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FROM THE PROTECTION OF MATTER TO THE PROTECTION OF EXPERIENCE: NEUROARCHITECTURE, EDUCATION, AND ARCHITECTURAL HERITAGE

OD OCHRONY MATERII DO OCHRONY DOŚWIADCZENIA: NEUROARCHITEKTURA, EDUKACJA I DZIEDZICTWO ARCHITEKTONICZNE

A b s t r a c t

Architecture is a multisensory experience. Contemporary research confirms what has formed part of human intuition for centuries: space affects people not only through its material form. This perspective also opens up a new approach to heritage conservation and spatial education, in which the focus extends beyond material substance to include the experience that constitutes the genius loci of a given place. The aim of this article is to determine the role of spatial education and digital technologies in identifying, documenting, and interpreting these values. An analysis of the literature and doctrinal documents was conducted. The result is a proposal to introduce a spatial perception chart and to reinforce the principle of prioritising in situ experience.

Keywords: *architectural heritage, genius loci, immersive technologies, neuroarchitecture, spatial education*

S t r e s z c z e n i e

Architektura jest doświadczeniem wielozmysłowym. Współczesne badania potwierdzają to, co od wieków stanowiło część ludzkiej intuicji – przestrzeń oddziałuje na człowieka nie tylko poprzez jej materialną formę. Perspektywa ta otwiera również nowe spojrzenie na ochronę dziedzictwa i edukację przestrzenną – przedmiotem zainteresowania staje się nie tylko materialna substancja, ale także doświadczenie składające się na *genius loci* danego miejsca. Celem artykułu jest określenie roli edukacji przestrzennej oraz technologii cyfrowych w rozpoznawaniu, dokumentowaniu i interpretowaniu tych wartości. Zastosowano analizę literatury oraz dokumentów doktrynalnych. Wynikiem jest propozycja wprowadzenia karty percepcji przestrzeni oraz wzmocnienie zasady pierwszeństwa doświadczenia *in situ*.

Słowa kluczowe: *dziedzictwo architektoniczne, edukacja przestrzenna, genius loci, neuroarchitektura, technologie immersyjne*

1. INTRODUCTION – PRESERVING EXPERIENCE

The contemporary state of research on the perception of architectural space is developing around interrelated issues: multisensory perception, experience, the interpretation of meanings, and the authenticity of contact with place. Research is shifting the focus from understanding architecture as form to analysing the relationships between the body, movement, the senses, and the environment, while taking into account the multisensory character of space[1]. The term "neuroarchitecture," which is appearing with increasing frequency in the literature, points to a growing interest in the influence of space on human behaviour and mental condition, which is gradually being reflected in design practice[2].

The protection of architectural heritage in Poland focuses primarily on the material substance of a building. Despite the expansion of contemporary conservation theory to include intangible values, practical documentation continues to be dominated by data concerning the physical parameters of buildings – the authenticity of construction materials, structural systems, building techniques, and architectural details. Protection also extends to the form, composition, historical layers and spatial arrangement of a building, while the manner in which these were perceived by users in motion is analysed less frequently[3]. This approach is fully justified, yet it does not exhaust the meaning of the genius loci of a given place – a multisensory experience of space encountered at a particular time, heard, touched, and perceived through its temperature and characteristic smell, in connection with the individual user's accumulated experience, knowledge, or physical condition. In the case of a building, then, does heritage reside in the material substance itself, or also in the experience associated with it[4]?

This article assumes that the value of architectural heritage arises both from the material durability of the building and from the possibilities of interpreting it through sensory experience, memory, and culture. The transition from protecting the building fabric to protecting the experience associated with it does not imply abandoning existing conservation practices or questioning their purpose and validity. Rather, it constitutes an attempt to expand the protection of architectural heritage to include the relationships between space, the body, the senses, memory, and culture. Spatial education, together with modern digital technologies, may become a link between conservation knowledge and practice and users' experience. The spatial perception chart proposed in this article constitutes the missing element supporting this process.

This approach is consistent with the 2003 UNESCO Convention, in which Article 2(1) defines intangible cultural heritage as practices, representations, expressions, knowledge, and skills, together with the instruments, objects, artefacts, and cultural spaces associated with them[5], as well as with the Nara Document, which broadened the understanding of the authenticity of a historic building by indicating that it may relate not only to form and substance, but

[1] J. Pallasmaa, *The Eyes of the Skin: Architecture and the Senses*, Wiley–Academy, Chichester 2005.

