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MULTISENSORY PERCEPTION OF ARCHITECTURE: AN INTERDISCIPLINARY APPROACH TO THE EXPERIENCE OF SPACE[1]

WIELOZMYSŁOWA PERCEPCJA ARCHITEKTURY: DOŚWIADCZENIA PRZESTRZENI W UJĘCIU INTERDYSCYPLINARNYM

Abstract

This article addresses the issue of the multisensory perception of architecture, analyzing how space affects the user through integrated sensory experiences. In contrast to the traditional visual approach to architecture, contemporary research emphasizes the role of all senses – sight, touch, hearing, smell, and kinesthesia – in the perception of space. The aim of the paper is to present the theoretical foundations of multisensory perception, propose a methodological framework for its study, and discuss the significance of this approach for design practice.

Keywords: *architecture, experience of space, multisensory perception, senses*

Streszczenie

Artykuł podejmuje problem wielozmysłowej percepcji architektury, analizując sposób, w jaki przestrzeń oddziałuje na użytkownika poprzez zintegrowane doświadczenia sensoryczne. W odróżnieniu od tradycyjnego, wizualnego podejścia do architektury współczesne badania podkreślają rolę wszystkich zmysłów – wzroku, dotyku, słuchu, węchu, a także kinestezji – w odbiorze przestrzeni. Celem pracy jest przedstawienie teoretycznych podstaw percepcji wielozmysłowej, zaproponowanie ram metodologicznych jej badania oraz omówienie znaczenia tego podejścia dla praktyki projektowej.

Słowa kluczowe: *architektura, doświadczenie przestrzeni, percepcja wielozmysłowa, zmysły*

1. INTRODUCTION

Architecture, a field situated at the intersection of art, technology, and the social sciences, has long been analyzed primarily in visual terms. The dominance of sight in the perception of space stems from the culturally entrenched primacy of the image and the development of architectural representation tools, such as drawing, photography, and digital visualizations.

[1] The research was carried out as part of work No. WZ/WA – IA/5/2026 at the Bialystok University of Technology and financed from a research subsidy provided by the Minister of Science and Higher Education.

However, the experience of architecture is a complex process that engages multiple sensory systems simultaneously[2].

Recent decades have seen growing interest in research on the embodied experience of space, emphasizing the body's role as a medium of perception[3]. In this context, architecture is not merely an object to be viewed, but an environment to be lived in.

2. PURPOSE AND METHOD OF RESEARCH

The aim of this study is to present the theoretical foundations of multisensory perception, propose a methodological framework for investigating it, and discuss the significance of this approach for design practice. Additionally, the author applies the multisensory perception method to the analysis of selected case studies.

3. THEORETICAL FOUNDATIONS OF MULTISENSORY PERCEPTION

Multisensory perception refers to an organism's ability to integrate stimuli from various sensory modalities into a coherent experience[4]. From a phenomenological perspective, this perception is pre-reflective and holistic – one experiences space as a unified whole rather than as a collection of distinct sensations.

Neuroscientific research indicates that sensory integration occurs at early stages of information processing, meaning that the senses do not function in isolation but rather in a dynamic relationship[5]. In architecture, this means that material properties, light, acoustics, and scent collectively shape the atmosphere of a place.

4. METHODOLOGY OF RESEARCH ON THE MULTISENSORY PERCEPTION OF ARCHITECTURE

Research approaches

Studying the multisensory perception of architecture requires an interdisciplinary approach that combines qualitative and quantitative methods. Three main research strategies can be distinguished:

- Phenomenological approach – focuses on the user's subjective experience. It employs methods such as in-depth interviews, experience diaries, and narrative analysis[6].

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[2] J. Pallasmaa, *The Eyes of the Skin* (3rd ed.), Wiley, Chichester 2012, pp. 51–56.

[3] M. Merleau-Ponty, *Fenomenologia percepcji*, Fundacja Aletheia, Warszawa 2001, p. 6.

