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Restorative Effects of Pocket Parks on Mental Fatigue among Young Adults: A Comparative Experimental Study of Three Park Types

Jingyi Xu, Bing Qiu *, Fan Zhang and Jinguang Zhang

College of Landscape Architecture, Nanjing Forestry University, Nanjing 210037, China;
xu_jingyi@njfu.edu.cn (J.X.); nlzhangfan@njfu.edu.cn (F.Z.); zjg@njfu.edu.cn (J.Z.)
* Correspondence: qiubing@njfu.edu.cn; Tel.: +86-13851872804

Abstract: Urban parks have been proven to effectively reduce mental fatigue among city residents; however, there has been less focus on the mental health benefits offered by pocket parks in densely populated areas from a field experiment perspective. Additionally, there is insufficient evidence providing information on the environmental characteristics that support recovery from mental fatigue. This study was based on 80 young adults aged 19–25 years. Three types of pocket parks were selected: street corners, interblock spaces, and intrablock spaces. Through a field experiment with questionnaire collection, physiological (BP, HR, and LF/HF) and psychological indicators (FS-14 and VAS) were used to explore the relationship between various pocket park features and respondents' mental fatigue recovery. This study investigated the restorative effects of 10 environmental features by collecting questionnaires. The results suggested that different types of pocket parks have the recovery effect of pocket parks. Four environmental factors, namely, vegetation colour ($\beta = -0.472$, $p = 0.002$), vegetation coverage ($\beta = 0.298$, $p = 0.046$), resting facility comfort ($\beta = -0.336$, $p = 0.028$), and plant species ($\beta = -0.437$, $p = 0.003$), were more predictive of mental fatigue recoverability. However, factors such as neighbourhood hygiene and spatial privacy did not show significant predictive effects. Our findings provide robust evidence for urban park planning and design. In the future landscape design of high-density urban areas, greater emphasis can be placed on the construction of pocket parks. The rational selection and configuration of environmental factors that contribute to recovery effects in pocket parks will contribute to meeting the psychological health service needs of high-density urban populations.

Keywords: urban forests; health; green spaces; mental fatigue; restoration effect

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1. Introduction

The acceleration of urbanisation in the 21st century has led to a gradual increase in the population of cities. The densification of urban development has continuously squeezed green spaces, resulting in decreased quality and accessibility [1]. The sense of crowding and busyness in cities presents numerous challenges to the mental and physical health of residents, with mental fatigue becoming prevalent among the urban population. People often attribute mental illness to pressure from life or work. However, mental fatigue is often overlooked in the interplay between external stressors and mental illnesses. People are often unaware of the mild forms of mental fatigue, and their accumulation over time can lead to serious psychological illnesses. An initial nationwide epidemiological survey on mental disorders in China revealed a lifetime prevalence rate of 16.57% among adults with mood disorders, primarily depression and anxiety disorders, showing an increasing trend [2]. This trend particularly affects the populations residing in high-density urban areas. Therefore, there is an urgent need for modern urban populations to seek methods to alleviate mental fatigue.

1.1. The Natural Environment and Restoration

While seeking simpler methods to prevent and alleviate mental fatigue, numerous studies have confirmed that the natural environment can effectively reduce both psychological and physiological stress. It has the potential to offer low-cost interventions to address human mental and physical health issues. Two widely recognised theories support this viewpoint. The first is Ulrich's Stress Reduction Theory, which states that patients recovering from and observing green landscapes through windows recover faster, experience fewer complications, and derive more benefits than those observing urban landscapes. This study suggests that natural environments activate positive emotional responses by providing interesting, pleasurable, varied, and non-demanding stimuli, thereby restoring attention to stress and reducing physiological responses and cognitive load. The second theory, Kaplan's Attention Restoration Theory, posits that nature does not demand focused attention for appreciation. When human attentional capacity is depleted, natural environments excel at replenishing this ability.

Multiple studies have shown that urban environments hinder stress relief among populations, whereas natural green environments tend to alleviate negative emotions to a greater extent than artificial settings. Some studies have compared urban parks with built-up city areas [3], whereas others have compared natural environments with urban settings, including forest environments [4,5], hills, and lakes [6]. Additionally, some studies have contrasted urban parks, woodlands, and built-up city areas [7]. These findings indicate that when individuals are exposed to urban woodlands, their overall perceived restorativeness is higher than when exposed to urban parks, with the lowest restorativeness observed in built-up city areas. Furthermore, it was concluded that even short-term visits to natural areas can have a positive mitigating effect on perceived stress, especially when compared to built environments.

However, studies have shown that not all natural environments are equally restorative [8], and research on the restorative effects of various natural environments has gained considerable attention in recent years. One of the most well-established findings is that different types of green spaces have unique characteristics that influence their restorative effects. Exposure to natural environments with high levels of biodiversity, such as forests and woodlands, has been found to be particularly effective in reducing stress and improving mood [7,9]. Green spaces are often associated with a sense of awe and wonder, which can lead to feelings of relaxation and rejuvenation. Studies have also been conducted on urban parks [10], school greenspaces [11], and community greenspaces, which may provide opportunities for physical activity [12], social interaction [13], and exposure to natural elements (e.g., trees and plants), which can be useful for improving cognitive function [14] and reducing stress [15]. Additionally, exposure to blue spaces, such as oceans, lakes, and rivers [16], can also have a restorative effect on mental health. Although many studies have explored the positive effects of green spaces on mental health from various perspectives, there is a relative lack of research on the restorative effects of small green spaces on mental fatigue in high-density urban areas.

1.2. Landscape Composition Affecting Restoration Effects

In recent years, the restorative effects of different landscape elements in high-density urban areas have attracted the interest of researchers. These studies aim to reveal the effects of different landscape elements on the restorative mental health of populations to guide urban planning and design. Natural elements are an important focus of the studies. Nordh et al. [17] assessed landscape components by evaluating representative photographs of urban green spaces and found that lawns, trees and shrubs, and water bodies are key components of the restorative effects in natural environments [18], and the quantity, type, and form of the layout determine the restorative effects produced to some extent [19]. Recent studies have found that sounds in natural environments, such as birdsongs, wind, and water flow, can trigger positive emotions, increase concentration, and provide a calming and relaxing experience [20], whereas urban roads and hard paving are negative factors. In addition to exploring the restorative effects of natural components, given that the restorative potential is, to some extent, influenced by the direct experience of space and activities, some studies have attempted to analyse the elements of landscape composition by examining the spatial organisation of urban park areas [21]. However, at this stage, there are still some deficiencies in researching the landscape composition aspects that affect restorative effects. On the one hand, there is a lack of multidimensional analysis, and current research mainly focuses on exploring the influence of individual landscape composition factors on the restoration effect, whereas the actual green space is a complex system consisting of multiple landscape composition elements that intertwine with each other and produce a comprehensive effect. Therefore, further research is required to explore the interactions among different landscape components and their combined effects on restoration. On the other hand, there is a lack of diversity in research methods, which currently focus on single-questionnaire surveys and laboratory studies. Although these methods are helpful in understanding the effects of landscape composition, they may not fully capture people's real experiences and feelings in the actual environment. Therefore, more research that employs interdisciplinary approaches, such as psychophysiological measures, mobile perception technologies, and virtual reality, is needed to assess the impact of landscape composition on restoration effects more accurately.

1.3. Growing Interest in Physiological Feedback

As technology continues to evolve, researchers are increasingly favouring the use of quantifiable devices and tools that can objectively record changes in environmental perceptions and physiology. The relationship between environmental perceptions and resilience was established by measuring the physiological responses of fatigued individuals in natural environments. Physiological feedback techniques that have been used in experimental studies include cardiovascular assays (e.g., heart rate, blood pressure, and heart rate variability), neuroendocrine (e.g., cortisol and salivary amylase) responses, and more recently, brain activity [22]. These physiological feedback techniques provide objective physiological measurements, such as heart rate variability (HRV), skin electrical conductivity (EDA), and brain waves, which, in turn, can objectively record an individual's physiological response to the natural environment, avoiding the bias of subjective assessments and memory inaccuracy. Among them, the heart rate variability (HRV) of the electrocardiogram (ECG) component is an important indicator of cardiac autonomic regulation, which reflects the body's ability to adapt to and recover from environmental stimuli. Higher levels of HRV are usually associated with a state of relaxation and recovery [23]; therefore, HRV is often used as an indicator in experimental research.