[2] A. Coburn, O. Vartanian, A. Chatterjee, *Buildings, Beauty, and the Brain: A Neuroscience of Architectural Experience*, "J. Cogn. Neurosci." 2017, no. 29(9), pp. 1521–1531.

[3] An example of the subordination of historical narrative to contemporary organisational requirements is the practice of beginning a tour of a historic palace in an outbuilding, due to the greater ease of managing visitor traffic there, including the location of the ticket office, cloakroom, and toilets (the Palace in Śmiełów, Greater Poland).

[4] L. Smith, *The Discourse of Heritage*, [in:] L. Smith, *Uses of Heritage*, Routledge, London 2006, pp. 11–43.

[5] UNESCO, *2003 Convention for the Safeguarding of the Intangible Cultural Heritage. Media kit*, p. 2, https://ich.unesco.org/en/convention#part3 (access: 1.06.2026).

also to function, traditions, techniques, location, "spirit and feeling," and other internal and external factors[6]. Both documents draw attention to the fact that heritage value is not always exclusively material in nature, but is often associated with emotions, memory, and experiences transmitted between generations, encompassing both individual memories and collective rituals, patterns of spatial use, and the meaning of space. Thus, just as it is possible to interpret the historical layers of material building fabric, it is also possible, using the author's own metaphor, to describe the historical layers of experiences associated with a given place.

2. FROM THE ASSESSMENT OF MATERIAL SUBSTANCE TO MULTISENSORY EXPERIENCE: ARCHITECTURE AS MOVEMENT AND SEQUENCE

The experience of architecture is simultaneously multisensory, material, and extended over time, while its perception emerges through movement and the user's interpretation. The representation of a building is therefore necessarily reductive: it may describe a given space, but it cannot replace the experience of it. Yet, to refer to the classics, Le Corbusier, in developing the concept of the promenade architecturale, already drew attention to the experience of architecture through movement, while Kazimierz Wejchert constructed his curve of impressions on the basis of the changing perception of space along a particular street traversed by an observer over a specified period of time. Without diminishing the importance of sight in the perception of space, it is worth emphasising its interaction with the other senses, proprioception, and movement. Sensory impressions are further accompanied by memory, associations, culture, and the user's existing knowledge, as well as their height, weight, psychophysical condition, and health[7]. Experience is never pure or free from prior influences, and the perception of space is not merely the analysis of an image or a physiological or emotional response, but the sum of all the user's past experiences[8].

For many years, architects have sought to place users within predefined frameworks. Today, the importance of differentiation is being emphasised with increasing clarity. After many years of striving for standardisation in design, numerous approaches have emerged that point to the need to account for the differences and diversity of users. Universal design and inclusive design broaden this perspective by indicating that the diversity of patterns of use cannot be reduced to a single set of dimensions.

3. SPATIAL EDUCATION AS A TOOL FOR BROADENING HERITAGE PROTECTION

Spatial education includes, among other things, developing the ability to experience space consciously, recognise its influence on users' behaviour, interpret meanings, and assess the

[6] ICOMOS, *The Nara Document on Authenticity*, 1994, pt. 13, p. 2.

[7] A. Jelić et al., *The Enactive Approach to Architectural Experience: A Neurophysiological Perspective on Embodiment, Motivation, and Affordances*, "Frontiers in Psychology" 2016, no. 7, art. 481.

[8] P. Haupt et al., *Investigating the influence of cultural conditions on the perception of visual aspects of architectural interiors*, "Technical Transactions" 2024, no. 121(1), pp. 1–13, https://doi.org/10.37705/TechTrans/e2024013 (access: 1.06.2026).

consequences of changes that have been, are being, or may be introduced within it. It may be applied both in the education of children and young people and in developing the awareness of adults, including ways of using space, opportunities to exert a real influence on its form and arrangement, the ability to interpret hidden meanings, and the impact that space may have on users' well-being and health. It may also be applied in museum and participatory activities, as well as in projects related to the protection of architectural heritage.

It is important to distinguish spatial education from the teaching of architectural history, as school education more often conveys historical knowledge than develops practical competencies in recognising and interpreting space. This is of considerable importance for conservation practice. Supplementing knowledge of styles in art and architecture with issues related to the perception, articulation, and use of space, not only in a historical context, provides new types of data, sensitises experts, and reveals values of architectural heritage that are usually overlooked.

In practice, spatial education generally takes an active form, focusing more on direct action than on theory and textbooks. Its fundamental principles are: touch, act, explore, and experience (what works for one person will not necessarily work for others).

