceived personal safety in relation to urban woodland vegetation—A review. *Urban For. Urban Green.* **2013**, *12*, 127–133. [CrossRef]
83. Keane, C. Evaluating the influence of fear of crime as an environmental mobility restrictor on women's routine activities. *Environ. Behav.* **1998**, *30*, 60–74. [CrossRef]