1.4. Significance of This Study

In the current irreversible trend of urbanization and high-density urban development, urban pocket parks, with their relatively small land area, strong spatial permeability, and ease of transformation, may become crucial green open spaces for people to connect with nature in their daily lives. These parks hold potential as valuable health resources, especially considering the limitations on the development of larger parks in urban areas. The Chinese government recognizes the importance of health, making it a strategic priority with initiatives such as the 'Healthy China 2030 Planning Outline' and the 'Healthy China Action Plan (2019–2030)'. Numerous studies suggest that natural environments are more effective in relieving stress than artificial environments [23]. However, much of this research is based on Western studies, and there is a relative scarcity of research on the restorative effects of natural environments in China. Despite a shift in research focus from specific demographics (e.g., children, teenagers, and the elderly) to specific landscape types (e.g., residential areas, campuses, forests, and urban parks) since 2018, there remains a significant lack of studies on pocket parks—flexible and potentially key components of building green networks in high-density urban areas. Furthermore, existing research on the restorative effects of pocket parks often relies on subjective assessments through questionnaire surveys, lacking a comprehensive combination of on-site experiments and surveys to closely approximate real experiences and scientifically support the exploration of the restorative effects of these parks. Additionally, understanding how to control the physical environmental factors of pocket parks to maximize recovery effects for individuals experiencing mental fatigue relies heavily on past design experience. While some research has started to address this issue, most studies have analysed only a few factors in isolation, failing to integrate these elements comprehensively to explore the combined effects of various factors on the restorative effects of mental fatigue. Given the rapid development of urban densification in China, this study is of increasing importance. It focuses on three types of small urban pocket parks (cross-block, street corner, and mid-block) in high-density urban areas, comparing them with an indoor environment without windows and green plants. The study aims to investigate whether these pocket parks have potential restorative effects and explore the physical environmental factors associated with their restorative effects. Using physiological indicators (blood pressure, heart rate, and LF/HF) and psychological indicators (FS-14, VAS, and PRS), the research combines qualitative and quantitative methods. The primary objective is to provide guidance for the restoration and improvement of urban green spaces, offering theoretical support for the planning and design of future urban pocket parks. This will help meet the psychological health needs of modern urban populations and enhance green network services for social and psychological well-being.

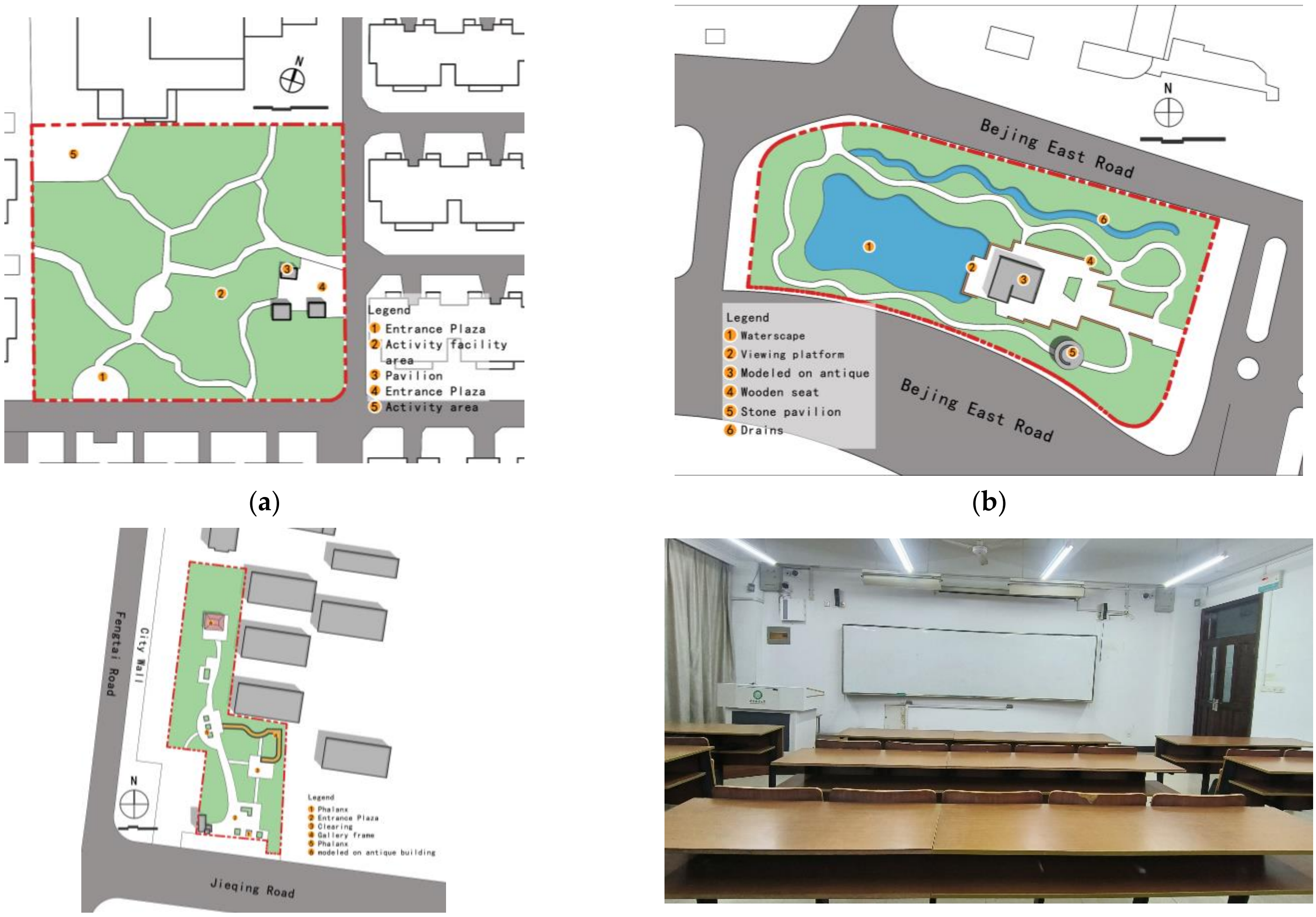
2. Materials and Methods

2.1. Study Sites

In China, the classification of green spaces is highly similar to that of pocket parks. The pocket parks discussed in this study are defined based on the latest ‘Urban Green Space Classification Standard’ CJJ/T85—2017 and are characterised by independent land use, smaller or diverse forms, convenient accessibility for residents, possessing certain recreational functions, and having an area smaller than 1 ha with a green coverage rate of not less than 65%. Considering the large-scale and scattered distribution of pocket parks in Nanjing, China, it was essential to select different types of samples for an in-depth study. The research team categorised the samples according to three positions: street corners, across streets, and within blocks (referencing ‘People Places’), selecting three different types of pocket parks as representatives within the high-density urban areas of Nanjing. Furthermore, the sample selection was based on several criteria. The sample should be within a 15 min drive from schools to reduce experimental errors caused by physiological fatigue and exhaustion during transit. Additionally, the sample sizes were kept moderate and balanced, ranging from 3000 to 6000 m^2, to eliminate errors arising from differences in the size of the pocket parks.

Nanjing is one of the most densely populated cities in China. The ‘central urban area’ spans an area of approximately 50 km^2. According to the seventh national census in Nanjing, this central urban area is home to approximately 2.75 million people, with a population density of around 55,000 individuals per square kilometre—far exceeding the standard for high-density urban areas (15,000 individuals per square kilometre) [24,25].

This study selected the green space at Suojinyi Village (Type I) as the sample for the street corner pocket park (Figure 1), covering an area of 3270.99 m^2 with a green coverage rate exceeding 0.65. The park is flanked by roads on both sides and features three entrances on each side. Surrounding the park are 4–5-story old buildings with a high volume of non-motorised traffic. Within this small park, the vegetation is tall and dense with a lush tree canopy. These pathways are relatively narrow and secluded. Towards the southern part of the site is an area designated for recreational fitness activities, serving as the central gathering area for the daily activities of the surrounding residents.



(**a**) (**b**)

(**c**) (**d**)

Figure 1. (**a**) The green space at Suojinyi Village (Type I); (**b**) the green space on the west side of Heping Park (Type II); (**c**) Ji Qingmen Park (Type III); (**d**) Classroom (Control).

The selected sample for the cross-street pocket park (Figure 1) was a green space on the west side of Heping Park (Type II), covering an area of 5690.09 m^2 with a greenspace coverage rate of 0.788. The site is surrounded by major urban thoroughfares close to prominent landmarks in Nanjing, which attract heavy vehicular traffic. The park features three entrances and exits, with a large paved area in the south. The distinctive features of this site are its traditional-style building and connecting corridors, often frequented by local residents and leisure tourists. A noteworthy aspect of this park is the inclusion of a stand-alone observation of water features within its premises.

The chosen sample for the pocket park within the block (Figure 1) was Ji Qingmen Park (Type III), covering an area of 5592.19 m^2 with a green coverage rate of 0.718. The site is adjacent to a city road only in the southern part and has only one entrance. The western side of the park abuts the ancient city wall, while the northern and eastern parts are bordered by residential walls. Professional horticulturists are employed to maintain its cleanliness and aesthetic appeal. The pathways within the park are relatively wide and the central area, featuring pergolas and trees, serves as the primary gathering spot for local residents.

Establishing a control group that receives the same mental fatigue-inducing stimuli but lacks stimulation from a pocket park, enables the determination of the restorative effects generated by the experiment attributable to the pocket park stimulus, rather than the effects induced by sedentary behaviour following mental fatigue. A classroom was selected for this purpose, with curtains drawn to cover the windows, maintaining a sealed experimental environment to eliminate external disturbances. (Figure 1).

