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Research paper

DESIGN FOR RESTORATION: COMPARATIVE ANALYSIS OF TWO OPEN PUBLIC SPACES IN BELGRADE

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Abstract

This paper examines the role of open public urban spaces in supporting users' psychological restoration within dense built environments. The research is based on the concept of restoration in environmental psychology, which refers to the process of "renewing physical, psychological, and social resources that have been depleted through everyday activities". The paper addresses a gap in the existing literature by questioning the methodological bias that arises from assessing restoration in urban spaces through the recurring opposition between "positive natural" and "negative urban" environments.

The paper aims to develop an evaluation matrix for analysing the design characteristics of open public urban spaces, and to test its applicability through a pilot study of two such spaces in Belgrade. The matrix is developed based on theoretical analysis, by combining Bornioli and Subiza-Pérez's theoretical model, structured around three levels of evaluation (containment, passive restoration, and active restoration), with Grave, Neven, and Mohammadi's classification of spatial elements.

The matrix was applied to two public spaces in Belgrade, Cvetni trg (Flower Square) and Park Starine Novaka. Pilot evaluation was conducted through field observation, photo-documentation, and multi-criteria expert evaluation using a 1–5 rating scale. The results indicate that, although the selected spaces are similar in size and position within the urban structure, they contribute to restorativeness at different levels and through different spatial characteristics. Park Starine Novaka shows stronger potential through natural elements of passive restoration, while Cvetni trg contributes more through architectural diversity, historical complexity, and symbolic identity. The paper proposes an evaluation matrix as an analytical tool for researchers and defines practical guidelines for design improvements for the two selected public spaces in Belgrade.

Key words: *Psychological restoration, Public open spaces, Urban design, Evaluation matrix, Belgrade*

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1. INTRODUCTION

Contemporary cities face growing challenges regarding reduced physical activity, higher stress levels, and social isolation. These challenges arise from urbanization, with projections that in 2050, about 68% of all people will live in cities [1]. In this context, the open public spaces of cities are becoming increasingly important as spatial typologies that have the potential to support the everyday public life of all citizens equally.

Concerning these challenges, contemporary literature highlights different concepts, one of which is the new paradigm of "restorative cities". Restorative cities draw on the basic concept of restoration that originated in environmental psychology in the 1980s and 1990s. Restoration refers to the process of restoring physical, psychological, and social resources that are depleted in the performance of everyday activities [2]. In a similar regard, restorative city promotes "the implementation of urban design for mental health and well-being"[3].

Existing restoration theories are based on the assumption that contact with environments that possess certain qualities can help in the recovery of attention fatigue and emotional exhaustion of users [4,5]. Key restoration theories (ART - Attention Restoration Theory, SRT - Stress Reduction Theory) emphasize natural environments and their inherent predisposition for achieving restorative effects.

In recent years, research has increasingly shifted towards restoration in urban environments. Previous studies have highlighted a significant methodological bias arising from comparisons between "positive natural" and "negative urban" environments [6,7,8,9], while others have emphasized the growing need to address these questions in both built and mixed environments [10,11].

Starting from the premise that urban open public spaces should be improved in ways that support restorative effects more effectively, this paper examines how restorative potential can be recognized, analyzed, and enhanced through the spatial and design characteristics of such spaces.

The paper aims to structure an evaluation matrix for analyzing the design characteristics of open public spaces in urban environments, based on the relevant theoretical framework, and to further test it through a pilot application in two open public spaces in Belgrade, Serbia. Research on restoration in the context of Belgrade, Serbia, is particularly relevant, given the high level of development in central city zones, traffic pressure, and the uneven quality of public space. Many of Belgrade's open public spaces are characterized by intensive use, noise, a limited share of greenery, and inconsistent maintenance, and for this reason, the city provides a relevant context for testing criteria related to restorative urban environments.

The research is based on the development of a theoretical framework based on analysis of the existing literature in restorative environments and open public spaces, which is further implemented in the comparative analysis and evaluation of two open public spaces in Belgrade, which will be discussed in the following chapters.

