Study of Different Vegetation Types in Green Space Landscape Preference: Comparison of Environmental Perception in Winter and Summer

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Abstract: Through field perception in winter and summer, people's preferences for vegetation types in green spaces with various structures (single-layer woodland, tree-shrub-grass composite woodland, tree-grass composite woodland, and single-layer grassland) and concrete and asphalt sites (areas) without plants are evaluated. The results show the following: (1) There are significant differences in landscape preference between the two seasons, and the environmental perception preference score for landscapes in summer is higher. (2) The preference score for the vegetation types in green spaces was single-layer woodland > tree-shrub-grass composite woodland > tree-grass composite woodland > single-layer grassland > concrete and asphalt sites (areas). The preference score for the single-layer woodland landscape in winter was significantly higher than that in summer. (3) The preferences of participants to carry out activities vary by season and the magnitude of thermal comfort; notably, rest and communication activities in green spaces with high thermal comfort, such as tree-shrub-grass composite woodland and single-layer woodland areas, are preferred in summer, and physical activities in the single-layer woodland landscape are preferred in winter. (4) Regardless of which environmental perception method is adopted, landscape preferences did not significantly differ by sex or professional background. Based on the above results, the two seasonal perception methods cannot replace each other. Therefore, the types of activities should be carefully selected to be appropriate for the specific vegetation types in green spaces and season in which they will occur, and the green space should be reasonably planned according to the thermal comfort of the vegetation types to provide a scientific basis for evaluating landscape perception and preferences in the future.

Keywords: green spaces; landscape preference; environmental perception; seasonal change; thermal comfort

1. Introduction

With the development of urbanization, understanding the public's views on and preferences for urban green spaces through people-oriented design to promote human well-being and quality of life is imperative [1,2]. Although some findings of landscape preference research have been directly applied in practice, there are doubts about the reliability of the strategies adopted by users, planners and practitioners, which may lead to a mismatch between the public demand for green space and actual urban design [3]. Outdoor space is very important for residents' lives, communication and organized activities. Visual sensory stimulation is an important preference factor affecting residents' participation in outdoor activities [4,5]. When people are in an outdoor environment, thermal comfort has also become one of the most important environmental factors affecting people's visual stimulation [6]. In addition to the physical factors affecting human outdoor thermal comfort, psychology, physiology, society and behavior all affect people's landscape preferences [7]. People's landscape preferences have not been studied [8]. Relevant studies have explained

landscape assessment, planning and design from various angles, which has become a broad field with various theoretical directions and methods [9]. Landscape preference largely depends on people's visual perception and people's perceptions of their environments. However, due to the variety of visual strategies used in the research, the lack of a scientific effectiveness test between these strategies will lead to inconsistent or contradictory results, resulting in potential risks in practical application [10]. The accuracy and equivalence of various visual strategies for landscape preference should be cross-tested [11,12]. Therefore, it is still not easy to compare the impacts of these strategies on landscape preference and experience, such as with environmental characteristics (vegetation type), visit time (season), and thermal comfort.

1.1. Environmental Preference and Impact of Plant Landscape

People have an innate preference for nature. Playing or walking in a plant landscape for a short time can enhance people's positive emotions [13]. For people living in urban environments, urban green space is an important part of happiness, but it is often in short supply. An important factor in residents' well-being and quality of life is the availability of urban green space. Urban green space can have a positive impact on happiness and health in many ways, and the increased level of activity through contact with nature can have benefits [14]. At present, the research methods of landscape preference usually emphasize the public's love for the landscape through a visually stimulating experience. visual landscape presentation methods have been used for different landscape types. In urban areas with little green space, people's health will be poor, but they may better benefit by spending more time in contact with nature or choosing to live in areas with substantial green space [15]. The natural environment is composed of a variety of landscape elements. The combination and layout of these elements form a variety of landscape environments. Green space is an important part of the landscape environment and is usually related to the type of green space [16]. At the same time, people's demands for space are increasing [17]. There are similarities and differences in the perception experience brought by the plant landscape. According to the research results of Tian et al., the preference score of students for semi open green space is the highest, followed by that for closed green space, and the score for open green space is the lowest [18]. Loadjim (2012) surveyed students' views on Hong Kong city parks but did not establish an evaluation tool to measure students views and preferences [19]. Finally, Zhang et al. (2013) found that the resident population and socioeconomic factors have a significant impact on the entertainment preferences for urban parks [20]. However, although these studies aim to evaluate urban green space in various ways from the perspective of public experience, the relationship between public preference for landscape and vegetation environmental characteristics has not been clear, and the driving factors affecting public cognition and preference have not been fully determined. In addition, these studies are limited to some specific locations or types of landscape elements, which makes it difficult to generalize the findings. Landscape perception is an active process between organisms and the environment [21]. People may need different environmental attributes to provide the experiences they seek [22]. At the same time, environmental attributes can be characterized according to people's perceptions of an environment. Therefore, it is necessary to determine people's understandings of the perceived value of the environment and reveal their environmental preferences [23].

