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PERCEPTION OF SPACE IN ARCHITECTURE AND URBAN PLANNING

PERCEPCJA PRZESTRZENI W ARCHITEKTURZE I URBANISTYCE

Abstract:

Shaping space is one of the fundamental responsibilities of architects. Issues related to urban planning and architecture have evolved over time. Despite the differences in their circumstances, these designs still allow us to experience specific sensations today, serving as a kind of journey through time. The integration of form, the textures of materials, and the dexterous application of light elevate architecture beyond its mere function as a structural framework, transforming it into a medium of artistic and functional expression. A comprehensive review of extant literature and scientific research reveals a broad array of issues pertaining to environmental perception. The findings of numerous studies support the multisensory nature of experiencing space, as humans perceive it not only through sight. The advent of novel research methodologies has engendered the possibility of a more deliberate and purposeful design of the environment that surrounds us. Consequently, the study of spatial perception should be recognized as a pivotal domain within the broader framework of architectural and urban planning research.

Keywords: *architecture, perception of architecture, space, urban space*

Streszczenie:

Kształtowanie przestrzeni należy do podstawowych zadań architektów. Zagadnienia związane z projektowaniem założeń urbanistycznych, jak i architektury ewoluowały w czasie. Pomimo odmiennych uwarunkowań, projekty te umożliwiają doświadczanie określonych wrażeń także współcześnie, będąc swego rodzaju podróżą w czasie. Forma, faktury materiałów czy umiejętne operowanie światłem sprawiają, że architektura jest czymś więcej, aniżeli obiektem mającym stanowić ramy dla zawartej w niej funkcji. Zarówno literatura przedmiotu, jak i badania naukowe prezentują w szerokim spektrum różnorodne zagadnienia związane z percepcją otoczenia. Wyniki szeregu opracowań potwierdzają wielozmysłowy charakteru doświadczania przestrzeni, gdyż człowiek odbiera ją nie tylko za pomocą wzroku. Rozwój nowych metod badawczych otwiera perspektywę bardziej świadomego projektowania otaczającego nas środowiska. Percepcja przestrzeni powinna być traktowana zatem jako jeden z podstawowych obszarów badań architektonicznych i urbanistycznych.

Słowa kluczowe: *architektura, percepcja architektury, przestrzeń, przestrzeń miejska*

1. INTRODUCTION

Space is the fundamental component of architecture and urban planning, and concurrently, it is one of the most significant factors determining the quality of human life. While its definition is rooted in its physical components, its true significance is only revealed through

its utilization and the user's experience of it. Architecture must be regarded not as a mere aggregation of objects characterized by specific technical parameters, but rather as a complex system of relationships between form, function, context, and the user's perception. Contemporary research indicates that the way space is perceived exerts an influence not only on a person's orientation within the environment, but also on their well-being, social behavior, stress levels, and sense of connection to a place.

The issue of spatial perception is a matter of concern for many academic disciplines, including architecture, urban planning, environmental psychology, urban sociology, history, and geography. The interdisciplinary character of this research stems from the understanding that the perception of space is a multidimensional process involving sensory responses as well as cognitive, emotional, and cultural mechanisms. The perception of space is not solely determined by its geometric parameters – it is also influenced by a person's prior experiences, memories, expectations, and social conditioning. This phenomenon is associated with ongoing processes of urbanization, the densification of urban structures, and the digitization of social life. Considering these changes, it is becoming increasingly important to design environments that meet not only functional and economic requirements but also people's psychological needs.

The purpose of this article is twofold: first, to provide a comprehensive analysis of the mechanisms through which architectural and urban space is perceived, and second, to identify the most salient factors that influence people's perception of their surroundings. A particular focus of this study is the relationship between the physical characteristics of space and the cognitive processes occurring in its users. The analysis was qualitative in nature and focused on identifying major research trends, the relationships between the characteristics of the built environment and user experiences, and contemporary directions in research. The method employed in this study enabled a synthetic presentation of the current state of knowledge and the formulation of conclusions relevant to both the theory of architecture and urban planning and to design practice.

2. THEORETICAL FOUNDATIONS OF SPATIAL PERCEPTION

Spatial perception is a foundational process that enables humans to function in their environment. From a psychological perspective, it is defined as the process of organizing and interpreting sensory information received from the environment. In the context of architecture, it refers to the way an individual recognizes, interprets, and evaluates a man-made environment.