Spatial education understood in this way may be directly relevant to the protection of architectural heritage. It also indicates the need to introduce changes in the scope of heritage protection and in the content of conservation documentation by extending both to include elements related to perception. It further requires these values to be documented before and after an intervention, together with an analysis of its impact on users' perception[9].

One proposal could be the creation of a spatial perception chart which, modelled on the White Card used for the registration of historic buildings, could serve to document the characteristics, relationships, and conditions affecting the sensory and spatial perception of a building, for example those associated with the identification of key sensory stimuli, the recording of characteristic movement sequences, daily and seasonal variability, or relationships between users, while naturally taking into account and indicating the level of uncertainty of the findings. The spatial perception chart could function online as an interactive document, providing easy access to the information it contains, including images, sounds, diagrams, films, virtual reconstructions, or other data characteristic of a given building. Its purpose would not be to "measure" the *genius loci*, but to document the conditions that influence how a place is experienced and that may be altered or lost as a result of an intervention.

The direct examination of a building, the recognition of its structure, patterns of use, and relationships with its surroundings make it possible to identify values that may not always be evident in a traditional historical description and allow for a better understanding of the value of a given place and its *genius loci*. In such a situation, the transmission of knowledge about a building expands to include learning how to act consciously within its space and discover its qualities. This is of particular importance for buildings that, for various reasons, must continue to serve the needs of local communities[10].

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[9] This analysis may address such aspects as changes in sound propagation, including footsteps and reverberation, as well as temperature, air humidity, draughts or their absence, privacy or public access, circulation routes within interiors, and similar factors.

[10] M.E. Embaby, *Heritage Conservation and Architectural Education: 'An Educational Methodology for Design Studios'*, "HBRC Journal" 2014, no. 10(3), pp. 339–350.

In the case of museum buildings, organising the visit in accordance with the principles of spatial perception – through movement, changes in perspective, the sequence of interiors, and varied sensory stimuli – makes it possible to reveal additional qualities of the building and bring the user closer to a fuller understanding of its value. The historic building becomes a space whose meaning can be partially recognised through personal experience; it is no longer viewed solely from a distance and explained by means of information panels. The above argument does not imply that full access and the possibility of directly touching the original fabric must be ensured in every building. Conservation restrictions remain necessary wherever contact with users could lead to the destruction or damage of the historic building. Nevertheless, remedial measures could often involve, for example, changing the visitor route, opening additional rooms, or allowing greater freedom in spaces of lesser historic value. Where a complete experience of the historic building is not possible, alternative solutions may be sought that are not limited solely to text, audio recordings, or images[11]. They may recreate inaccessible spaces, patterns of movement, sounds, scale, light, textures, former modes of use, or even temperature and psychophysical comfort. It is important not to treat education as an attractive addition to a visit, but as a tool for recognising the value of the building and making the fullest possible use of its potential, to the extent permitted by the actual safety requirements of the historic building. At this point, spatial education and heritage protection become open to the application of digital technologies[12].

4. DIGITAL TECHNOLOGIES IN SUPPORTING SPATIAL EDUCATION

Digital technologies are currently developing almost continuously, and over the past few years a significant increase in the possibilities associated with their use can be observed. Their primary functions include documentation and monitoring, interpretation and dissemination, as well as reconstruction and simulation.

The development of artificial intelligence opens up new perspectives in these areas for architects, researchers of architectural history, and heritage conservation professionals. Artificial intelligence accelerates and partially automates activities that previously required time-consuming expert analysis, for example in relation to large and heterogeneous datasets, including conservation documentation, as well as the recognition and organisation of three-dimensional models, the reconstruction of non-existent or damaged fragments, the monitoring of subtle changes in technical condition through sensor systems, the creation of digital twins, and the adaptation of narratives to users' needs[13]. Experience from digital game design may provide a source of solutions related to navigation, interaction, and engaging spatial narratives.

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[11] Interpret Europe, Engaging Citizens with Europe's Cultural Heritage: *How to make best use of the interpretive approach*, Witzenhausen, 2017, https://www.interpret-europe.net/fileadmin/Documents/publications/ie_engaging_citizens_with_europes_cultural_heritage_co.pdf (access: 1.06.2026).

[12] J. Kidd, E. Nieto McAvoy, *Immersive Experiences in Museums*, *Galleries and Heritage Sites: A Review of Research Findings and Issues*, "Creative Industries Policy and Evidence Centre, Discussion Paper" 2019, no. 2, pp. 6–8, https://pec.ac.uk/wp-content/uploads/2023/12/PEC-Discussion-Paper-Immersive-experiences-Cardiff-University-November-2019.pdf (access: 1.06.2026).