1.2. Impact of Seasonal Perception on Plant Landscape

The appearance of green space may change greatly with the change in seasons, thus affecting people's landscape preferences. In the same season, weather conditions will also affect the preference results [24]. In hot urban spaces, dense vegetation can alleviate the microclimate and make pedestrians feel hot and visually comfortable [25]. Thermal discomfort can also be alleviated by improving visual comfort, and vice versa. However, few studies have considered seasonal dynamics [26,27]. Most studies have introduced participants to the landscapes in warm seasons such as spring and summer [28,29]. There

are two limitations in the study of landscape preference. First, some studies show that although exposure to natural images has a positive impact, but such natural exposure may not effectively meet people's health needs in the long run [30,31]. Second, almost all studies have been conducted in summer or used photos of the summer natural landscapes. Therefore, it is unclear whether the health benefits associated with natural exposure can also be obtained in colder seasons [32,33]. As one of the typical representatives of the climate, winter restricts people's outdoor activities, resulting in a gradual decline in the level of public sports activities [34], but people's urgent need for physical and mental health does not diminish. Due to the lack of information about people's views and preferences in winter, the entertainment quality of urban green space is limited to the corresponding improvement range [35]. Therefore, it is worth including visual strategies to compare seasons in this study. Therefore, starting with the field perception method in summer and winter, this study investigated the participants' preferences and types of activities for four vegetation types (single-layer grassland, single-layer woodland, tree-shrub-grass composite woodland, and tree-grass composite woodland) and concrete and asphalt sites (areas) in summer and winter. The results provide a scientific basis for landscape preference evaluation in the future.

Our research aims to investigate the following questions:

(1) What is the impact of seasonal changes on participants' activity choice preferences?
(2) What vegetation types of green space do individuals prefer?
(3) Are there seasonal changes in the green space vegetation type preferences?

2. Materials and Methods

2.1. Study Area and Research Object

The study was conducted in Xi'an, the capital of Shaanxi Province, China (34°16′ N, 108°54′ E), with a total area of 10,752 km^2 and a population of 12.6 million. The green coverage rate of the city is approximately 33.5% [36]. In this study, the vegetation types in green space with different vegetation structures in a park in Xi'an were selected as the study area. To avoid any deviation of perception and preference caused by some prominent attributes of the landscape rather than the vegetation structure itself, the green space of colored leaf trees is excluded due to the possible influence of seasonal color changes.

The "vegetation types of green space" in this study refers to the type of space creation that combines the three levels of vegetation structures of trees, shrubs, and herbs, such as a single-layer that creates an open green space, grassland, single-layer woodland and tree-grass composite woodland for semi-open green space (underforest, overstory landscape), and tree-shrub-grass composite woodland for closed green space.

According to the spatial morphological attributes of the plant landscape and the spatial construction form of the green spaces, four vegetation types of green spaces and one concrete and asphalt space were selected: single-layer grassland *(Axonopus compressus (SW.) Beauv.)*, single-layer woodland *(Pinus tabuliformis carr)*, tree-shrub-grass composite woodland *(Gleditsia sinensis Lam Ligustrum lucidum Ait., Prunus Cerasifera Ehrhar f. atropurpurea (Jacq.) Rehd., Nandina domestica, Euonymus japonicus' aureo marginatus' in Phnom Penh, Axonopus compressus (SW.) Beauv.)*, tree-grass composite woodland *(Gleditsia Sinensis Lam, Axonopus compressus (SW.) Beauv.)*, and the concrete and asphalt space. The four vegetation types of green space include common landscape types in Xi'an (Figures 1 and 2).
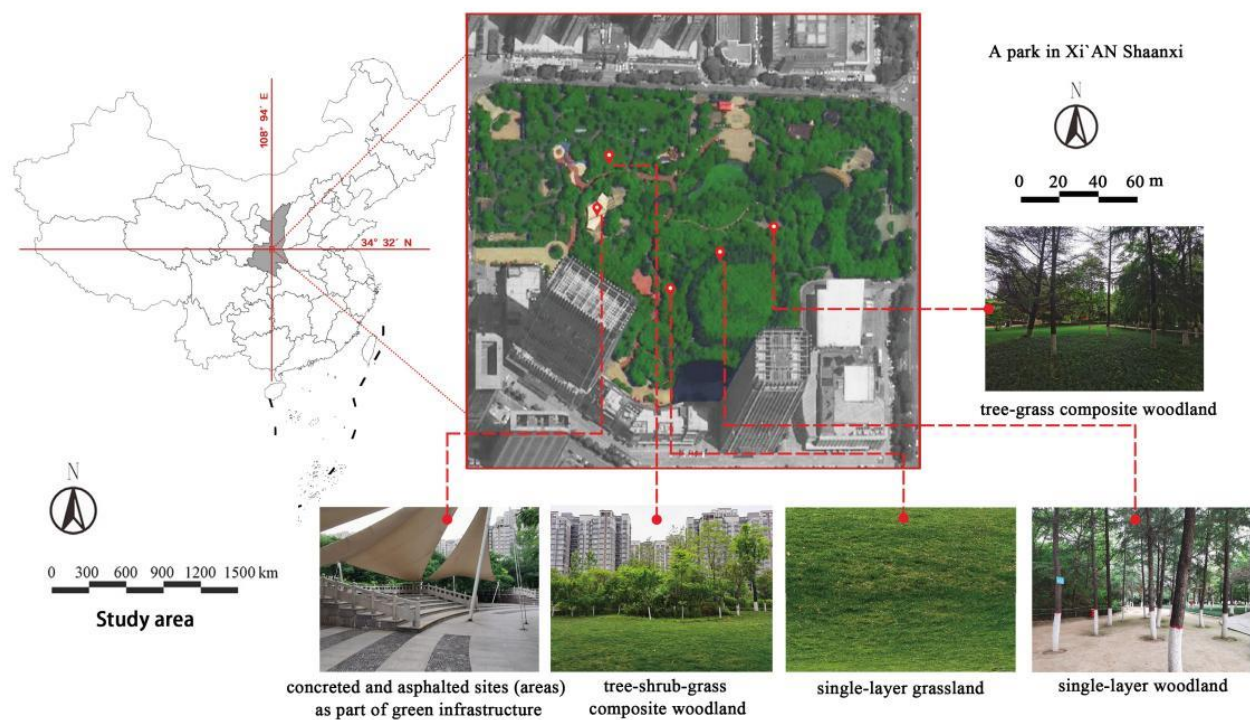
Figure 1. Study area.