[4] B.E. Stein, T.R. Stanford, *Multisensory integration: Current Issues from the Perspective of the Single Neuron,* "Nature Reviews Neuroscience" 2008, no. 9, pp. 255–266, https://doi.org/10.1038/nrn2331 (access: 15.07.2026).

[5] *Ibidem*.

[6] D. Seamon, *A way of seeing people and place: Phenomenology in environment-behavior research*, [in:] S. Wapner et al. (eds.), *Theoretical perspectives in environment-behavior research: Underlying assumptions, research problems, and methodologies*, Kluwer Academic Publishers, New York–

- Experimental approach – based on controlled laboratory studies that analyze reactions to specific stimuli (e.g., sound, light, texture)[7].
- Environmental (in situ) approach – involves studying perception within the actual architectural context, taking into account natural conditions of use[8].

Research tools

A variety of tools are used in the analysis of the multisensory experience of space:
- perceptual questionnaires and semantic scales,
- recording of physiological reactions (e.g., heart rate, skin conductance),
- motion and eye-tracking technologies,
- audio recordings and acoustic analyses,
- sensory mapping, which involves visualizing user experiences within a space.

Methodological limitations

Research on multisensory perception faces numerous difficulties. One of the main issues is the subjective nature of the experiences and the difficulty of operationalizing them. Furthermore, multiple stimuli act simultaneously, making it hard to isolate their individual effects. The lack of standardized research tools also remains a significant challenge[9].

5. THE ROLE OF INDIVIDUAL SENSES IN THE PERCEPTION OF ARCHITECTURE

Sight as a sense that organizes experience

Sight plays a dominant role in organizing the perception of space by identifying geometric relationships, proportions, and the hierarchy of architectural elements[10]. It is through vision that the user constructs mental maps of a space, enabling orientation and navigation.

However, reducing architecture to a visual image leads to an experiential "flattening." Spaces designed solely for visual effect may be appealing in representation yet lack sensory depth in actual use. While sight often initiates perception, its interpretation is modulated by other senses – for instance, the visual perception of a material as "warm" may be confirmed or challenged by tactile experience.

Touch and hapticity as the foundation of the experience of materiality

Touch plays a pivotal role in the perception of architecture, as it enables direct contact with its material dimension. Literature emphasizes the significance of "hapticity" – an expanded understanding of touch that encompasses both physical contact and "visual touch," or the ability to imagine a material's properties based on its appearance.

Boston–Dordrecht–London–Moscow 2000, pp. 157–178, https://doi.org/10.1007/978-1-4615-4701-3_13 (access: 15.07.2026).

[7] C. Spence, *Senses of place: architectural design for the multisensory mind*, "Cognitive Research: Principles and Implications" 2020, no. 5, art. 46, https://doi.org/10.1186/s41235-020-00243-4 (access: 15.07.2026).

[8] J. Gehl, *Life Between Buildings. Using Public Space*, Island Press, Washington, DC 2011, pp. 32–59.

[9] C. Spence, *op. cit.*

[10] S.E. Rasmussen, *Experiencing Architecture*, MIT Press, Cambridge, MA 1962, pp. 35–36.

Materials such as wood, concrete, and steel not only differ visually but also elicit distinct somatic reactions. The coolness of stone, the softness of fabrics, or the roughness of raw surfaces influence one's sense of comfort, security, or distance[11]. Crucially, touch is a sense deeply linked to bodily memory; a user's past experiences can shape their response to a given space.

Hearing and the acoustic dimension of space

Auditory perception is an integral part of the architectural experience, even though it often goes unnoticed at a conscious level. Every space possesses unique acoustic characteristics resulting from its geometry, materials, and the presence of occupants.

Sound serves informational functions (e.g., indicating the size of a space through reverberation) and orientational ones (enabling the localization of sound sources), while also evoking emotional responses. Spaces with high reverberation, such as places of worship, can inspire a sense of sublimity and transcendence, whereas spaces with dampened acoustics foster intimacy and concentration[12].

It is worth noting that the perception of sound is temporal in nature – it unfolds over time – thereby transforming the experience of architecture into a process rather than a static act of perception.