2.2. Participants

Before recruitment, this study utilized G*Power software 3.1 to conduct power analysis, ensuring that the research had an adequate sample size to capture the expected effect size. In the case of selecting a paired sample *t*-test, a two-tailed test was chosen, employing Cohen's (1988) [26] calculation method with an effect size (Cohen's d) set at 0.5. The significance level (αerr prob) was set at 0.05, and the power (1-β err prob) was set at 0.8, resulting in a calculated minimum sample size of 34, requiring 17 participants per group. In the case of selecting a two-way repeated-measures analysis of variance (ANOVA), an effect size of 0.25 was chosen, with αerr prob set at 0.05 and power set at 0.8. The study involved four groups, each undergoing three repeated measurements, and the analysis determined a minimum sample size of 64, requiring 16 participants per group. In summary, the maximum value obtained for the minimum sample size is 68, requiring a minimum of 17 participants per group.

This study, organised by the School of Landscape Architecture at Nanjing Forestry University, aims to maximise participation by issuing notices across the entire campus and creating online groups to involve as many potential participants as possible. Participants were required to meet the following criteria: (1) good health: individuals diagnosed with cardiovascular diseases, arrhythmia, or autonomic nervous system disorders were strictly excluded from the experiment; (2) no psychological or mental disorders; (3) no habits of excessive alcohol consumption or smoking [27]; and (4) no recent use of medication [28,29]. In the end, a total of 96 participants were recruited, including undergraduate and graduate students (50% male, 50% female; M = 20.71, sd = 1.904). The sampling pool encompassed students from various regions of China and diverse disciplines (eight different colleges).

The participants were divided into four groups based on the experimental settings, with 24 individuals in each scenario. To control the influence of gender on the experiment, 12 males and 12 females were randomly assigned to each group. Each group participated exclusively in one experimental scenario, with experiments conducted in sets of four individuals across seven sets per group, resulting in 96 experimental trials across four experimental scenarios. After the experiment, eighteen participants were excluded based on their heart rate variability data and fatigue assessment due to the unsuccessful application of the stressor. To ensure an equal sample size across each experimental scenario, an additional recruitment phase was conducted (eight individuals), followed by a second round of experiments, retesting the validity of the data, resulting in a final dataset of 20 participants per experimental scenario (50% male, 50% female), yielding a total of 80 valid datasets. This exceeded the maximum minimum sample size determined by the power analysis.

2.3. Experimental Design

2.3.1. Timing of the Experiment

The experiments were conducted between mid-May and mid-June 2023, a season marked by vigorous growth of green vegetation and increased bird and insect activities. The time slots were chosen during clear weather with relatively warm temperatures (ranging from 22 to 29 °C) and moderate wind speeds of 2–3 on the Beaufort scale, specifically between 9:00–11:00 and 13:00–15:00.

2.3.2. Experimental Procedure

The 96 subjects were randomly assigned to four locations based on their exposure to the visiting environment. Experiments were conducted only on clear weather days with suitable temperatures and were rescheduled if rain occurred. The subjects abstained from caffeine, tobacco, and food for 2 h prior to the experiment. Upon arrival at the designated experimental environment, the participants signed informed consent forms and completed basic information sheets. Four assistants individually explained the experimental procedures and instrument wearing requirements to the participants without disclosing the purpose of the study. Under the guidance of research personnel, participants wore wrist blood pressure monitors (Omron, HEM-6221, Dalian, Liaoning Province, China) and portable Holter monitors (Lepu, ER 1, Shenzhen, China) attached to sensors for approximately 5 min [11] of resting with closed eyes (T1), ensuring stable physiological indicators while recording baseline values for electrocardiography and blood pressure; for the stress phase (T2), participants were instructed to perform a continuous mental subtraction task [30] with eyes closed within 15 min [21,31], aiming to induce fatigue. In the case of errors, the assistant immediately said 'Stop, start over', while recording electrocardiography and blood pressure values. In this phase, the four subjects continuously vocalised the calculated numbers to create mutual noise interference, thereby increasing their sensation of mental fatigue. To intensify their mental fatigue, the participants were introduced, and the subjects were informed that they would receive an additional 20 RMB if they completed the mental calculation task within 10 min, after which they completed the Chalder Fatigue Scale-14 (FS-14) and visual analogue scale (VAS). During the recovery phase (T3), the subjects in the outdoor experimental group walked at a speed not exceeding 4.5 km/h along a pre-specified route accompanied by the assistant to control the route and speed's effect on the experiment. Subsequently, the subjects were directed to sit in the designated seats for 8 min. The recovery phase lasted for no less than 15 min [32,33], during which dynamic electrocardiography and blood pressure values were recorded, after which the participants completed the Perceived Restorativeness Scale (PRS) and rated the dimensions of the questionnaire on the relief of mental fatigue caused by the high-density urban pocket park. The experimental assistant then clarified the purpose of the experiment, allowing the subjects to inquire about the study and receive 50 RMB of compensation. The entire experiment lasted approximately 1 h. The experimental procedure was referenced from existing literature [34], with modifications made according to the specific requirements of this study. The final procedure is illustrated in Figure 2.

2.4. Data Collection and Reduction

2.4.1. Physiological Measurements

HR

The electrocardiography (ECG) results were recorded using a single-lead dynamic ECG recorder (Lepu, ER1, Shenzhen, China) comprising three primary components: (1) the ECG recorder, (2) electrodes, and (3) Bluetooth devices. The electrodes were attached to electrode snaps with the R-end pointing to the right, higher than the left by approximately 45°, and placed close to the skin on the left side of the chest, with the R-end within 2 cm of the sternal notch. In this study, data collected from the R-R intervals were processed to derive heart rate, LF, and HF data.

The heart rate (HR) is controlled by both branches of the autonomic nervous system, the sympathetic and parasympathetic nervous systems, and is commonly considered to directly reflect the body's stress condition. Excessive stress activates the sympathetic nervous system, leading to an increased heart rate. Conversely, increased activity in the parasympathetic nervous system lowers the heart rate. A decrease in heart rate indicates a certain degree of stress [22].

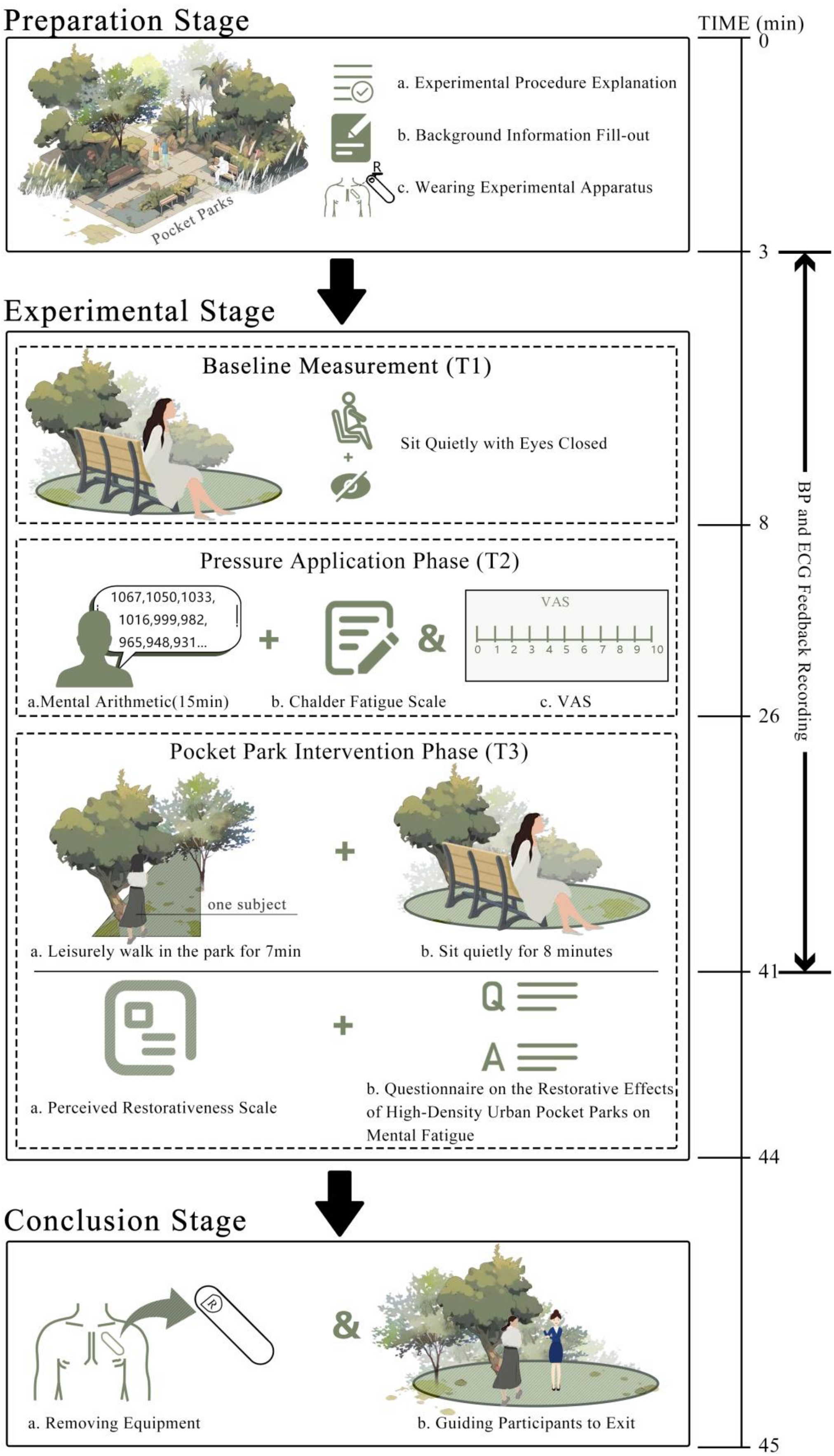


Figure 2. The experimental procedure.