Figure 2. Research object.

2.2. Participants

A total of 400 college students with different professional backgrounds (M age = 21.85, SD age = 3.34, age range = 17–25 years) were recruited as participants in this study. The participants were divided into a professional group studying landscape and a non-landscape professional group, including studying other majors (the course discipline does not include mathematical calculation). The gender ratio of the participants was 1:1, and the proportion of those with a professional background to those without was 1:1.5. All participants were healthy students who spoke Chinese. All subjects were informed of the test procedures, relevant risks and confidentiality issues, and all subjects provided informed consent before the experiment. The study was conducted in accordance with the Declaration of Helsinki. The participants were randomly divided 10 groups, with 40 people in each group. We randomly assigned each participant to one of the ten groups in the corresponding vegetation type and season (Figure 3).
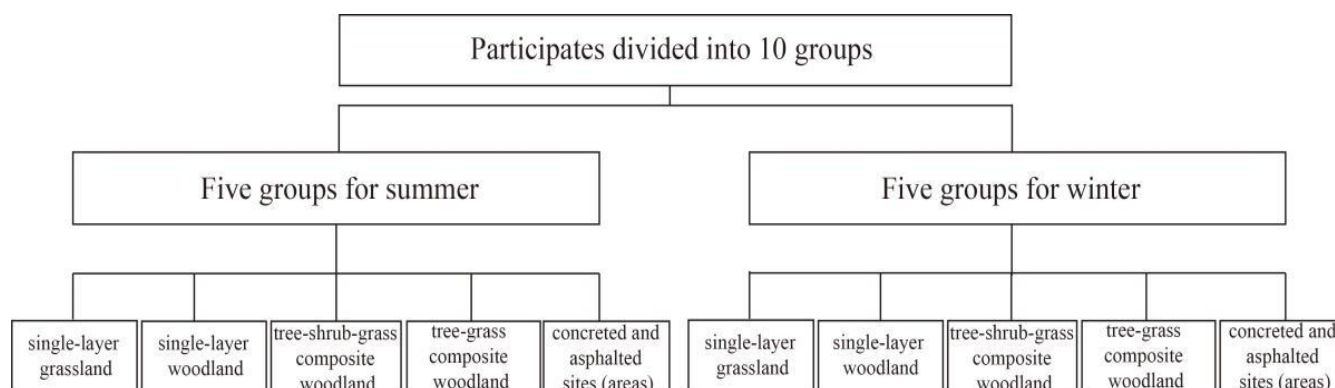
Figure 3. The hierarchical arrangement of participation groups.

2.3. Survey of Preference

In this study, a questionnaire was used to determine the participants' views and preferences on the selected urban vegetation types of green space scenes. The questionnaire consisted of three parts, including basic personal information (gender and occupation), preferences and suitable activities. Preferences were measured using a five-point Likert scale, with a score of 1 indicating 'greatly dislike' to 5 indicating 'greatly like'. To identify the types of activities suitable for the scene after people enjoy a scene, the types of activities were divided into four categories: entertainment and leisure (gathering, singing, dancing, literary and artistic activities), rest and communication (chatting, sitting down and stopping), viewing and sightseeing (taking photos and watching), and physical exercise (walking, running and sports activities). The choice of activity types involved in the activity preference were presented using single choice or multichoice open-ended questions. A total of 400 activity preference questionnaire were collected in winter and summer. Before the start of the trial, the participants were provided with an explanation of the purpose of the study and the trial process.

2.4. Procedure

Before the start of the trial, the participants completed the informed consent forms and provided basic personal information. This time allowed the participants to integrate the sensory stimulation experience, be able to fully perceive the relationship between the surrounding environment and the scene space, and then complete the preference questionnaire. This stage mainly involved the participants walking through and viewing the specified site and lasted for 3 min [33]. After the test, the participants left the test site. In addition, before the start of the test, a reminder was posted within 2 m around the test site to inform visitors that the front is the test area to reduce the interference of external factors (visitors' activities, noise, etc.). To reduce the occurrence of mixed outdoor variables, we ensured that the factors of the surrounding environment were quiet and that the physical environment, such as light, temperature, humidity and wind speed, in the landscape area were as similar as possible.

2.5. Vegetation Period

The selected landscape study areas were in the vegetation period (summer) or outside the vegetation period (winter). The summer period was from 1 June to 30 June 2021, and the average temperature was 26.8 °C (11.2 ± 2.75). The time of environmental perception in winter was from 1 November to 30 November 2020, and the average temperature was 11.2 °C (11.2 ± 1.27). During the test, the weather was sunny (no rain).