2. THEORETICAL FRAMEWORK

The theoretical framework of the paper is based on the concept of restoration within environmental psychology, as well as on state-of-the-art approaches that extend this concept to built urban environments in the context of design and planning.

2.1. Basic theories

The research in restorative environments has been led by two main theories: Attention Restoration Theory - ART, and the Psycho-Evolutionary Theory of Stress Reduction - SRT [6].

ART positions on the idea that daily activities, decision-making, orientation, and exposure to information require attention, and that long-term use of attention leads to mental fatigue and reduced focus. ART highlights the qualities and values of environments that prompt higher restoration capacities, namely: “being-away” environments that enable "escape" from everyday demands, that possess a degree of fascination, coherence, and compatibility [4]. Recent literature addresses these abstract ideas, translating them into more manageable characteristics of spaces that contribute to their restoration potentials [12,8].

On the other hand, SRT measures users’ emotional and physiological responses to the environmental characteristics. The premise of this theory is that certain environments can contribute to stress reduction through rapid affective reactions and changes in the users’ physiological state [5,13].

Both theories focus on natural environments, but newer research insists on the value of examining the relationship between the built urban environments and nature.

2.2. The spatial shift in focus of research in restoration

With the recent shift in research focus towards urban environments, studies have shown that exposure to positive urban built environments without the presence of nature can lead to affective and/or cognitive benefits [11], but also to neutral or negative effects [14,15,16]. Of particular interest are spaces that enable activities supporting recovery from attention fatigue and stress, with increasing focus on rest and recreation environments, whose improvement can contribute to public health in cities [8].

For this purpose, studies have analyzed spaces such as urban parks, cafes, restaurants, shopping centers [8], squares [17], museums [18], and other historical spaces [19], which have been shown to have restorative potential. The quality of these spaces is examined by measuring their “restorative potential”, which includes factors that reduce stress and support restoration [17].

Studies analyze both positive and negative factors that affect spaces in supportive or hindering ways. The analysis of these factors is highly complex and includes various categories. Grave et al. (2024) [20] propose categorizing the characteristics of spaces with restorative effects in built environments as follows: natural characteristics, such as vegetation and water; landscape characteristics, such as topography, slopes, and

infrastructure; and architectural characteristics, such as openness, refuge, design, and shaping.

In the following chapter, one of the most recent models of restorative research in urban areas is presented.

2.3. Models for studying restorativeness in the built environment

Bornioli and Subiza-Pérez (2023) [6] offer a model for studying restoration in built urban settings. The model they propose consists of three levels, each contributing to the assessment of the restorative value of built space.

The first level is Containment, referring to the basic conditions of space that enable a restorative experience. The purpose of this level is to control or mitigate the negative impacts of the environment and prepare it for further improvements. It implies the absence of stressors (noise, pollution, crowds); perception of safety; compatibility of social landscape and acceptable climatic and thermal conditions.

The second level, called Passive restoration, includes bottom-up features of space, such as green and blue infrastructure, biophilic design, historic elements of the environment, moderate complexity, architectural variation, moderate prospect, and multisensory stimulation. It helps reduce stress, increase positive affect, and restore attention.

The third level, Active restoration, introduces top-down characteristics, such as personal engagement in a cultural-social context, memories of a particular place, attachment to a place, social interaction, sense of community, and belonging. Benefits of these characteristics include stress reduction, attention restoration and stimulation, cognitive engagement, positive affect, and eudaimonic wellbeing.

The paper expands these levels by combining them with systematized environment characteristics and elements that affect restoration potential from Grave et al. (2024)[20]. The combined theoretical insights are formed into a new matrix for assessing and evaluating restorative values of open public spaces in cities, which will be elaborated in the next chapter.

3. METHODOLOGY

The research methodology combines literature analysis, formation of an evaluation matrix, and its pilot application through a comparative analysis of two open public spaces in Belgrade. The research is organized in two phases.