HRV

Heart rate variability (HRV) is a representative indicator used to assess mental fatigue [35,36]. This reflects the interaction between the excitatory sympathetic nervous system and the parasympathetic nervous system. The excitatory sympathetic nervous system predominates during stressful periods, while the inhibitory parasympathetic nervous system predominates during relatively safe and recovery periods [37]. In the present study, the LF/HF ratio in the frequency domain was primarily used to evaluate the balance between the sympathetic and vagal nervous systems. An increase in sympathetic nervous system activity was indicated by a significant increase in the LF/HF ratio.

BP

Blood pressure (BP) is considered an indicator of the body's arousal or relaxation state [38]. We used a wrist-type blood pressure monitor to measure blood pressure (systolic [mmHg], diastolic [mmHg], and pulse rate [bpm]) on the left wrist and conducted three measurements at each stage (Omron, HEM-6221, Dalian, Liaoning Province, China).

2.4.2. Psychological Measurements

Mental Fatigue

Accurately measuring mental fatigue solely through performance on simple tasks is challenging. Subjective feelings of mental fatigue experienced by individuals may appear before a decline in task performance [39]. Therefore, when describing mental fatigue, subjective personal reports of mental fatigue may be more suitable than task performance assessments. This study used the Chalder Fatigue Scale-14 (FS-14) [40]. This scale comprises 14 questions, and participants are required to mark 'yes' or 'no' based on the items. The final three items on the scale were scored in reverse order.

PRS

Restorativeness and Experience: The psychological recovery effects of an environment on mental fatigue are mainly manifested in a reduction in negative emotions [7] and the restoration of attention [8]. To subjectively assess the restorativeness of an environment, researchers initially developed and gradually refined the Perceived Restoration Scale (PRS) [41,42]. Numerous studies have used this scale [43,44]. A Chinese study developed a 22-item version of the scale based on a 26-item scale, which was found to have sufficient reliability for measuring the effect of the environment on individual psychological recovery (Cronbach's alpha > 0.769–0.936) [45]. The scale is primarily constructed from four elements: five items for assessing 'being-away', six items for assessing 'fascination', five items for assessing 'extent', and six items for assessing 'compatibility'. Using a seven-point scale ranging from 1 (not at all) to 7 (completely), reverse-scored questions were reverse-coded before the analysis.

Measurement of Physical Environmental Characteristics

Existing research has demonstrated partial features of how small parks facilitate recovery from mental fatigue. Natural environmental characteristics play a crucial role in promoting individual psychological and emotional recovery, particularly the significant contribution of plants to restorative experiences, as reported in numerous studies [46]. Greenery plays an important role in fostering emotional balance and psychological comfort. Additionally, the area covered by lawns plays a key role in alleviating mental fatigue [17,18,47], whereas the degree of restoration is significantly associated with different types of natural landscapes [48], supporting the promotion of mental health. Emphasising an individual's need for privacy during recovery is closely related to their relaxed state in a private environment [49]. The comfort of rest facilities [50] and their orientation support the relaxation and rest of individuals experiencing mental fatigue. Studies have shown that parks with diverse and abundant facilities and activity spaces provide opportunities to engage in various physical activities. As the number of active facilities increases, so does the opportunity for physical activities within parks, showing a positive correlation between the two [51], and that the cleanliness of the environment directly impacts the physical health of the respondents.

Building upon the research findings of Peng et al. [52] and the relevant literature, through the comparison, integration, and elimination of potential indicators combined with expert opinions, a summary was compiled to develop a dimensional scoring table related to the impact of pocket parks in high-density urban areas on alleviating mental fatigue. This table measures the physical and environmental characteristics. Ten indicators were included in this study (Table 1). The statistical reliability and validity of the questionnaire were assessed, with results indicating a Cronbach's α of 0.767. The Cronbach's α values for the three pocket parks were all greater than 0.7, demonstrating a considerable level of reliability. Simultaneously, the KMO value was found to be 0.692, and the data passed the Bartlett sphericity test ($p < 0.001$), indicating both the credibility and effectiveness of the data and suggesting the feasibility of further analysis.

Table 1. Measurements of physical environmental factors.

Factors	No.	Indicators	Explanation	Question	References
Natural	1	Plant colour	The colours presented by plants in pocket parks.	The rich variety of plant colours in pocket parks helps me recover from mental fatigue.	Peng (2018) [43]
	2	Vegetation coverage	The percentage of the ground area covered by the vertical projection of vegetation (including leaves, stems, and branches) within the surveyed area.	The extensive vegetation coverage in pocket parks gives me a sense of pleasure.	Peschardt et al. (2016) [18] Nordh et al. (2009) [17]
	3	Plant species	The variety of plant species present within the pocket park.	(1) When I feel mentally fatigued, I prefer park areas with a greater variety of plant species.	Robinson (2006) [48]
				(2) The richness of plant species in pocket parks helps in my mental fatigue recovery.	
Perceptual	1	Surrounding environmental cleanliness	The cleanliness and hygiene conditions in the surroundings of the pocket park site.	(1) The level of cleanliness in the surrounding area of the park space greatly affects how relaxed I feel while in the park.	Nordh et al. (2013) [49]
				(2) Good cleanliness in the surroundings of the pocket park helps me recover from mental fatigue.	
	2	Spatial privacy	The selective control individuals have over the degree of closeness to the space.	(1) When I feel mentally fatigued, I hope to have some privacy in the pocket park.	Nordh et al. (2013) [49]
				(2) Good privacy in the pocket park helps me recover from mental fatigue.	

Table 1. *Cont.*

Factors	No.	Indicators	Explanation	Question	References
Design	1	Comfort of rest facilities	Whether the rest facilities within the green area, such as benches and sunshades, can provide a comfortable experience.	(1) When I feel mentally fatigued, I am willing to stay longer in an area with comfortable rest facilities.	Pasha et al. (2013) [50]
				(2) The comfort of the rest facilities in pocket parks helps me recover from mental fatigue.	
	2	Orientation of rest facilities	The direction in which the rest facilities in the park are oriented.	(1) I feel uncomfortable when rest facilities face noisy city streets or buildings, affecting my experience of recovering from fatigue.	Peng et al. (2018) [43]
				(2) Facing beautiful scenery or green vegetation, rest facilities help alleviate my mental fatigue.	
	3	Number of activity areas	The areas where people engage in various outdoor activities.	Having sufficient activity spaces is helpful in alleviating my mental fatigue.	Paquet et al. (2013) [51]
	4	Types of recreational fitness facilities	The different types of equipment or facilities available for entertainment and fitness activities within the pocket park.	Having diverse recreational and fitness facilities is helpful in alleviating my mental fatigue.	Paquet et al. (2013) [51]
	5	Quantity of recreational fitness facilities	The total number of recreational and fitness facilities within the pocket park.	Having an ample number of recreational and fitness facilities is helpful in alleviating my mental fatigue.	Paquet et al. (2013) [51]

3. Results

3.1. Psychological Results

3.1.1. Overall PRS

Using a one-way ANOVA, as shown in Table 2, there was a statistically significant difference in the overall perceived restoration among the four groups (F(3,76) = 10.897, $p < 0.001$). Bonferroni post hoc tests revealed that Type I (106.00 ± 17.24, $p < 0.001$), Type II (103.05 ± 13.28, $p < 0.001$, $\eta^2 = 0.30$), and Type III (107.05 ± 17.85, $p < 0.001$) all exhibited significantly higher restoration potentials compared to the control group (79.65 ± 21.04). However, there were no significant differences in the overall perceived restoration among the experimental groups (Figure 3).

Table 2. Measurement analysis of the PRS scale.

Experimental Scenarios	Overall PRS Scores	Subscales			
		Being-Away	Fascination	Compatibility	Extent
	M ± S.D.	M ± S.D.	M ± S.D.	M ± S.D.	M ± S.D.
Control	79.65 ± 21.04	3.48 ± 1.20	3.31 ± 1.34	2.98 ± 1.16	4.90 ± 1.01
Type I	106.00 ± 17.24	4.59 ± 1.26	4.49 ± 1.08	4.31 ± 1.02	6.05 ± 0.78
Type II	103.05 ± 13.28	4.82 ± 0.89	4.4 ± 1.04	4.04 ± 1.14	5.66 ± 0.75
Type III	107.05 ± 17.85	4.65 ± 1.25	4.65 ± 1.15	4.38 ± 1.11	5.92 ± 0.79

Note: The PRS is based on a 7-point scale, with lower values indicating lower levels of restorative experience. N = 20 for each scene.