2.6. Data Analysis

Participants in different gender and professional background groups were evenly distributed between the sites, and accordingly, a univariate analysis of the general linear

model was applied to the entire sample to identify the effects of the most decisive factors (gender, professional background, vegetation type in green spaces and perception method) on preference. To determine the differences across vegetation types, multiple comparisons of posttests were used for analysis. To understand the influence of seasons on the participants' preference to experience vegetation types in green space, we used a one-way ANOVA. At the same time, to understand the types of activities carried out by the participants in the vegetation types of green space in different seasons, we used descriptive statistics to analyze the participants' preferences for activity types. All statistical analyses were performed using IBM SPSS Statistics 26.0 (IBM, Inc., Armonk, NY, USA) software.

3. Results

3.1. Factors Affecting Landscape Preference

The results of the univariate analysis of the general linear regression model are shown in Table 1. The model shows that the environmental perception methods of vegetation types in green space and seasons have a significant impact on landscape preference ($p < 0.05$), while gender and professional background have no impact ($p > 0.05$, Table 1). This shows that there were significant differences in the participants' preferences for vegetation types of green space due to the different environmental perception methods of the two seasons.

Table 1. Intersubject effect test of factors affecting landscape preference.

a. General information about general linear regression models				
	Type III Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance
Calibrated model	209.727	29	7.232	12.045	0
Mistake	222.15	370	0.6		
Correction total	431.878	399			
b. General information about general linear regression models.				
	Type III Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance
Perception method	4.327	1	4.327	7.208	0.008
gender	0.634	1	0.634	1.056	0.305
Professional background	0.563	1	0.563	0.938	0.333
vegetation type	95.077	4	23.769	39.589	0

3.1.1. Influence of Seasonal Changes in the Vegetation Types in Green Space on Preference

The results of univariate analysis by the general linear model showed that there was a significant difference between vegetation types (Table 1). We used post hoc analysis to compare preference scores for different types of vegetation types of green space. The results shown in Table 2 indicate that there is a significant difference between the preference scores in summer and those in winter, comparing the five green spaces, there was only one significant difference between the single-layer grassland landscapes: single-layer grassland and single-layer woodland. There was also only 1 significant difference in single-layer woodland: single-layer woodland and tree-grass composite woodland. There was a significant difference in the concrete and asphalt sites (areas) preference scores for only four comparisons: (1) concrete and asphalt sites (areas) as part of green infrastructure and single-layer grassland, (2) concrete and asphalt sites (areas) and single-layer woodland, (3) concrete and asphalt sites (areas) and tree-shrub-grass composite woodland, and (4) concrete and asphalt sites (areas) and tree-grass composite woodland. Among them, the preference score of single-layer woodland was the highest, followed by tree-shrub-grass composite woodland tree-grass composite woodland, single-layer grassland, and finally the concrete and asphalt sites (areas) (Table 2).

Table 2. Effects of vegetation types in green space and seasons on preference scores.

a. Influence of seasonal variation on preference scores.			
	Environmental Perceive in Summer	Environmental Perceive in Winter	F Value	p Value
Preference score Mean ± SD	3.65 ± 0.056	3.39 ± 0.087	7.208	0.008

b. Effects of vegetation types in green space on preference scores.						
	Single-Layer Grassland	Single-Layer Woodland	Tree-Shrub-Grass Composite Woodland	Tree-Grass Composite Woodland	Concreted and Asphalt Sites (Areas)	F Value	p Value
Preference score Mean ± SD	3.65 ± 0.089	3.96 ± 0.097	3.84 ± 0.084	3.66 ± 0.107	2.48 ± 0.121	39.589	0

3.1.2. Seasonal Changes in Vegetation Types of Green Space

To compare the preferences for each vegetation type in green spaces in different seasons, a one-way ANOVA was carried out. Table 3 shows that there is a significant difference between the preference scores for single-layer woodland in summer and winter, and there is a significant difference between the preference scores for concrete and asphalt sites (areas) in summer and winter. The preference score for single-layer woodland in environmental perception in winter is the highest.

Table 3. Mean value and *p* value of the preference scores of seasonal changes in various vegetation types.

	Environmental Perceive in Summer	Environmental Perceive in Winter	F Value	p Value
Single-layer grassland	3.68 ± 0.121	3.63 ± 0.132	0.298	0.767
Single-layer woodland	3.7 ± 0.13	4.23 ± 0.131	−2.822	0.007
Tree-shrub-grass composite woodland	3.78 ± 0.136	3.9 ± 0.1	−0.741	0.463
Tree-grass composite woodland	3.73 ± 0.119	3.6 ± 0.178	0.572	0.57
Concreted and asphalt sites (areas)	3.35 ± 0.116	1.6 ± 0.078	12.315	0

3.2. Activity Preference Setting of the Vegetation Types of Green Space

3.2.1. Impact of the Vegetation Types of Green Space on the Activity Preference Setting

Among the most frequent activities of the participants were rest and communication activities, followed by physical exercise activities, cultural activities, and finally viewing and excursion activities. The results show that recreational communication activities were the activities that the participants were most willing to carry out, followed by physical exercise and cultural activities, for which the number of visitors was the lowest.