The first phase includes the analysis of existing literature in the field of restorative environments and open public spaces of cities. After establishing the primary theoretical framework (ART and SRT), the study conducts a search and selection of other relevant research papers. The literature search was conducted through keywords and by using the Research Rabbit tool for snowballing and citation. Two significant papers were singled out as the most relevant for establishing the evaluation matrix. The matrix structure draws on Bornioli and Subiza-Pérez's (2023)[6] three levels of restorability (containment, passive restoration, and active restoration), while the subdivision of the passive layer follows Grave, Neven, and Mohammadi's (2024)[20]

classification of natural, landscape, and architectural elements. The reviewed literature served as the basis for developing the evaluation matrix presented in Figure 1.

The second phase of the research involves the pilot application of the evaluation matrix through a comparative analysis of two open public spaces in Belgrade. The case study selection was based on several criteria: (1) both spaces needed to be located in the dense urban fabric of Belgrade; (2) be publicly accessible; (3) have similar surface areas; (4) while also having differences in character and design, with one featuring hard surfaces, and the other more green areas. Cvetni trg and Park Starine Novaka were selected as they meet these conditions while also representing two recurring, contrasting typologies of open public space within the city's traditional urban fabric.

Cvetni trg (Flower Square) represents a predominantly paved, urban, and functionally active public space in Belgrade's Vračar municipality, while Park Starine Novaka (The Park of Starina Novak) offers a more pronounced green character within the dense urban fabric of Palilula.

The analysis was carried out through a single documented site visit per location, combining field observation, photographic documentation, spatial mapping, and multi-criteria expert evaluation. This allowed the scores to be checked against recorded material after the visit. Scores were assigned on a 1-5 scale (1 - criterion absent or severely deficient, 3 - moderate/acceptable, 5 - optimally satisfied) according to pre-defined criteria composed from theoretical analysis, and the same criteria set was applied identically to both cases to ensure comparability. As a single-rater pilot assessment, however, the results remain indicative rather than final, with inter-rater validation planned for future phases. Given that active restoration criteria are contingent on individual users' experiences, their evaluation is deferred to a future phase that employs survey instruments and behavioural observation. This phase assesses the matrix's local applicability, its strengths and limitations, and informs the resulting comparative overview and design guidelines.

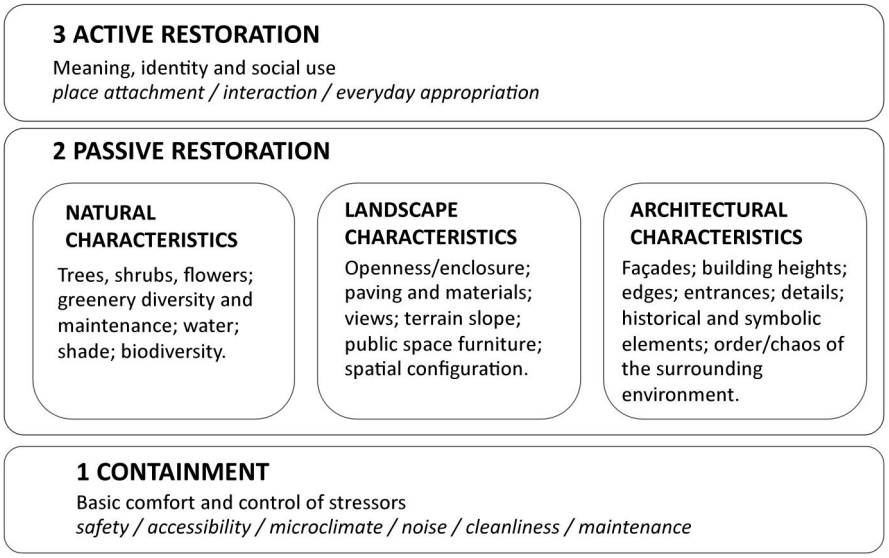


Figure 1. Methodological matrix for assessing restoration in built urban environments, author's illustration, based on Bornioli and Subiza-Pérez (2023) and Grave et al. (2024).