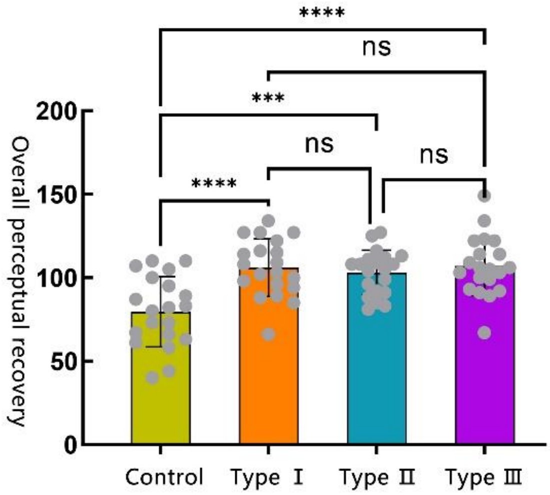


Figure 3. A comparison of the overall perceived restoration after visits to four experimental sites; N = 80; ns: not significant, *** $p < 0.001$, **** $p < 0.0001$; one-way ANOVA test.

3.1.2. Subscale Scores

To further explore the distinct characteristics of urban pocket parks and indoor environments in fatigue recovery, scores on sub-dimensions were subjected to one-way ANOVA based on data meeting the normal distribution and passing the homogeneity of variance tests (Table 2, Figure 4). The results indicate significant statistical differences among the four environments in the dimensions of 'being-away' (F(3,76) = 5.563, $p = 0.002$, partial $\eta^2 = 0.18$), 'fascination' (F(3,76) = 5.585, $p = 0.002$, partial $\eta^2 = 0.181$), 'compatibility' (F(3,76) = 6.837, $p < 0.001$, partial $\eta^2 = 0.213$), and ' extent ' (F(3,76) = 7.509, $p < 0.001$, partial $\eta^2 = 0.228$). The scores for each dimension among the four environmental spaces exhibited consistent trends after pairwise comparisons using the Bonferroni correction. Significant differences were observed among the three pocket park groups and the control group (Table 2). As shown in Table 3, when comparing the mean scores for 'being away' among the three pocket park environments, Type II scored higher than Type I, which scored higher than Type III. For 'fascination' and 'compatibility', Type III was successively higher than Type I and Type II. Regarding 'consistency', Type II was successively higher than Types III and I; however, none showed significant differences.

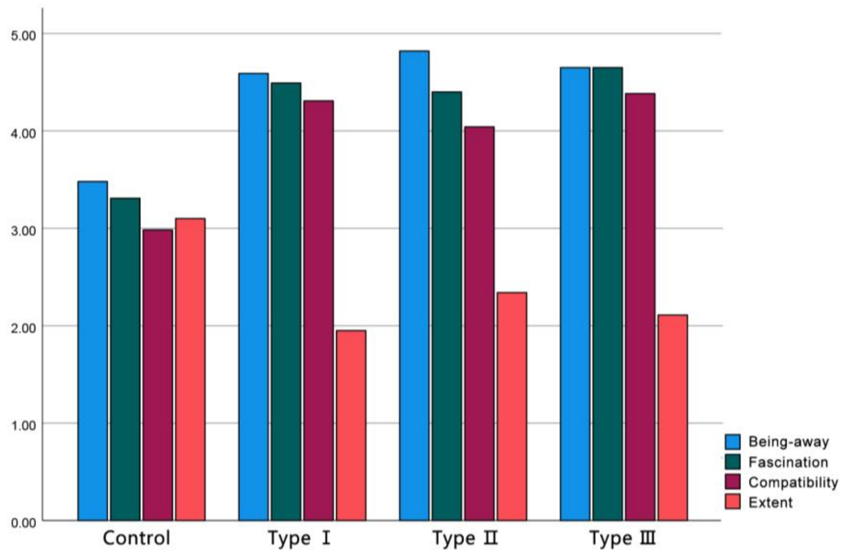


Figure 4. The perceived restoration characteristic levels of four experimental sites.

Table 3. A comparison of PRS subscale scores among different environments.

Scale	**Type**	**Classroom**		**Green Space at Suojinyi Village**		**Green Space on the West Side of Heping Park**		**Ji Qingmen Park**	
		I-J	***p***	**I-J**	***p***	**I-J**	***p***	**I-J**	***p***
Being away	Control	—		−1.110 *	0.020	−1.340 *	0.003	−1.170 *	0.012
	Type I			—		−0.230	1.000	−0.060	1.000
	Type II					—		0.170	1.000
	Type III							—	
Fascination	Control	—		−1.183 *	0.011	−1.092	0.023	−1.342 **	0.003
	Type I			—		0.092	1.000	−0.158	1.000
	Type II					—		−0.250	1.000
	Type III							—	
Compatibility	Control	—		−1.325 **	0.002	−1.058 **	0.020	−1.400 **	0.001
	Type I			—		0.267	1.000	−0.075	1.000
	Type II					—		−0.342	1.000
	Type III							—	
Consistency	Control	—		1.150 ***	0.000	0.760 *	0.030	0.990 **	0.002
	Type I			—		−0.390	0.855	−0.160	1.000
	Type II					—		0.230	1.000
	Type III							—	

Note: For each environment, N = 20. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

3.2. *Physiological Results*

3.2.1. BP

As the sample size of the four experimental groups was less than 30, hypothesis testing was conducted to determine the difference between pre-recovery systolic blood pressure and post-recovery systolic blood pressure. All datasets showed |skewness/skewness standard error| < 1.95, |kurtosis/kurtosis standard error| < 1.95, passing the Shapiro–Wilk normality test ($p = 0.309$). Therefore, a paired-sample *t*-test was performed.

For the control group, the systolic blood pressure before recovery (mmHg) was 129.35 ± 14.87, and after recovery, it was 119.50 ± 12.43. The difference between the two groups and their 95% confidence interval was 9.85 (6.285, 13.415), t = 5.783, $p < 0.01$, d = 1.29, indicating a significant difference in diastolic blood pressure before and after recovery for the control group. The diastolic blood pressure before recovery (mmHg) was 92.10 ± 16.12, and after recovery, it was 83.60 ± 11.39. The difference between the two groups and its 95% confidence interval was 8.50 (2.799, 14.201), t = 3.121, $p = 0.006 < 0.05$, d = 1.29, indicating a significant difference in systolic blood pressure before and after recovery in the control group.

The BP indicators for Types I, II, and III decreased significantly (Table 4): Type I systolic blood pressure (129.10 ± 10.35 and 119.25 ± 8.58, $p < 0.01$, d = 1.67), diastolic blood pressure (93.80 ± 10.78 and 83.90 ± 8.87, $p < 0.01$, d = 1.29); Type II systolic blood pressure (129.80 ± 14.56 and 118.35 ± 10.99, $p < 0.01$, d = 1.47), diastolic blood pressure (89.60 ± 11.44 and 82.65 ± 7.93, $p < 0.01$, d = 1.54); Type III systolic blood pressure (131.45 ± 14.34 and 118.00 ± 9034, $p < 0.01$, d = 1.10), diastolic blood pressure (92.30 ± 13.79 and 79.20 ± 10.37, $p < 0.01$, d = 1.27). As shown in Figure 5, the degree of decrease in systolic and diastolic blood pressures before and after recovery among the three experimental groups showed no significant differences compared with the control group.

Table 4. Changes in diastolic and systolic blood pressure after viewing in different environments.