Among them, in the concrete and asphalt sites (areas) landscape, the participants chose entertainment and leisure activities, followed by rest and communication activities, physical exercise and sightseeing activities. In the tree-grass composite woodland landscape, the participants chose rest and communication activities, followed by physical exercise activities and sightseeing activities, leisure activities. In the tree-shrub-grass composite woodland landscape, the participants chose rest and communication activities, followed by sightseeing activities, entertainment and leisure activities and physical exercise activities. In the single-layer woodland landscape, the participants chose rest and communication activities, followed by physical exercise activities, sightseeing activities and entertainment and leisure activities. In the single-layer grassland landscape, the participants most often chose rest and communication activities, while recreational and leisure activities, physical exercise activities and sightseeing activities were less selected by the participants (Figure 4). In the concrete and asphalt site (area) landscape without vegetation, the number of participants choosing recreational and leisure activities is greater, while in the green landscape with different vegetation types, the number of participants choosing rest and communication activities is the largest, and the rest of the activities also vary according to the characteristics

of different vegetation types. By recognizing the differences in activities in the five green space landscapes, it is concluded again that the seasonality of the green space land-scape has a significant impact on the types of activities. The focus of activities carried out by the participants in the green space landscape also varied with the season (Figure 4).
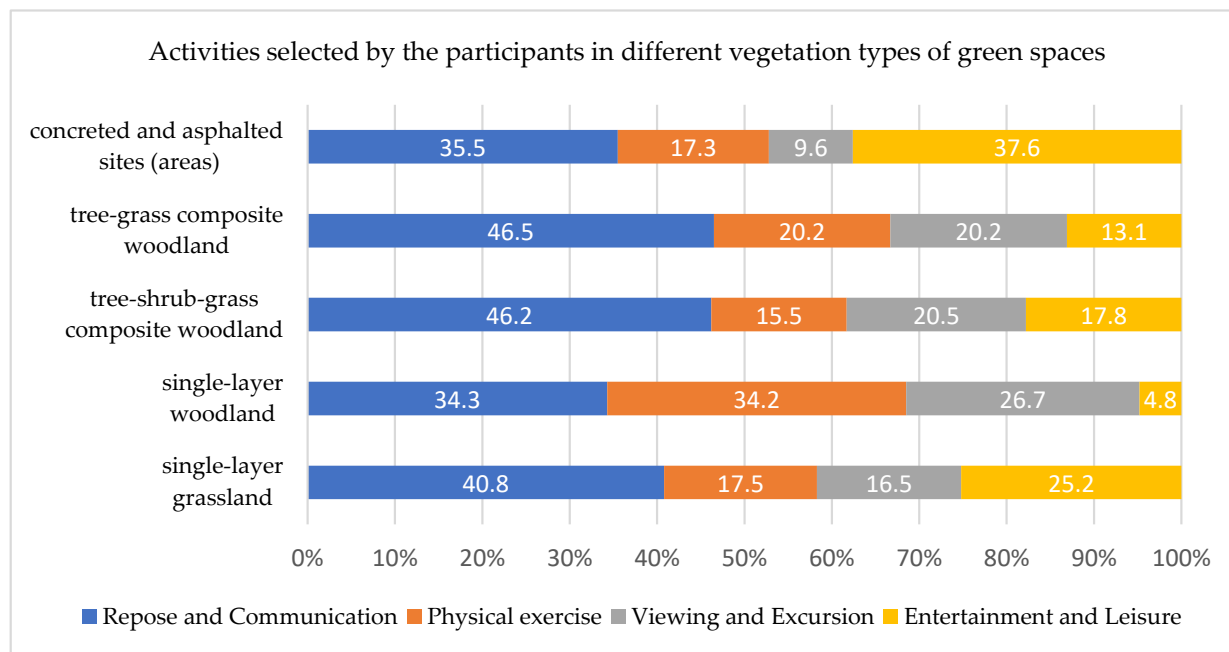
Figure 4. Activities selected by the participants in different vegetation types of urban green spaces.

3.2.2. Influence of Seasonal Change on the Activity Preference Setting of the Vegetation Types in Green Space

(1)   Effects of vegetation types of green space on activity preference in summer

Among the activity preferences for the vegetation types of green space in summer, the participants most often chose rest and communication activities, followed by viewing and excursion activities, entertainment and leisure activities, and finally physical exercise activities. Among them, the participants in the concrete and asphalt sites (areas) chose rest and exchange activities. In the tree-grass composite woodland landscape, the participants were willing to choose rest and communication activities. In the tree-shrub-grass composite woodland landscape, the participants were willing to choose rest and communication activities. In the single-layer woodland landscape, the participants were willing to choose rest and communication activities. In the single-layer grassland landscape, the participants were willing to choose rest and communication activities (Figure 5).

(2)   Effects of vegetation types of green space on activity preference in winter

Among the activity preferences for the vegetation types in green space in winter, the participants most often chose rest and communication activities, followed by physical exercise activities, and entertainment and leisure activities, while sightseeing activities were the least preferred. Among them, in the tree-grass composite woodland landscape, the participants chose rest and communication activities, such as chatting, sitting, meditating, communicating and interacting, stopping and resting. In the tree-shrub-grass composite woodland landscape, the participants chose rest and communication activities. In the single-layer grassland landscape, the participants were willing to have rest and communication activities. However, in the concrete and asphalt sites (areas), the participants were willing to carry out entertainment and leisure activities. In the single-layer woodland landscape, the participants were willing to engage in physical exercise (Figure 6). (Figure 6). In the winter environment perception, in the concrete and asphalt sites (areas) landscape without vegetation, the number of participants choosing recreational and leisure activities is greater,