4. PILOT EVALUATION: CASE STUDY OF CVETNI TRG AND PARK STARINE NOVAKA

As outlined in the Methodology, Cvetni trg and Park Starine Novaka were selected as a contrasting pair of comparable size. A paved, symbolic square is set against a greener park, enabling the matrix to be tested across differing spatial characters within Belgrade's dense urban fabric (Figure 2).



Figure 2. Pilot-study locations in Belgrade: A) Cvetni Trg; B) Park Starine Novaka (author's illustrations on photos from https://earth.google.com/web/).

The basic urban parameters emphasize the contrast between the two spaces. Cvetni trg covers approximately 2,830 m², with green areas accounting for only about 0.4% of its total area, while Park Starine Novaka has a comparable area of 2,824 m², but with green spaces comprising 65%. Another difference between the two spaces lies in their urban significance. Cvetni trg is a public space of city-wide importance, located near Slavija, the most prominent roundabout in Serbia, and next to the Yugoslav Drama Theatre. By contrast, Park Starine Novaka has a more local significance, primarily within its immediate urban surroundings. The locations differ in spatial character, functional intensity, and the balance between green and paved surfaces, as shown in Figure 3.



Figure 3. Two pilot-study locations, a) Cvetni trg and b) Park Starine Novaka (author's photographs)

4.1. Containment

At the containment level, the assessment included safety, visibility and accessibility, microclimatic quality, noise acceptability, and the acceptability of maintenance and cleanliness levels (Table 1).

Based on the expert evaluation, Park Starine Novaka achieved a significantly higher average score (3.50) than Cvetni trg (2.75). At Cvetni trg, the main issues identified

were high noise levels, inadequate maintenance of urban equipment, proximity to traffic, and a high share of paved surfaces. Park Starine Novaka shows an adequate level of formal maintenance, while cleanliness remains problematic due to user neglect and littering. Its microclimatic quality is considerably better than that of Cvetni trg.

Table 1. Containment comparative evaluation

	Cvetni trg		Park Starine Novaka	
	score	note	score	note
Safety, visibility, accessibility	4	Good lighting and visibility; medium accessibility	4	Good lighting and visibility; medium accessibility
Microclimate quality	3	High percentage of paved surfaces; proximity to traffic	4	Adequate microclimate quality
Noise level	2	Proximity to traffic and noise	3	Proximity to traffic
Maintenance and cleanliness	2	Medium paving quality; inadequate maintenance	3	Adequate maintenance; poor cleanliness
	2.75		3.50	

4.2. Passive restoration

Passive restoration was assessed through three sets of characteristics. The first set refers to natural characteristics, including vegetation, water features, shade, and biodiversity. Landscape characteristics included the balance between openness and enclosure, the quality of ground surfaces and materials, moderate changes in elevation, and the presence of views. The final set refers to architectural and design characteristics, including moderate building height, moderate diversity of details, the presence of aesthetically pleasing surrounding structures, biophilic materials, historical, symbolic, and other elements, as well as order, coherence, and viewpoints (Table 2).

Table 2. Passive restoration comparative evaluation

	score	Cvetni trg	score	Park Starine Novaka
Natural characteristics	3.33	Limited vegetation; fountain as a water element; low shade, and biodiversity.	4.00	Diverse vegetation and strong shade; water present indirectly; varied planting.
Landscape characteristics	3.75	Mostly open with some enclosure; medium paving quality; elevation differences reduce accessibility; views present.	4.00	Good balance of open and enclosed zones; good material variety; mild elevation differences; some views.
Architectural / design characteristics	4.00	Rich architectural variation, façade details, and symbolic elements; lack of natural materials.	3.25	Weaker architectural and symbolic elements; some biophilic materials; stronger sense of order.
Overall passive restoration potential	3.69	Stronger through architectural and symbolic qualities than through natural elements.	3.75	Stronger through natural and landscape qualities than through architectural articulation.

