

Urban Design for Sustainable Built Environments

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1. Introduction

Within the context of Agenda 2030, the built environment stands at the crossroad of the Sustainable Development Goals (SDGs) [1], as it is a determinant for making green, energy-efficient and zero-pollution buildings and neighbourhoods (SDG3, SDG11, SDG15); boosting the circular economy (SDG8); lowering GHG emissions and contributing to climate change mitigation and adaptation (SDG3, SDG9); protecting biodiversity (SDG15); and creating strong and global partnerships (SDG17). The built environment is also key to the health and well-being of people, and its design is instrumental in achieving high-quality urban environments in response to societal, environmental and economic sustainability challenges like climate change, energy consumption, nature preservation and pollution [2,3]. However, a scrutiny of the literature in sustainability and urban design studies shows that mainstream ‘sustainable’ approaches to the design of the built environment are mainly driven by a digital and technocratic approach applied to the building and neighbourhood scale, which tends to sideline the public realm and the social and natural life which unfolds there [1,4,5]. Furthermore, mainstream ‘sustainable’ approaches are underpinned by theoretical and methodological frameworks with a bias towards cognitivism, thus overlooking the complex and interrelated cognitive, emotional, affective and corporal conditions of human beings [6].

To tackle these challenges, sustainability scholars have developed novel sustainability paradigms, such as the Regenerative Sustainability (RS) and the Sensory Sustainability Science (SSS) frameworks. The RS paradigm, for instance, aims to manifest thriving complex adaptive systems in a fully integrated individual-to-global system and calls for humans to live in conscious alignment with the living system principles of wholeness, change and relationships, as nature does [3]. Another novel approach is represented by the one underpinning the so-called SSS paradigm, which calls for incorporating recent advances in social science, sensory studies and neo-phenomenology related to theories about corporeality, materiality, atmosphere and resonance in sustainability science [6].

However, how are these sustainability paradigms addressed in urban design by scholars and practitioners? What are the implications for theoretical and applied research, practice and developments in sustainability and urban design?

This Special Issue, “Urban Design for Sustainable Built Environment”, scrutinises these open questions through a collection of nine research articles which reflect a paradigm shift towards sustainable urban design practices and studies which privilege people and sustainable development in respect of the planet.

Specifically, these articles address three macro-themes: (a) regenerative streets and green public spaces; (b) emotions, cognition and orientation; and (c) methods and technology, as outlined in the following sections.



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Citation: Vida, J.; Radicchi, A.; Xiao, J. Urban Design for Sustainable Built Environments. *Sustainability* **2023**, *15*, 15493. <https://doi.org/10.3390/su152115493>

Received: 24 October 2023

Accepted: 27 October 2023

Published: 31 October 2023



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2. Regenerative Streets and Green Public Spaces

In the article titled “Regenerative Streets: Pathways towards the Post-Automobile City”, Alberti proposes the notion of the street as a ‘space of potential’ as an alternative regenerative sustainability design model to the still-prevailing car-oriented one, providing an inductive classification of regenerative actions which can be used as a conceptual and operational framework for research and practice in urban design and sustainable mobility.

Through the lens of the SR and SSS paradigms, Herranz-Pascual and colleagues present and discuss the benefits of the ‘NbS-CoBAs tool’ for assessing the psychosocial benefits of nature-based interventions in urban regeneration, which was developed through a co-design process and validated with the Delphi method in the framework of the H2020 CLEVER-Cities project. Specifically, the tool can be used to assess Perceived General Health and Psychosocial Health (and their combination) via seventeen attributes. After testing, it showed validity and potential for its replicability in different contexts.

Szczepańska, Gałęcka-Drozda and Wilkaniec present an original quantitative study about flat prices and accessibility to good-quality greenery in new housing estates in Poznan, Poland. The results show that the price of flats does not necessarily affect the quality of residential greenery. Conversely, and perhaps counterintuitively, even better accessibility to quality green spaces can be found in the cheaper flats of the estates.

3. Emotions, Cognition and Orientation

Although momentary subjective assessment of emotional states towards existing or designed environments is a common tool to evaluate environmental qualities, creative representations and methods to integrate such data with architectural or urban design practices and education remain under-explored. Drawing upon the concept of ‘ambiance empathy’ and an experiential Environmental Impact Assessment method, Piga and her colleagues utilised the City Sense app and Russell’s circumplex model of emotions to facilitate an experiential walk with a group of students in the ‘Città Studi’ district of Milan, Italy. With supplementary lectures and workshops to analyse and reflect on the experience, participants became more aware of the affective states experienced in specific areas and were able to spatialise their responses. The outcome of this project revealed a transferable evidence-based approach to better incorporate citizens’ affective reactions into decision-making for future development projects, facilitating meaningful urban transformation.