while in the green landscape with different vegetation types, the number of participants choosing rest and communication activities is greater. However, at most, participants' preference for physical activity was significantly higher in winter than in summer.
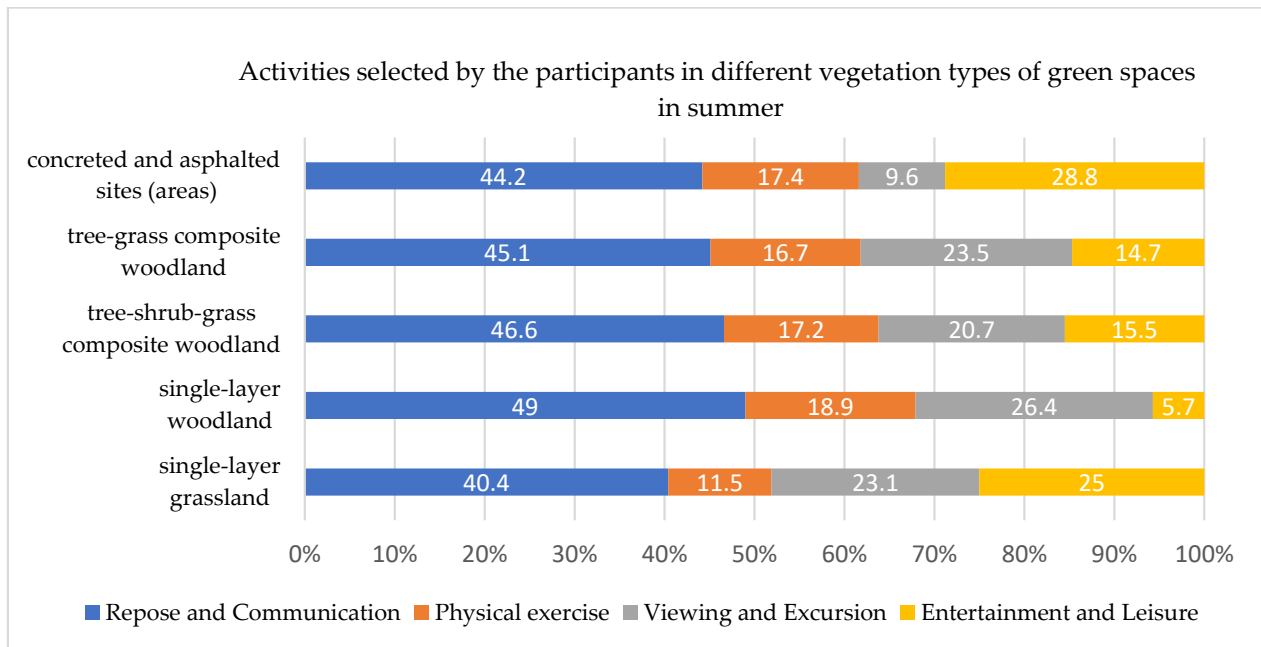
Figure 5. Activities selected by the participants in different vegetation types of urban green spaces in summer.
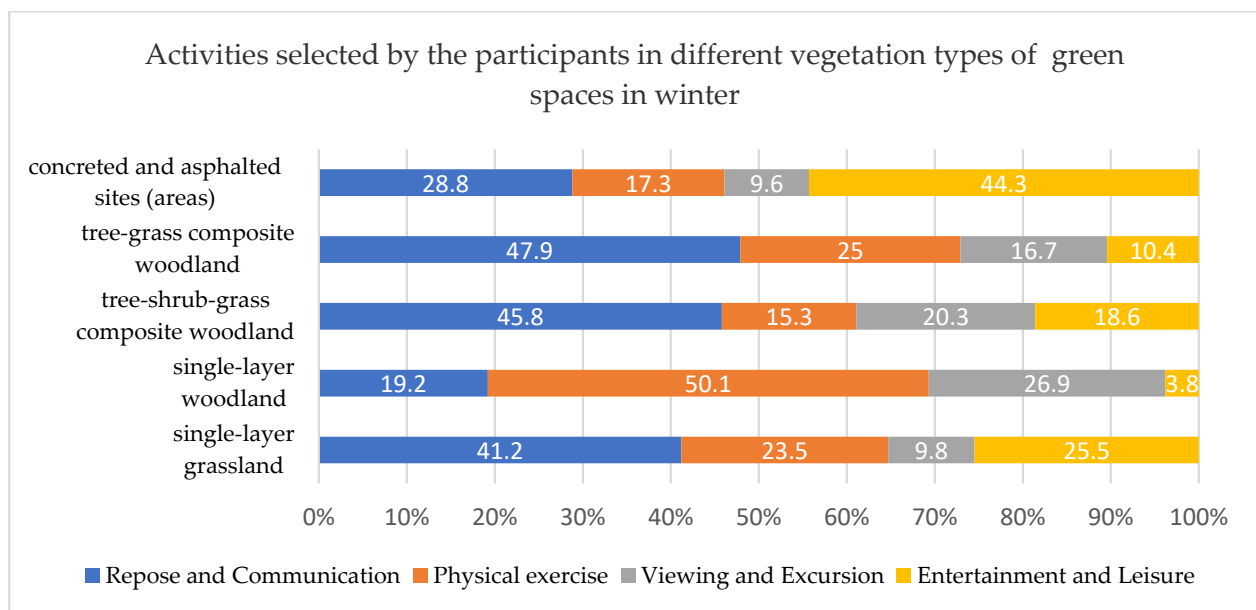
Figure 6. Activities selected by the participants in different vegetation types of urban green spaces in winter.