In the natural elements segment, Cvetni trg was evaluated as being less restorative than its counterpart, due to the lack of quality green elements, shade and biodiversity. The square does feature a water fountain, which supports this segment. Park Starine Novaka scored higher with larger amounts of vegetation, trees, green areas, shade, and biodiversity. In terms of landscape characteristics, Cvetni trg was rated slightly lower than Park Starine Novaka, mostly due to slight inaccessibility from stairs and changes in elevation. Park Starine Novaka has a better balance between more public and more intimate zones, gentler height differences, and greater material diversity. Architectural characteristics show different results. Cvetni trg has stronger potential in this category, led by architectural diversity, façade details, historical elements, and symbolic landmarks. Park Starine Novaka has a less pronounced architectural and symbolic framework.

4.3. Active restoration

Since active restoration is closely related to individual experience in space, this study only identifies relevant assessment criteria within this framework. These could be further examined in future research through survey-based methods. Active restoration would evaluate:

1. opportunities for personal socio-cultural engagement,
2. place attachment,
3. social interaction,
4. and a sense of community and belonging.

Assessing these categories would provide a more complete understanding of the identity, meaning, and individual experiential potential of the examined spaces. This assumption is further supported by initial studies conducted through the course Urban Design: Principles and Methods, within the second year of the Integrated Academic Studies in Architecture at the University of Belgrade, where four generations of students examined the same spaces through on-site observation and evaluation. Within future research, based on these student observations, it may be assumed that Cvetni trg would achieve a higher score at this level, given its more pronounced urban identity, historical and symbolic elements, central location, and stronger role in the social life of the city.

4.4. Synthesis of Comparative Findings and Improvement Guidelines

The comparative evaluation shows that Cvetni trg and Park Starine Novaka achieve restorative potential through different spatial characteristics. Cvetni trg received a lower score at the containment level, primarily due to the strong impact of traffic and noise, the high proportion of paved surfaces, limited shade, and issues related to the maintenance of urban equipment. Its stronger potential is identified in its architectural and symbolic characteristics, including the presence of façades, historical elements, views, and a distinct urban identity.

Park Starine Novaka shows a more balanced restorative profile, with higher scores in containment, natural, and landscape characteristics, supported by greenery, shade,

diverse plant elements, quality ground surfaces, and a better balance between open and enclosed zones. Its limitations relate to a less pronounced architectural and symbolic framework, as well as issues of cleanliness and maintenance.

Based on these results, design guidelines for Cvetni trg should focus on mitigating the impact of traffic, increasing shade, introducing additional green and water elements, and improving accessibility, while preserving the space's urban identity. For Park Starine Novaka, priorities include improving maintenance, more clearly defining entrances, paths, and areas for staying, as well as introducing additional sensory, water-related, and socially activating elements.

CONCLUSION

This paper examined the restorative potential of open public urban spaces through the development and pilot application of an evaluation matrix based on contemporary theories of restorative environments. By combining the levels of containment, passive restoration, and active restoration with natural, landscape, and architectural characteristics, the research proposed a framework for analysing how specific design features may support psychological restoration in dense urban settings.

The pilot evaluation of Cvetni trg and Park Starine Novaka showed that spaces of similar size and position within the city can contribute to restorativeness in different ways. Park Starine Novaka demonstrated stronger potential through greenery, shade, microclimatic comfort, and landscape qualities, while Cvetni trg showed greater value through architectural diversity, historical references, and symbolic identity. This indicates that restorative potential in urban environments cannot be reduced only to the presence of natural elements, but should be understood through the relationship between basic comfort, spatial qualities, and socio-symbolic meaning.

The main contribution of the paper is the proposed evaluation matrix, while its limitation lies in the pilot character of the research. The active restoration level, intentionally left for user-based methods, constitutes the next phase of this research, to be addressed through surveys and behavioural observation. The matrix can also be replicated as an exploratory diagnostic tool in similar dense urban contexts. The pattern observed here, stronger architectural and symbolic qualities compensating for weaker natural elements, and vice versa, is likely to recur in cities with comparable historical urban fabric. However, its extent will depend on local spatial and cultural conditions.

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