Indicator	T2	T3	Mean Difference	t	*p*
Control SBP	129.35 ± 14.87	119.50 ± 12.43	9.85 (6.285, 13.415)	5.783	0.000
Control DBP	92.10 ± 16.12	83.60 ± 11.39	8.50 (2.799, 14.201)	3.121	0.006
Type I SBP	129.10 ± 10.35	119.25 ± 8.58	9.85 (7.082, 12.618)	7.448	0.000
Type I DBP	93.80 ± 10.78	83.90 ± 8.87	9.90 (6.297, 13.503)	5.752	0.000
Type II SBP	129.80 ± 14.56	118.35 ± 10.99	11.45 (7.807, 15.093)	6.579	0.000
Type II DBP	89.60 ± 11.44	82.65 ± 7.93	6.95 (3.996, 9.904)	4.924	0.000
Type III SBP	131.45 ± 14.34	118.00 ± 9034	13.45 (9.349, 17.551)	6.864	0.000
Type III DBP	92.30 ± 13.79	79.20 ± 10.37	13.10 (8.263, 17.937)	5.668	0.000

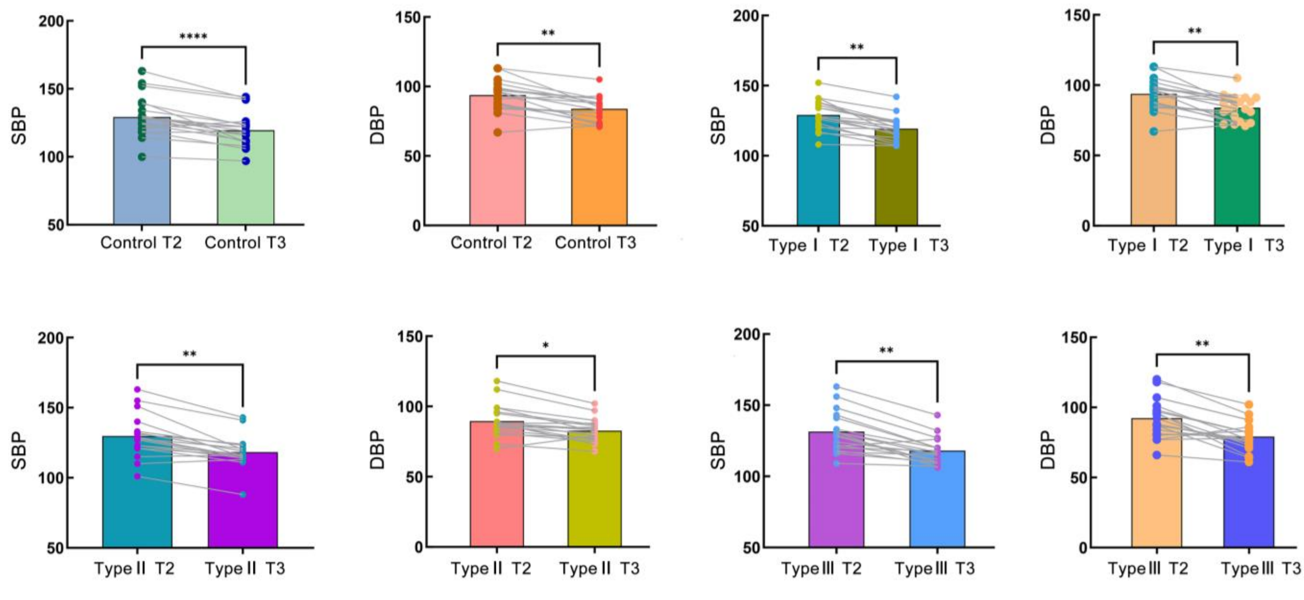


Figure 5. A comparison of blood pressure changes after visiting four experimental locations (T2 vs. T3). * $p < 0.05$; ** $p < 0.01$; **** $p < 0.0001$.

3.2.2. HR

Changes in stress were measured through electrocardiograms, calculating heart rate based on the interval between 'R' waves (R-R interval). A longer R-R interval signifies a lower heart rate, indicating a reduction in stress. Analysis of the electrocardiogram data revealed that, from the stress phase (T2) to the recovery phase (T3), the R-R intervals of all participants increased, signifying a decrease in the heart rate. The impact of time and environment on the heart rate was assessed using a two-way repeated-measures analysis of variance (Table 5). There was no significant interaction between time and environment on heart rate. Analysis of the mean difference in heart rate from the stress (T2) to recovery (T3) phases indicated a greater change in heart rate in the control group than in the experimental group. However, the variance analysis indicated that the effect of the environment on the heart rate was not significant. Time had a significant impact on heart rate ($F(2,152) = 103.79$, $p < 0.001$, partial $\eta^2 = 0.58$). As shown in Table 6, Bonferroni pairwise comparisons revealed significant differences among all pairs in the three periods. The difference in heart rate between T1 and T2 was significant ($p < 0.001$), with a mean difference of −8.275 (95% confidence interval −10.381 to −6.169). The difference in heart rate between T2 and the recovery phase T3 was significant ($p < 0.001$), with a mean difference of 9.725 (95% confidence interval 7.983 to 11.467). The difference in heart rate between T1 and T3 was significant ($p = 0.047$), with a mean difference of 1.450 (95% confidence interval 0.013 to 2.887).

Table 5. The results of the repeated-measures analysis of variance on the length of R-R intervals from the baseline to the recovery phase.

Group	T1	T2	T3	Repeated Measures ANOVA		
	M ± SD	M ± SD	M ± SD	F	*p*	Partial η^2
Control	82.8 ± 9.97	90.95 ± 14.14	81.95 ± 11.59			
Type I	79.4 ± 11.39	88.15 ± 11.88	78.1 ± 9.87			
Type II	83.05 ± 11.7	90.4 ± 11.32	80.35 ± 11.88			
Type III	80.2 ± 9.21	89.05 ± 13.07	79.25 ± 10.23			
Group Main Effect				0.412	0.745	0.016
Time Main Effect				103.79	0.000	0.577
Group × Time				0.229	0.951	0.009

Table 6. The pairwise comparison results of the repeated-measures analysis of variance for heart rate.

Time			I-J	SE	*p*	95% Confidence Interval	
						Upper-Bound	Lower-Bound
T1	vs	T2	−8.275 *	0.86	0.00	−10.38	−6.17
	vs	T3	1.450 *	0.59	0.05	0.01	2.89
T2	vs	T1	8.275 *	0.86	0.00	6.17	10.38
	vs	T3	9.725 *	0.71	0.00	7.98	11.47
T3	vs	T1	−1.450 *	0.59	0.05	−2.89	−0.01
	vs	T2	−9.725 *	0.71	0.00	−11.47	−7.98

* The significance level for I-J is 0.05.

3.2.3. LF/HF

An increase in the LF/HF values indicates a relative increase in sympathetic nervous system activity compared to vagal nerve activity, signifying an increase in mental fatigue. Across all experimental environments, there was an upward trend in the LF/HF values from the baseline (T1) to the stress phase (T2) and a downward trend from the stress phase (T2) to the recovery phase (T3). The two-way repeated-measures analysis of variance was conducted to assess the impact of time-related changes in the experimental environment on the subjects' LF/HF values. Shapiro–Wilk tests confirmed a normal distribution for each group ($p > 0.05$). Mauchly's sphericity test yielded $W = 0.946$, with a significant p-value of 0.123, indicating sphericity. The results indicate a significant main effect for time ($F(2,152) = 53.209$, $p < 0.001$, $\eta^2 = 0.412$), a significant main effect for environment ($F(3,76) = 5.040$, $p = 0.030$, partial $\eta^2 = 0.166$), and a significant interaction effect for time x environment ($F = 2.716$, $p = 0.016$). Subsequently, separate effect tests were performed for the environment and time factors (Table 7).

Table 7. The results of the repeated-measures analysis of variance for LF/HF from the baseline to the recovery phase.

Group	T1	T2	T3	Repeated Measures ANOVA		
	M ± SD	M ± SD	M ± SD	F	p	Partial η^2
Control	1.86 ± 0.40	2.83 ± 0.68	2.68 ± 0.65			
Type I	1.65 ± 0.60	2.42 ± 1.07	1.73 ± 0.44			
Type II	1.62 ± 0.59	2.24 ± 0.79	1.81 ± 0.53			
Type III	1.63 ± 0.47	2.37 ± 0.69	1.86 ± 0.70			
Group Main Effect				5.04	0.003	0.17
Time Main Effect				53.21	<0.001	0.41
Group × Time				2.72	0.016	0.10

The interaction between the environment and time significantly affects LF/HF (F = 2.716, p = 0.016, partial η^2 = 0.097). As shown in Table 8, when the experimental environment was held constant, comparing the effects of time (Table 8). In the control group, there were significant differences between T1 and T2, as well as between T1 and T3 (p < 0.001), while there was no significant difference between T2 and T3 (p = 0.756). In experimental Group I, significant differences were observed between T1 and T2, and between T2 and T3 (p < 0.01). However, there was no significant difference between T1 and T3 (p = 0.932), with a difference of −0.075 (95% confidence interval −0.416 to 0.266). In experimental Group II, significant differences were found between T1 and T2 (p < 0.01) and between T2 and T3 (p = 0.036), whereas there was no significant difference between T1 and T3 (p = 0.457), with a difference of −0.187 (95% confidence interval −0.528 to 0.154). In experimental Group III, significant differences were observed between T1 and T2 (p < 0.01), and between T2 and T3 (p = 0.011), whereas no significant difference was found between T1 and T3 (p = 0.250), with a difference of −0.239 (95% confidence interval −0.579 to 0.102).

Table 8. The simple effect comparisons of environment × time for the repeated-measures analysis of LF/HF—Part 1.