In the Legibility Efficacy of Historical Neighborhoods in Creating a Cognitive Map for Citizens, Askarizad, He and Khotbehara investigated the spatial legibility of historical neighbourhoods in Iran and its relationship to creating a sense of belonging and cognitive maps. A three-step process is applied through a questionnaire, space syntax simulation in Depthmap10, and empirical observations, looking at the morphological, spatial and socio-cultural factors. The results suggest that, apart from landmarks, navigation boards and significant monuments that play a role in the visual signs in urban spaces are the most important factors affecting legibility. Findings on the correlations between highly integrated spatial configurations and prominent landmarks could lead to new debates in spatial cognitive theories. The practical insights from this research, such as enhancing spatial permeability to connect urban landmarks in core areas, offer valuable guidance for future conservation and regeneration efforts in historical neighbourhoods which respect their organic spatial layout.

Addressing envelope design-related energy consumption in the context of climate change, Gao and colleagues examined the efficiency of green living walls in moderating the surface temperatures of facades in mild climates through a real-life case study in Manchester, UK. An extra dimension offered in this project is the exploration of the impacts of orientation on the thermal performance of green living walls. The simulation results in Envi-met show a clear drop in temperature during the summer months on the southeast and northwest facades with green living walls. The results for the winter period show minimal differences in increasing façade temperatures on the northwest and a slight increase on the southwest wall. These results provide evidence for future applications of green living walls as an

alternative energy-efficient design element in mild climate regions. The discussion brings attention to future research on the construction detailing of living walls for better thermal performance, including the air cavity, type of plants, thickness and type of substrate.

4. Methods and Technology

Environmental noise has traditionally been one of the main local issues that urban managers must face and solve and is a major concern within cities with important connections with other environmental problems affecting citizens and their quality of life. Specific legal and technical regulations help planners and managers to prevent and reduce unwanted or harmful outdoor noise, but the challenge comes from the need for measurement networks and the manual evaluation of the recordings in support of such regulation. With this in mind, Chilean researchers present a machine learning-based system for the automatic recognition of sound sources in audio files recorded in the built environment: the so-called FuSA system project. The main objective is to assist the analysis of environmental sound sources by means of Deep Learning (DL), a branch of ML focused on training deep artificial neural networks (ANNs), to solve complex pattern-recognition problems. Their paper presents the results after using FuSA tools to analyse the environmental noise recorded in Valdivia, south of Chile, according to current Chilean environmental noise regulations.

Urban renewal has been a key approach to sustainable urban development policies, especially for areas under development, replanning old spaces and areas within city limit expansion. Liang, Várady and Zagorác focus on the dilemma between efficiency and quality in urban renewal, a challenge for which researchers turn to emerging technologies. As low simulation accuracy was found when applying algorithm models based on graph theory, topology and shortest path principles, the authors propose a dynamic pedestrian activity model based on a multi-agent system (MAS) and incorporating visual features to address the problem. Constructing a pedestrian activity model and conducting field recordings of activity information and patterns, the comparison of model simulation results with the recorded pedestrian activity paths showed that the simulation improved accuracy after visibility graph analysis (VGA) was incorporated. Based on the pedestrian activity model, the authors were able to develop a new self-generating model which is useful for urban renewal design. Compared with the traditional empirical design approach, the MAS has higher efficiency, a lower investment cost and a broader range of applications.

Finally, González and colleagues present a very interesting case study that relates noise exposure to people cycling around Montevideo in Uruguay. Noise dosimetry was carried out along the monitoring routes in order to search for healthier places for cycling. To meet the challenge, researchers determined the most important cyclist noise exposure parameters along two routes that are both almost 6 km in length: route no. 1, a closed-circuit characterised by a higher average building height and street aspect ratio than route no. 2, a straight wide boulevard with high traffic flow. The multivariate statistical tests of field data, consisting of 66 noise dosimetries, including principal component analysis (PCA) and clustering, showed that noise exposure is mainly related to the variability in sound pressure levels (SPLs), traffic flow, the number of trucks and the normality or not of the series. Sensorial phenomena were also found to play an important role in the way citizens experience cities beyond the health problems directly associated with noise exposure.

Author Contributions: Conceptualization, J.V., A.R. and J.X.; formal analysis, J.V., A.R. and J.X.; writing—original draft preparation, J.V., A.R. and J.X.; writing—review and editing, J.V., A.R. and J.X. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: We would like to thank all authors for their contributions to this Special Issue and for their high-quality work and effort in the reviewing process of the manuscripts. We would like also to acknowledge the pioneering research work on the Sensory Sustainability Science by Harald Heinrichs which has been inspirational to the conception of this Special Issue.

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

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