4. Discussion

4.1. Preference Effects of Vegetation Types in Different Seasons and Activity Choice Preferences

4.1.1. Influence of Vegetation Type on Preference

In previous off-site and on-site perception studies, we found that the preference for a single-layer grassland landscape was relatively high [37]. However, in the two seasonal perceptions, the attraction of single-layer grassland is not prominent, which may be related to the thermal comfort of the vegetation types of green space, and the effect of single-layer grassland on cooling and humidification is small [38].

The reasons for the low preference score for the concrete and asphalt sites (areas) landscape are commonly known. Too many hard materials remind individuals of their indoor work and life environments. The participants' evaluations were mostly given in negative words such as "monotonous", "no green" and "general environment". Studies have shown that improving the greening rate, aesthetics and interesting aspects of the plant landscape environment around hard pavement can effectively decrease the negative emotions of the participants [39]. Other comments noted the single vegetation in the single-layer grassland landscape by mentioning "mottled grassland", "poor greening", and "few tree species" as well as the environmental atmosphere of the site ("air cooling", "desolation", and "monotonous scenery"). At the same time, the effect of a single-layer grassland landscape on alleviating heat discomfort is limited. These factors may have led to the low preference scores of the participants for the single-layer grassland landscape and the moderate preference score for the tree-grass composite woodland landscape, which may be due to the attraction of the tree-grass composite woodland landscape itself. The plants in the tree-grass composite woodland landscape have high aesthetics and a comfortable and relaxed atmosphere. However, participation is low, and the participants cannot enter the space to experience and feel the landscape. The perception scales of the sense of space, naturalization, species richness and sheltering affect people's landscape preferences [40]. Therefore, the participants' preference evaluations of the tree-grass composite woodland landscape were primarily environmental perception evaluations of "beautiful environment", "green", "full of vitality", and "quiet", lacking interactive evaluation. The preference scores for the tree-shrub-grass composite woodland landscape were second only to those of the single-layer woodland landscape. The reason for their relatively high preference score is that the moderate openness (meaning a certain degree of openness and a certain degree of shadow effect), moderate vegetation density and plant diversity in the tree-shrub-grass composite woodland landscape improve the attraction of the landscape environment [18]. According to the "lookout shelter" theory, the tree-shrub-grass composite woodland and single-layer woodland landscapes can meet individuals' needs for vision and a sense of security [41]. At the same time, the vegetation density of the tree-shrub-grass composite woodland landscape is greater than that of the single-layer woodland landscape. Overly dense trees limit vision and reduce the sense of security, but they provide better privacy and shadow. Therefore, the preference score for the tree-shrub-grass composite woodland landscape was relatively high. The participants characterized this landscape primarily with words such as "quiet", "bird singing", "relaxing", "rich plant color matching" and "sense of hierarchy", with "ventilation" and "physical and mental pleasure" being the most evaluated. The preference score for the single-layer woodland landscape was the highest, and the evaluation of the participants was also dominated by positive words such as "sense of light and shadow", "sense of hierarchy", "independent space", "healing", "quiet", "relaxed", "quiet", and "comfortable". Sunlight is usually related to warmth and heat, which may activate the emotional response related to heat, thus affecting the perception of heat and overall comfort [25]. In a sunny climate, visual perception is an important factor affecting residents' thermal comfort [42]. Louafi et al. found a positive correlation between thermal comfort and visual comfort. In other words, better lighting conditions and higher visual comfort can alleviate thermal discomfort [25], which is related to the special attributes of vegetation in the single-layer woodland landscape and the thermal comfort of the vegetation types in green space. Therefore, the preference score for the single-layer woodland landscape was higher than those for the other vegetation types of green space.

4.1.2. Effects of Vegetation Types of Green Space on Season Preference

There was a significant difference between the preference scores for summer and winter (F = 6.084, p = 0.014), and the preference score was higher in summer. This is related to seasonal changes caused by climate change. The visual characteristics of plants in different seasons affect the perception of landscape preference standards [43], and visual comfort includes the impact of landscape and sunlight on people's perceptions [44].

Some studies have shown that the season affects people's connection with nature in urban environments [45], while others believe that winter may reduce people's happiness index [46]. However, other studies have shown that walking in urban parks in winter can increase people's positive emotions [47], but people's landscape preferences mainly come from the feeling of subjective consciousness. Therefore, the cold climate in winter blocks people's preferences for landscapes. The higher perceived preference score for the concrete and asphalt sites (areas) landscape in summer was due to the rich vegetation color and community level matching and the perfect allocation of functional facilities [39]. The environment surrounding the concrete and asphalt sites (areas) landscape in winter was relatively depressed. At the same time, affected by physical factors such as temperature and humidity, the subjective consciousness of the participants did not allow them to accept the concrete and asphalt space landscape in winter. There are four reasons for the high preference scores for the single-layer woodland landscape in winter. First, the physical factor of a large illumination angle is far less than that of direct illumination in summer. The mottled shadow in a single-layer woodland landscape enriches the interest and aesthetics of the landscape. At the same time, shade reduces surface temperature and increases latent heat exchange in the process of evapotranspiration [48]. Second, in the sensory dimension of landscape perception, individuals prefer quiet, followed by the sense of space [40]. The single-layer woodland landscape in winter is relatively quiet and can quickly relax people's bodies and minds. Third, cultural artistic conception affects preferences, and pine and cypress plants have a solemn and sacred cultural artistic conception in traditional Chinese culture [49]. Fourth, the volatiles of pine and cypress plants can alleviate the negative emotions of the human body [50]. Therefore, the experiential effects of vegetation types of green space on participants vary with the seasons. In future designs, the different effects of seasonal changes in the vegetation types of green space landscape should be fully considered.