Group	Time	Time	I-J	p	95% Confidence Interval	
					Lower-Bound	Upper-Bound
Control	T1	T2	−0.97 *	0.000	−1.323	−0.621
		T3	−0.82 *	0.000	−1.164	−0.482
	T2	T1	0.97 *	0.000	0.621	1.323
		T3	0.15	0.756	−0.259	0.557
	T3	T1	0.82 *	0.000	0.482	1.164
		T2	−0.15	0.756	−0.557	0.259
Type I	T1	T2	−0.77 *	0.000	−1.118	−0.416
		T3	−0.08	0.932	−0.416	0.266
	T2	T1	0.77 *	0.000	0.416	1.118
		T3	0.69 *	0.000	0.284	1.100
	T3	T1	0.08	0.932	−0.266	0.416
		T2	−0.69 *	0.000	−1.100	−0.284
Type II	T1	T2	−0.62 *	0.000	−0.967	−0.266
		T3	−0.19	0.457	−0.528	0.154
	T2	T1	0.62 *	0.000	0.266	0.967
		T3	0.43 *	0.036	0.022	0.837
	T3	T1	0.19	0.457	−0.154	0.528
		T2	−0.43 *	0.036	−0.837	−0.022
Type III	T1	T2	−0.74 *	0.000	−1.091	−0.389
		T3	−0.24	0.250	−0.579	0.102
	T2	T1	0.74 *	0.000	0.389	1.091
		T3	0.50 *	0.011	0.094	0.909
	T3	T1	0.24	0.250	−0.102	0.579
		T2	−0.50 *	0.011	−0.909	−0.094

* The significance level for I-J is 0.05.

As shown in Table 9, comparing the environmental effects with a time held constant, the comparison between the baseline T1 and stress phase T2 among the four experimental groups did not demonstrate any significant statistical differences, indicating the comparability of the experiment (Table 9). Furthermore, when the recovery phase T3 was held constant, the control group differed significantly from experimental Group I (difference 0.950, $p < 0.01$), Group II (difference 0.871, $p < 0.01$), and Group III (difference 0.813, $p < 0.01$), whereas no significant differences were observed among the three experimental groups. This indicates that recovery from a state of mental fatigue while in an enclosed, non-green indoor space is lower than exposure in informal outdoor green recreational areas.

Table 9. The simple effect comparisons of environment × time for the repeated-measures analysis of LF/HF—Part 2.

Time	Group	Group	I-J	*p*	95% Confidence Interval	
					Lower-Bound	Upper-Bound
T1	Control	Type I	0.20	0.783	−0.245	0.650
		Type II	0.24	0.648	−0.212	0.682
		Type III	0.23	0.674	−0.218	0.676
	Type I	Control	−0.20	0.783	−0.650	0.245
		Type II	0.03	1.000	−0.415	0.480
		Type III	0.03	1.000	−0.421	0.474
	Type II	Control	−0.24	0.648	−0.682	0.212
		Type I	−0.03	1.000	−0.480	0.415
		Type III	−0.01	1.000	−0.453	0.441
	Type III	Control	−0.23	0.674	−0.676	0.218
		Type I	−0.03	1.000	−0.474	0.421
		Type II	0.01	1.000	−0.441	0.453
T2	Control	Type I	0.41	0.537	−0.294	1.109
		Type II	0.59	0.145	−0.111	1.292
		Type III	0.46	0.393	−0.240	1.162
	Type I	Control	−0.41	0.537	−1.109	0.294
		Type II	0.18	0.981	−0.518	0.884
		Type III	0.05	1.000	−0.648	0.755
	Type III	Control	−0.59	0.145	−1.292	0.111
		Type I	−0.18	0.981	−0.884	0.518
		Type III	−0.13	0.997	−0.831	0.572
	Type III	Control	−0.46	0.393	−1.162	0.240
		Type I	−0.05	1.000	−0.755	0.648
		Type II	0.13	0.997	−0.572	0.831
T3	Control	Type I	0.95 *	0.000	0.447	1.454
		Type II	0.87 *	0.000	0.368	1.374
		Type III	0.81 *	0.000	0.310	1.317
	Type I	Control	−0.95 *	0.000	−1.454	−0.447
		Type II	−0.08	0.999	−0.583	0.424
		Type III	−0.14	0.976	−0.640	0.366
	Type III	Control	−0.87 *	0.000	−1.374	−0.368
		Type I	0.08	0.999	−0.424	0.583
		Type III	−0.06	1.000	−0.561	0.446
	Type III	Control	−0.81 *	0.000	−1.317	−0.310
		Type I	0.14	0.976	−0.366	0.640
		Type II	0.06	1.000	−0.446	0.561

* The significance level for I-J is 0.05.

3.3. Construction of a Multiple Regression Model

The multiple linear regression equation aims to identify which physical environmental factors of pocket parks in high-density urban areas have an impact on alleviating mental fatigue. The research team excluded control group data that did not meet the objectives of constructing the multiple linear regression equation. We established a multiple linear regression equation using 60 sets of data from three groups of participants undergoing the recovery process in a small park environment (Table 10).

Table 10. The regression coefficients and significance test.

Parameters	Unstandardized Regression Coefficient		Standardized Regression Coefficient	t	p	Collinearity	
	B	S.E.	Beta			Tolerance	VIF
(Constants)	6.739	0.928		7.264	0.000		
Plant colour	−0.507	0.156	−0.472	−3.261	0.002	0.615	1.627
Vegetation coverage	0.368	0.179	0.298	2.050	0.046	0.610	1.640
Plant species	−0.401	0.128	−0.437	−3.145	0.003	0.668	1.497
Spatial privacy	0.168	0.122	0.198	1.371	0.176	0.617	1.622
Comfort of rest facilities	−0.394	0.174	−0.336	−2.269	0.028	0.587	1.703
Orientation of rest facilities	0.104	0.126	0.106	0.824	0.414	0.780	1.282
Number of activity areas	0.056	0.127	0.073	0.444	0.659	0.470	2.126
Types of recreational fitness facilities	0.106	0.157	0.135	0.676	0.503	0.320	3.122
Quantity of recreational fitness facilities	−0.086	0.170	−0.103	−0.509	0.613	0.311	3.213
Surrounding environmental cleanliness	−0.099	0.164	−0.084	−0.605	0.548	0.670	1.492

Through bivariate correlation analysis (Figure 6), the variance analysis results indicated significance, with an F-test of 2.871 and a significance level of 0.007 < 0.005 ($F = 2.871$, $p = 0.007$). This indicates a significant correlation between the eigenvalues in the model and the restoration effect, allowing the establishment of a linear model. The value of R was 0.608, R^2 was 0.369, and the adjusted R^2 was 0.241. This suggests that the independent variables have meaningful predictive power for the perceived restoration of the dependent variable, explaining 36.9% of the variance. As shown in Table 10, the four independent variables plant colour, vegetation coverage area, comfort of resting facilities, and plant species all had a relatively significant impact on the perceived restoration of the dependent variable. 'Plant colour' has the most predictive power with a p-value of 0.002, followed by 'plant species' with a p-value of 0.003, both less than 0.01. The comfort of resting facilities ($p = 0.028$) and vegetation coverage areas ($p = 0.046$) also exhibited some predictive capability. The regression coefficients were derived from a non-standardised multiple linear regression equation for the perceived restoration of pocket parks in high-density urban areas.

$$y = 6.739 - 0.472x_1 + 0.298x_2 - 0.336x_3 - 0.437x_4 \quad (1)$$

In the equation, 'y' represents the overall perceived restoration result, while 'x_1', 'x_2', 'x_3', and 'x_4', respectively, represent plant colour, vegetation coverage area, comfort of resting facilities, and plant species.

The regression equation indicated that, for every decrease of 0.472 units in plant colour in the pocket park environment, an increase of 0.298 units in the vegetation coverage area, a decrease of 0.336 units in the comfort of resting facilities, and a decrease of 0.437 units in plant species per unit, there was an enhanced restorative effect on mental fatigue.