Scientific efforts to explain the mechanisms of spatial perception emerged alongside the development of personality psychology in the early 20th century. Individuals perceive their environment as a unified entity, rather than as a collection of discrete components. This suggests that the perception of a building or urban space does not result solely from the analysis of individual components, but rather from the relationships between these components. The principles of similarity, proximity, and continuity play a significant role in the process of interpreting spatial arrangements. The field of phenomenology also exerted a substantial influence on the evolution of perception theory in the domain of architecture. Its proponents have drawn attention to the subjective nature of the experience

of space, emphasizing the importance of experiences, emotions, and memory. Christian Norberg-Schulz[1] has noted that every space possesses its own genius loci, or "spirit" of the place, arising from the relationship between landscape, culture, and history. According to this concept, the role of architecture is to fortify the sense of place and facilitate the establishment of a community within that locale. From this perspective, the analysis of space must extend beyond a geometric arrangement, as its perception is contingent on its capacity to engender a sense of belonging and identification with the place. Juhani Pallasmaa[2] adopted a comparable position, expressing criticism of the preeminence of sight in contemporary design. According to the Finnish architect, the experience of space is multisensory. The perception of architecture encompasses not only the visual observation of form, but also the auditory, olfactory, tactile, and visual elements of materials and the dynamic interplay of light. This approach engenders the perception of architecture as an environment that engages the entire body. This perspective is currently corroborated by research in neurocognition[3], which underscores the significance of integrating diverse sensory stimuli in the perceptual process.

In the domain of urban planning, Kevin Lynch's[4] seminal research on mental images of the city holds particular significance. He proposed that specific characteristics of spatial structure may exert a pervasive influence on the legibility of urban environments. According to this concept, the appropriate design of paths, boundaries, neighborhoods, nodes, and landmarks facilitates the formation of mental images of space, regardless of individual differences among users. The author demonstrated that residents create simplified mental models of urban space that enable them to orient themselves and navigate. This approach laid the foundation for a significant corpus of subsequent research on spatial orientation. It can be seen, in a sense, as a return to patterns that were utilized not only in antiquity but also in the Renaissance layouts of so-called "ideal cities." Therefore, the legibility of a city's spatial structure is contingent upon the presence of distinctive landmarks, transportation axes, boundaries, and nodal spaces[5].

Jan Gehl[6], an esteemed authority in the field of urban studies, particularly in the context of public space utilization, has shared an insightful perspective that has garnered significant interest. In contrast to numerous theorists who prioritize an analysis of spatial forms, Gehl's research is centered on the activities of individuals within these spaces. The methodology employed enables an assessment of the quality of space, predicated on the observation of social behavior, the duration of user presence, and the intensity of interpersonal interactions. From the perspective of contemporary urban planning, this is significant because it allows for the evaluation of space based on its actual functionality.

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[1] Ch. Norberg-Schulz, *Genius Loci: Towards a Phenomenology of Architecture*, Rizzoli, New York 1980, pp 50–69.

[2] J. Pallasmaa, *The Eyes of the Skin: Architecture and the Senses*, (3rd ed.), John Wiley & Sons, Chichester 2012, pp. 41–72.

[3] N. Ávila et al., *Neuroscience-Informed Approaches in Architectural Design: A Systematic Review of Cognitive Measures and Interactive Technologies from an HCI Perspective*, "Frontiers in Computer Science" 2026, no 8, art. 1819538.

[4] K. Lynch, *The Image of the City*, MIT Press, Cambridge, MA 1960, pp. 46–117.

[5] J. Jacobs., *The Death and Life of Great American Cities*, Random House, New York 1961, pp. 29–73, 372–391.

[6] J. Gehl, *Cities for People*, Island Press, Washington, DC 2010, pp. 3–29, 33–54, 62–211.

Contemporary research[7] [8] expands on these concepts, emphasizing the importance of the neurological processes responsible for the perception of the environment. Advancements in neuroimaging[9] methodologies have enabled the analysis of brain activity during exposure to diverse forms of spatial environments. The capacity to quantify cerebral activity unveils novel research prospects while concomitantly engendering inquiries into the interpretation of the outcomes obtained. Critics emphasize that neurological responses do not fully explain the complexity of spatial experience and cannot replace social, cultural, or phenomenological analyses. Research findings suggest that specific spatial configurations can elicit measurable emotional and physiological responses, affecting stress levels, feelings of safety, or the ability to concentrate.