4.1.3. Influence of Vegetation Types of Green Space on Activity Choice Preferences

Through the activity preferences of the participants for the vegetation types of green space, the results show that the participants are more willing to choose rest and communication activities, such as chatting, sitting, stopping and resting, in the vegetation types of green space. Rest and exchange activities were the most common in the single-layer grassland, tree-shrub-grass composite woodland and tree-grass composite woodland landscapes, while rest and exchange activities and entertainment and leisure activities were the most common in the concrete and asphalt space landscape, and rest and exchange activities and physical exercise activities were the most common in the single-layer woodland landscape. The main behavior patterns exhibited by the participants in urban parks were resting, stopping and communicating, which are also people's greatest demands for urban parks. Since plant density and vegetation types of green space provide people with a diversity of social interaction behaviors [51], the interaction behavior patterns exhibited between people and plant landscapes gradually begin to appear diverse. For urban residents, the main purposes of recreation in urban parks are not to improve work efficiency, improve interpersonal relations or promote family harmony but to provide emotional utility, including happiness, relaxation and fulfillment [52]. With the change in health problems and understanding of the natural environment, the goal of parks has changed from enhancing "health" to promoting "fitness" [53]. People carry out different activities depending on the characteristics of the vegetation types of green space landscape, and the rational use of the vegetation types of green space promotes people's physical and mental health.

4.2. Impact of the Participants' Gender and Professional Background on Landscape Preference

In this study, gender and occupation had no effect on preference. This result is consistent with Lyons' findings [54] but contrary to the findings of other studies [55–57]. According to Lyons, the preference difference across genders may be related to age and residence, but all respondents of this study were college students of the same age living on

campus [54]. Moreover, although the sites selected in this study had different vegetation structures, they were common and conventional spatial types in urban environments and are familiar to students. For spaces with few novel characteristics, the influence of gender and occupation on preference is not significant. Therefore, to determine the impact of gender and professional background on the vegetation types of green space preference, it is very important for us to further study variables such as the gender, professional background and age of participants in future research.

4.3. Limitations of the Study

This study also has some shortcomings. First, all participants were college students. The reasons for choosing college students are as follows: On the one hand, the sample size of college students accounts for a major group in the experiment, and college students belong to one of the more typical groups in the social population. Some mental diseases, such as depression, anxiety, are more common and gradually popularized among college students. At the same time, many problems, such as life, work and study, bring too much pressure, and symptoms, such as chronic diseases and cardiovascular diseases, are also gradually appearing in younger populations. On the other hand, college students are easy to assemble and motivate to participate in research, and they can easily provide information. College students were used in the studies of Tian [18], Lyons [54], Xiang [58], Browning [59] and others, and the stability of college students as test samples has been verified many times. However, the results may not reflect other social groups. The results should be further verified in other groups. Second, the age range of the participants was 17–25 years, but those in other age ranges may differ. The age variable can be used as an effect correction variable for further research. Third, although the four vegetation types of green space were typical and representative, the types of vegetation were not comprehensive enough. To fully explore the differences between vegetation types of green space and participant groups, we should consider further research on other vegetation types of green space or other plant species. Finally, because these studies were conducted only in winter and summer, visual perception affected the residents' thermal comfort, which is related to climate change and vegetation types of green space structure. Therefore, climate change and seasonal changes in plants affect the preferences of individuals.

5. Conclusions

In this study, environmental perception in summer and winter was used to evaluate the landscape preferences for vegetation types of green space for the first time, and the landscape preferences for and activity types in the vegetation types of green space were evaluated. First, there were significant differences between the two seasonal landscape preferences, and the preference score for the summer landscape was higher. Second, the preference score for the single-layer woodland landscape was the highest, followed by those for the tree-shrub-grass composite woodland, tree-grass composite woodland and single-layer grassland landscapes, with concrete and asphalt sites (areas) landscape being the least preferred. The preference score for the single-layer woodland landscape in winter was significantly higher than that in summer. Third, the activity preferences of the participants varied with the seasons, thermal comfort and thermal environment problems, changing from rest and communication activities in community landscapes with high thermal comfort, such as the tree-shrub-grass composite woodland and single-layer woodland landscapes in summer, to physical exercise activities in the single-layer woodland landscape in winter. The results show that in the green space landscape in summer, the participants were more willing to carry out rest and communication activities, such as chatting, sitting, meditating, stopping and resting, while the thermal comfort and thermal environment of the green space landscape affected the participants' environmental perception and landscape preference. At the same time, people are more willing to maintain static activity behavior in summer, which reduces sweating and physical and mental pleasure. The main types of activities carried out in the green space landscape in winter were recreational

and communication activities, physical exercise activities and entertainment and leisure activities, but the types of activities that the participants chose for each vegetation type in green spaces were not always dominated by recreational and communication activities, which is closely related to seasonal changes and thermal comfort. Finally, no matter which environmental perception method was adopted, there was no significant difference in the participants' landscape preferences across gender and professional background groups. Based on the above results, the two seasonal perception methods cannot replace each other. Therefore, landscape perception methods and appropriate activities should be carefully selected for the specific vegetation types of green space in a specific season, and green space should be reasonably planned according to the thermal comfort problem to provide a scientific basis for evaluating landscape perception and preferences in the future. Future research should further study, compare and explore the vegetation types of green space across the four seasons and combine it with research on thermal com-fort to lay a solid foundation for future research on green space landscapes.

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