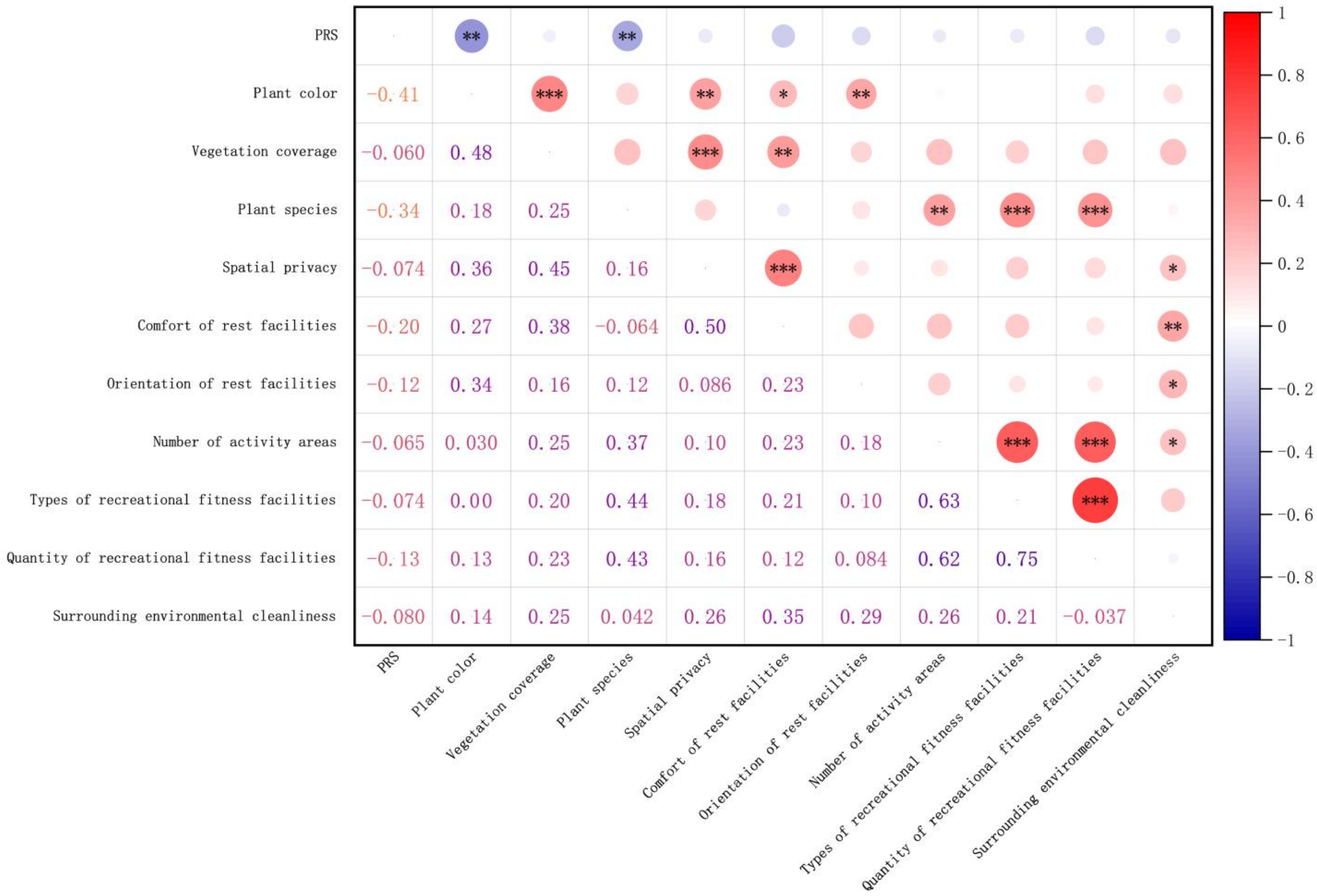


Figure 6. A correlation analysis. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Discussion

4.1. Beneficial Effects of Pocket Parks among Young Adults

This study is among the first studies to focus on the restorative effects of pocket park exposure on mental fatigue in high-density urban areas. Data from the subjects' blood pressure, heart rate variability, and PRS indicate that exposure to pocket parks within high-density urban areas (street corners, cross-blocks, and within blocks) is equally important in the recovery from mental fatigue compared to that in enclosed, non-green indoor environments. This aligns closely with previous studies [23,52,53]. Interestingly, comparisons between the different types of pocket parks showed no significant differences in either physiological or psychological data. This suggests that the effect of the pocket park type on promoting recovery from mental fatigue is relatively similar across the various types.

The significant changes in physiological parameters indicate that exposure to pocket park landscapes provides relief from mental fatigue compared with exposure to indoor spaces. Blood pressure, heart rate, and heart rate variability's LF/HF index showed a rapid alleviation of mental fatigue levels after a 15 min recovery period, suggesting that the recovery time from immediate stress-induced fatigue is less than 15 min. This result was consistent with that of Ulrich et al. [32]. The LF/HF data showed no significant differences between the T1 and T2 stages, indicating comparability between the experimental states. Furthermore, the LF/HF index of the subjects exposed to indoor environments from T2 to T3 did not exhibit significant changes, whereas the index of the subjects in the other three experimental groups showed a significant decreasing trend. Focusing on the recovery stage (T3), the LF/HF index of subjects exposed to enclosed, non-green indoor environments differed significantly from those exposed to pocket parks, whereas there were no significant differences among the various experimental groups within the pocket parks. Additionally, we observed that blood pressure and heart rate mostly decreased to baseline levels at T3, indicating some degree of recovery. However, most LF/HF levels did not recover to T1 levels within 15 min, indicating a relatively unstable state of the autonomic nervous system, where the parasympathetic nervous system remained active. This could be due to multiple factors in the outdoor pocket park environment or the smaller size of the pocket park, which requires more time to regulate the parasympathetic nervous system to achieve a complete physiological balance.

The PRS scoring results indicate that the recovery benefits of indoor environments are lower than those of the other three types of pocket parks. Among the three types of pocket parks, the street-centre pocket park (Type III) has a slightly higher overall PRS score than the cross-block and street-corner pocket parks; however, this difference is not statistically significant. This might be related to fewer disturbances and a quieter atmosphere in the street-centre pocket, suggesting that exposure to pocket parks in high-density urban areas, regardless of the type, has a restorative effect on mental fatigue. However, owing to individual differences, there may be slight variations in the restorative effects across different types.

4.2. Relative Importance of Pocket Park Features in Restoring Mental Fatigue

To explore the relationship between pocket park features and recovery from mental fatigue, we developed dimensional scoring tables for regression analysis. One study discovered that plant colour was the most predictive factor for mental fatigue recovery, followed by plant species, as they contribute to a comfortable environment by improving microclimates [54]. Subsequently, the predictive roles of the comfort of the resting facilities and vegetation coverage were closely followed. All three significantly impactful factors are environmental, suggesting a correlation between the extent of greening and the presence of natural elements during the recovery process [55]. This trend indicates that adequate green vegetation and natural landscapes in natural environments not only provide pleasure but also have profound effects on psychological and physiological recovery. This correlation has been emphasized in various studies [20,56,57]. Additionally, within pocket parks, we found that vegetation coverage was more crucial for mental fatigue recovery than plant colour or species. A higher canopy coverage offers better cooling effects, potentially leading to a more comfortable physiological experience.

However, concerning the restorative impact of design-related and perceptual factors, we found that the comfort of resting facilities within pocket parks did not significantly affect the restoration effect. This might be attributed to the differences between individuals experiencing mental fatigue and those experiencing physical fatigue. Individuals with mental fatigue may not rely heavily on recovery from physical fatigue.

4.3. Limitations and Future Studies

China is currently witnessing a trend of rural population migration to urban areas and is facing challenges related to an ageing population, among other issues. Considering China's extensive ethnic and cultural diversity, this study recruited relatively young participants, which may have some limitations. While this approach contributes to the preliminary assessment of the restorative effects of urban pocket parks on young individuals, focusing solely on the perspectives of young people may not fully reflect the needs and experiences of diverse population groups. Nevertheless, according to a meta-analysis based on previous research, there were no significant differences in environmental assessments between the student and non-student groups [58]. Future studies, following the proposal by Cacioppo et al. in 2000 [59], could involve a more diverse range of samples to confirm the universality of the results of the current study and further explore the differences among different population groups.

Second, owing to insufficient research equipment, certain physiological indicators, such as an electroencephalogram (EEG) and an electromyogram (EMG), could not be obtained. These physiological measures could potentially offer information about cognitive and emotional states such as anxiety levels, relaxation levels, and emotional changes. This study has some limitations in comprehending the restorative effects of high-density urban pocket parks on mental fatigue.

Additionally, the relatively small sample size used in the current study might have resulted in certain factors influencing the recovery effects not being adequately explained in the statistical analysis, thereby masking the potentially small yet significant effects present in real-world settings. Future research should focus on increasing sample sizes [52] and employing more sophisticated statistical analyses to explore the relationship between the influencing factors and recovery effects. This will contribute to a more comprehensive understanding of the role of pocket parks in high-density urban areas and provide a more reliable scientific foundation for urban planning and design.

5. Conclusions

This study expands the existing research on the environmental impact on psychological and physiological recovery. From a methodological perspective, our study combines several research methodologies commonly used in similar studies: physiological feedback devices and questionnaire surveys. The findings indicate that, while there were subtle differences in physiological and psychological measures among different types of pocket parks, they indeed provide an environment conducive to recovery. Furthermore, the factors influencing the restorative effects of pocket parks were quantified. A comparative analysis of various indicators indicated that different characteristic factors may have varying potential impacts on stress alleviation and attentional restoration. We found that natural factors had greater predictive power for recovery from mental fatigue than perceptual and design-related factors. Specifically, it was the vegetation coverage area rather than the plant colour or species or the comfort of recreational facilities that had a more significant impact on restoration.

Overall, as urbanisation increasingly limits the development of large parks and green spaces, smaller alternatives such as pocket parks and informal green areas still hold tremendous potential for providing activity spaces for urban residents. The findings provide a clear cognitive framework that encourages people to pay attention to the health needs of populations in high-density urban areas. These findings provide a reference for future urban green space planning and design in China and other regions with similar characteristics. They contribute to meeting the psychological health service needs of high-density urban populations and enhance the green network of social psychological health services.

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Data Availability Statement: The data presented in this study are available upon request from the corresponding author. The data are not publicly available due to the privacy of the subjects involved.

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