3. ARCHITECTURE AS A MULTISENSORY EXPERIENCE

For centuries, the discipline of architecture was viewed as the art of shaping visual form. The utmost significance was ascribed to the dimensions, configuration, and visual appeal of edifices. However, contemporary research suggests that this approach is inadequate for comprehending the intricate relationship between humans and their environment. As previously mentioned, the experience of space is multisensory in nature. The human perception of space is influenced by sensory input from all channels, which collectively provide information that contributes to the subjective assessment of spatial quality. Therefore, architecture cannot be considered as a static entity, but rather as a dynamic environment experienced as one moves through it.

The role of light in architectural perception is of particular significance, as it can be regarded as the fundamental element influencing the visual experience of architecture. The quality and quantity of natural lighting is subject to constant changes related to the time of day, weather conditions, and the season. Consequently, architectural space is never perceived in the same way. The texture of the material used exerts a direct influence on the appearance of a surface, contingent on the direction of the light. The thermal properties of materials also influence how space is perceived. The use of natural materials, such as wood or stone, often fosters a sense of authenticity and intimacy. Conversely, industrial surfaces can contribute to a perception of anonymity. Furthermore, the use of materials at varying scales within a single building can produce distinctly different impressions. In such cases, the role of different acoustic properties cannot be overlooked. The acoustic characteristics of space have been demonstrated to influence users' comfort and their interpretation of the environment. A variety of structures exist that possess disparate acoustic properties, which influence the emotional reception of individuals within these environments. Examples of such structures include places of worship, train station concourses, and city squares.

When understood from this perspective, the multisensory nature of architecture suggests that the perception of space is the result of a complex interaction between the physical

[7] J.L. Nasar, *The Evaluative Image of the City*, Sage Publications, Thousand Oaks, CA 1998, pp. 21–24.

[8] C. Peng et al., *City Landscape in Sight: A Crowdsourced Framework for Unlocking Urban-Scale Window View Perceptions from Real Estate Imagery*, "Landscape and Urban Planning" 2026, no 275, art. 105734.

[9] J. Zeisel, *Inquiry by Design: Environment/Behavior/Neuroscience in Architecture, Interiors, Landscape, and Planning*, W.W. Norton, New York 2006, pp. 141–156, 191–256, 355–380.

environment and the human body. Consequently, design should encompass not only formal aspects but also the comprehensive spectrum of the user's experience.

Composition is a critical factor in defining spatial experiences. In the disciplines of architecture and urban planning, this concept refers to the organization of spatial elements and the relationships between them. Composition is not confined exclusively to aesthetic dimensions; rather, it functions as a medium for organizing the environment in a manner that facilitates intuitive interpretation by users. The human body exhibits a natural inclination to seek order in its environment. In the process of perception, the human mind endeavors to identify patterns, axes, dominant features, and repetitive structures. Consequently, spaces exhibiting a clear composition are widely regarded as more user-friendly and more easily navigable. In this section, the principles of urban composition that have been applied in city planning for centuries must be highlighted. The dimensions of space are of equal significance. The relationship between building heights and street widths, the dimensions of squares, and the distances between buildings has been demonstrated to influence users' sense of comfort. Spaces characterized by human-scale proportions have been demonstrated to foster social interaction and strengthen a sense of belonging to a place. Conversely, excessively vast spaces have been shown to evoke a sense of disorientation, anonymity, or a lack of control over one's surroundings. The sequence of sensory experiences is also of significance. As observers move through space, they perceive successive fragments of the environment, which collectively construct a unique narrative. The design of visual sequences, the gradual revelation of spatial openings, and the incorporation of elements of surprise have been demonstrated to facilitate the creation of more nuanced perceptual experiences. This approach is characteristic of both historic urban complexes and contemporary projects based on the concept of user experience. A substantial body of research findings suggest that environments which exhibit a harmonious balance between clear organization and an optimal level of complexity and diversity tend to elicit the most favorable perceptions.

Urban space constitutes a distinctive perceptual environment, distinguished by its complexity and the intensity of its stimuli. In contrast to the concept of a solitary architectural object, urban space is characterized by a complex network of spatial, functional, and social relationships. The perception of this phenomenon is influenced by the physical characteristics of the environment and the activities and experiences of its users. It has been demonstrated that areas which combine residential, service, recreational, and cultural functions are, as a general rule, perceived as more attractive than those which serve but a single function. The presence of diversity fosters social interaction, thereby encouraging individuals to congregate and enhancing the sense of security derived from the constant presence of other users. A compelling area of research pertains to public spaces, including squares, pedestrian zones, parks, and boulevards. These spaces provide a foundation for social interaction and are recognized as a primary indicator of the quality of the urban environment. Similar conclusions can be drawn from William Whyte's work.[10]

Furthermore, Jan Gehl[11] emphasizes the necessity of evaluating the quality of public space from the perspective of a pedestrian. Spaces designed on a car-scale frequently diminish their social and perceptual value. Conversely, urban spaces that facilitate observation of

[10] W.H. Whyte, *The Social Life of Small Urban Spaces*, Conservation Foundation, Washington, DC 1980, pp. 17–23, 54–59, 90–101.