[13] L. Caroux, *Presence in Video Games: A Systematic Review and Meta-Analysis of the Effects of Game Design Factors*, "Applied Ergonomics" 2023, no. 107(3), art. 103936.

Digital documentation may include binaural recordings, 360° panoramas, laser scanning and the point clouds generated from it, sensor data, and maps of light and sound. Many of these solutions are now widely accessible, including through the use of relatively simple and cost-effective devices such as mobile phones or tablets. They may be used to record information about a building, create its digital representation, or provide access to selected data in real time during a visit. Combining these tools may enable the creation of a multilayered record of a place, constituting an attempt to preserve the broadest possible spectrum of the properties of a given building by integrating information derived from multiple sources.

Immersive technologies such as VR, AR, and MR may be used to explore inaccessible places, reconstruct spaces that no longer exist, simulate changes in lighting, recreate soundscapes, or present a building before and after its transformation. In the literal sense, immersion means becoming immersed in an experience that may be multisensory in nature. At present, available technologies still do not allow for the widespread and faithful recreation of the bodily and social experience of place: they lack the capacity to fully convey sensations such as fatigue, temperature, smell, the resistance of materials, or the presence of other people. Despite these limitations, they nevertheless constitute a promising field for application in spatial education and in the multisensory experience of historic buildings. Beyond the fundamental task of integrating data derived from different sources, they may support the process of exploring a building. In combination with dedicated applications, they may, for example, enable the virtual "disassembly" of a building structure or architectural detail and its subsequent reassembly, display recorded sequences of users' movements, indicate alternative solutions, or present a space that no longer exists.

Importantly, the immersive experience does not have to be limited solely to images and sound. With the use of additional devices, it is possible to simulate the thermal conditions characteristic of a given interior, air movement, humidity, or material texture, as well as the user's actual movement.

Artificial intelligence may be used as a tool for interpretation: to group and supplement information, conduct an active dialogue with an individual user, respond to current needs, and update stored data. It may support VR and MR solutions, among other things by continuously adapting the parameters of the experience to the user's mode of interaction, experience, knowledge, and psychophysical abilities. It may assist professionals in detecting errors, identifying possible courses of action, linking facts, making comparisons, and proposing and testing alternative solutions. It may analyse sensor data and issue alerts when irregularities are detected. It may be particularly significant in synthesising large datasets resulting from an in-depth conservation survey that incorporates perceptual data. At this point, it is worth emphasising the continuing need to verify this tool, particularly with regard to the sources used and implicit assumptions, for example those concerning personalisation.

5. CONCLUSION AND DISCUSSION

The considerations presented above indicate the need to expand the traditional understanding of architectural heritage protection to include values associated with the experience of space. This does not entail abandoning the protection of material substance or questioning established conservation methods, but rather supplementing them with an analysis of the relationships between space, movement, the body, the senses, memory, and culture. The material

structure does not encompass all the meanings that may be important to its users and may shape their understanding of the need to protect a given historic building. This expansion complements, rather than replaces, the protection of material substance.

The experience of space is variable and depends on numerous factors, including the individual characteristics of the user, their knowledge and previous experiences, memory, and cultural context. What may be documented, however, are the conditions that enable particular impressions to arise: movement sequences, the succession of interiors, visual axes, acoustic properties, variations in light, textures, microclimate, smells, and patterns of use. The spatial perception chart proposed in this article could serve as a tool for documenting the characteristics and relationships that influence the perception of a historic building. It nevertheless requires further specification, particularly with regard to the scope of the data, methods of data acquisition and recording, and the level of uncertainty involved in interpretation.

Spatial education enables a transition from the transmission of theoretical information to the development of skills in independently interpreting and identifying meanings, patterns, and structures. In this way, it may reveal values overlooked in traditional documentation and strengthen understanding of the need to protect heritage. Digital technologies may also support this process by integrating material, spatial, sensory, and other types of data. In this context, care must be taken to ensure that they do not begin to displace activities undertaken in physical space. These technologies should not replace *in situ* experience. They may, however, prepare users for it, support them during the visit, and preserve and evoke the experience after the visit has ended. They may provide significant support for people with disabilities and other limitations, but even in such cases, where direct experience of the place is possible, it should retain priority over its digital equivalent. It should also be remembered that preserving experience does not mean freezing it, but maintaining the conditions that allow subsequent users to interpret the meaning of a given place as fully and independently as possible.

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