[11] J. Gehl, *op. cit.*

fellow users, rest, and impromptu interactions have been shown to foster social cohesion and augment the appeal of a city. Adequate lighting, optimal visibility, the presence of other individuals, and a well-designed spatial layout are all contributing factors to a positive assessment of a given location. It has been demonstrated that spaces that have been neglected, poorly maintained, or socially isolated are often perceived as less safe, regardless of the actual crime statistics for the area. This phenomenon can be attributed to the fact that, from the perspective of users, safety is not solely determined by the actual level of threat but is also influenced by the characteristics of space.

In contemporary urban settings, a salient issue pertains to the phenomenon of perceptual overload. An excess of advertisements, visual information, noise, and heavy traffic can lead to cognitive fatigue among users. Therefore, it is imperative to design an environment that achieves a balance between diversity and clarity.

Natural elements play an important role in shaping the environment. Additionally, studies have shown that these natural elements can also enhance the psychophysical well-being of individuals who utilize it. Among the most significant theoretical frameworks elucidating the importance of nature is the concept of biophilia, as proposed by Edward O. Wilson[12]. The theory posits the existence of a biologically determined human need for contact with nature. According to this theory, environments containing natural elements are perceived as more welcoming and conducive to mental regeneration. A body of research in environmental psychology[13] [14] indicates that the presence of greenery has the potential to reduce stress levels, enhance concentration, and augment satisfaction with the use of a given space. These effects have been observed in both large urban parks and small green spaces integrated into the urban fabric. Natural elements also serve compositional and symbolic functions. This phenomenon is particularly evident in historic cities, where the relationship between the natural landscape and the urban fabric has been shaped over centuries. Blue-green infrastructure, which integrates ecological, social, and aesthetic functions, is also gaining importance. The contemporary approach to urban planning is predicated on the notion that natural elements should be regarded as integral components that influence how the city is perceived and used.

4. NEUROARCHITECTURE AND CONTEMPORARY METHODS FOR STUDYING SPATIAL PERCEPTION

Advancements in research technology have precipitated the development of novel methodologies for analyzing the relationship between individuals and the built environment. The interdisciplinary field of neuroarchitecture[15], which integrates elements of architecture, cognitive psychology, and neuroscience, is undergoing rapid development. The foundational principle of neuroarchitecture is the notion that spatial dimensions elicit quantifiable neurological responses that exert a discernible influence on users' behavior, emotions, and cognitive

[12] E.O. Wilson, *Biophilia*, Harvard University Press, Cambridge, MA 1984, pp. 103–118.

[13] S.-H. Hung, C.-Y. Chang, *Designing for Harmony in Urban Green Space: Linking the Concepts of Biophilic Design, Environmental Qi, Restorative Environment, and Landscape Preference*, "Journal of Environmental Psychology" 2024, no 96, art. 102294.

[14] L. Steg, J. De Groot (eds.), *Environmental Psychology: An Introduction* (2nd ed.), Wiley, Hoboken, NJ 2018, pp. 55–75, 104–122.

[15] Ch. Metzger, *Neuroarchitecture*, Jovis Verlag, Berlin 2018, pp. 12–60.

processes. A substantial body of research[16] has indicated that environments characterized by an adequate amount of natural light, the presence of greenery, and a clear spatial organization have the potential to reduce stress and improve concentration. Conversely, spatial environments characterized by disorder, challenging orientation, or excessive monotony have been shown to induce cognitive overload, thereby compromising psychological well-being.

Furthermore, virtual and augmented reality technologies are undergoing constant development and refinement. Users can experience virtual models of buildings and public spaces, and researchers can observe behaviors and emotional reactions under controlled conditions during experiments. One of the research tools employed is eye-tracking technology, which captures and analyzes participants' eye movements to identify elements that attract their attention and assess the legibility of an architectural composition. Contemporary research on spatial perception is increasingly integrating qualitative and quantitative data to create a comprehensive picture of the user experience.

5. IMPLICATIONS OF RESEARCH ON SPATIAL PERCEPTION FOR CONTEMPORARY ARCHITECTURAL AND URBAN PLANNING PRACTICE

A comprehensive review of extant theories and contemporary research findings on the perception of space clearly indicates that the relationships between people and their surroundings are far more complex than traditional design models assume. Contemporary architecture is increasingly moving away from viewing a building as an autonomous object toward understanding it as an element of the user's experiential system. In this context, it is also pertinent to refer to the design principles that were employed during the medieval and ancient periods. These principles presuppose that, depending on a structure's function, it also must convey a certain symbolic meaning, a concept particularly evident in structures related to religious worship or buildings inhabited by the most important figures in the state.

One of the most significant conclusions that emerges from an examination of spatial perception is the imperative to incorporate the user's perspective into all phases of the design process. Contemporary architectural literature repeatedly encourages, as it were, a return to adapting space to the human scale. In practice, this entails a shift from design based exclusively on functional, technological, or economic factors, to one that incorporates considerations related to environmental psychology, ergonomics, and spatial experience into the decision-making process. Pedestrian-centered designs have been shown to receive higher ratings from users than those designs that prioritize vehicular traffic. The appropriate proportions of streets, squares, and buildings have been demonstrated to influence the sense of comfort and safety, as well as the formation of social bonds.

In the context of advancing globalization and the standardization of space, the preservation of the local characteristics of the cultural landscape is of particular significance. In the context of urban development, the absence of distinctive character in cities and buildings can impede residents' sense of connection to their environment. In this context, a significant task

[16] S. Lee, W. Shin, E.J. Park, *Implications of Neuroarchitecture for the Experience of the Built Environment: A Scoping Review*, "Archnet-IJAR: International Journal of Architectural Research" 2022, no 16(2), pp. 225–244.

for architecture is to reinforce local distinctiveness through the conscious use of materials, spatial forms, historical urban layouts, and landscape elements. Preserving and creating unique architectural details is of great importance, as they have lost their original significance due to the standardization.

Concurrent with this phenomenon is the occurrence of significant transformations in the domain of architectural design, particularly in the context of climate change and the accelerating processes of urbanization. Recent studies have demonstrated that exposure to natural environments is a significant factor in the formation of a positive perception of space. Urban green spaces have evolved beyond their initial aesthetic and recreational functions, becoming essential components of a healthy living environment. The integration of green spaces with the built environment, including the creation of pocket parks, green roofs, and ecological corridors – contributes both to improved climatic conditions and to making these spaces more attractive to residents. In many of the most developed urban centers, there are ongoing efforts to restore the natural environment to its pre-economic-development state.

Virtual reality, parametric modeling, and advanced behavioral analysis are tools that facilitate a more comprehensive assessment of the quality of designed environments prior to implementation. This represents a transition from an intuitive design approach to a methodology informed by empirical data. Consequently, architects and urban planners are equipped to anticipate potential user reactions and identify solutions that enhance the quality of the built environment. It is important to acknowledge, however, that despite advancements in technology, the perception of space remains a subjective phenomenon to a certain extent. Each user interprets the environment through the lens of their own experiences, age, cultural background, and social circumstances. Conversely, the designer's role entails the creation of an environment that offers a variety of experiences and caters to the diverse needs of a wide range of users. Consequently, contemporary research on the perception of space is prompting a redefinition of the role of architecture and urban planning. These disciplines are increasingly regarded not only as instruments for the practical organization of the environment, but also as competencies that facilitate an influence on human health, well-being, social conduct, and quality of life. Consequently, design is evolving into a method for shaping spatial experiences, with the user as the central focus.

6. CONCLUSION

The analysis conducted indicates that the perception of space constitutes a pivotal concern in the domain of contemporary architecture and urban planning. The manner in which individuals perceive their environment exerts a significant influence on various aspects of their well-being, including their spatial orientation, emotional state, level of social engagement, sense of security, and overall quality of life. A comprehensive review of the extant literature and research findings reveals that the perception of space is a multidimensional process shaped by the interplay of physical, psychological, social, and cultural factors. Consequently, architectural space does not have a single, objective meaning but is interpreted in many ways by different groups of users.

The multisensory nature of architectural experience suggests that architectural design should take into account the full spectrum of sensory experiences, rather than being limited solely to visual aspects. The integration of contemporary technologies, neurophysiological

assessments, and components of neuroarchitecture allows for a deeper understanding of users' responses to particular attributes of spatial environments.

Consequently, the study of spatial perception should be recognized as a pivotal domain within the broader framework of architectural and urban planning research. The expansion of our understanding of how users perceive their environment is instrumental in the creation of spaces that are more functional, aesthetic, sustainable, and people-friendly.

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