Smell as a carrier of memory and the identity of a place

The sense of smell is often marginalized in architectural analyses, even though it plays a significant role in shaping the atmosphere of a space. Scents have the power to evoke strong emotional reactions and trigger memories, thereby strengthening the user's connection to a place[13].

Sources of scent in architecture vary widely – ranging from building materials and ventilation systems to natural elements such as vegetation and water. In urban environments, scent can also reflect a location's function (e.g., dining areas).

The temporal variability of scents is another important aspect, further reinforcing the dynamic nature of architectural perception.

Kinesthesia and proprioception: architecture as an experience of movement

Kinesthesia (the sense of movement) and proprioception (awareness of body position) allow the user to experience architecture as a sequence of spatial events. Moving through a building reveals its structure gradually, creating a spatial narrative[14].

Elements such as scale, rhythm, the compression and expansion of space, and changes in level influence how the body responds to its surroundings. Narrow corridors can evoke a sense of tension, while open spaces foster a feeling of freedom.

Architecture thus affects not only the senses but also the user's motor system, shaping their behavior and manner of movement.

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[11] P. Zumthor, *Atmospheres: Architectural Environments, Surrounding Objects*, Birkhäuser, Basel–Boston–Berlin 2006, pp. 10–70

[12] B. Blesser, L.-R. Salter, *Spaces Speak, Are You Listening? Experiencing Aural Architecture*, MIT Press, Cambridge, MA–London 2007, pp. 2–8.

[13] J. Drobnick (ed.), *The Smell Culture Reader*, Berg Publishers, Oxford–New York 2006, pp. 4–9

[14] D. Seamon, *op. cit.*

6. THE SIGNIFICANCE OF MULTISENSORY DESIGN IN ARCHITECTURE

Incorporating multisensory perception into design leads to the creation of spaces that are more sustainable, inclusive, and responsive to the actual needs of users. Experience-based design posits that architecture should engage all the senses, creating cohesive and meaningful environments[15].

This is particularly significant in the context of universal design, which addresses the needs of individuals with various sensory impairments. In such instances, other senses can compensate for the absence of a dominant perceptual channel.

Integrating multisensory perception into the design process entails shifting away from the paradigm of architecture as a visual object toward architecture as an experience. This approach necessitates a redefinition of both design tools and the criteria used to evaluate the quality of space.

Experience-based design

Contemporary design approaches increasingly focus on the user and the user experience. This necessitates an analysis of how a space is perceived through all the senses at various stages of its use.

Experience design encompasses, among other things:

- the deliberate shaping of natural and artificial light,
- the selection of materials based on their tactile and acoustic properties,
- the design of spatial sequences that influence the perception of movement,
- consideration of scents and the microclimate.

This approach leads to the creation of more cohesive and engaging spaces that affect the user in a multidimensional way.

Inclusive architecture and sensory accessibility

Multisensory engagement plays a key role in inclusive design, which seeks to address the needs of individuals with diverse perceptual abilities. Tactile and auditory stimuli are essential for blind or visually impaired people, whereas limiting sensory overload is crucial for those with sensory hypersensitivity.

Inclusive design therefore requires balancing the intensity and variety of sensory experiences to ensure the space is legible and comfortable for the widest possible range of users.

Atmosphere as a design category

One of the key concepts associated with the multisensory perception of architecture is atmosphere. It refers to the overall impression a space makes on the user, resulting from the interaction of all sensory stimuli.

Atmosphere is not a characteristic of a single element but an emergent property of the entire environment. Designing atmosphere therefore requires a holistic approach that takes into account both material and immaterial aspects.

Design tools and their limitations

One of the major challenges in multisensory design is the lack of adequate representation tools. Traditional drawings and visualizations focus on the visual aspect, overlooking other senses.

[15] C. Spence, *op. cit.*

In response, new methods – such as acoustic simulations, physical models, and virtual reality (VR) or augmented reality (AR) – are being developed to enable more comprehensive design testing. Nevertheless, fully replicating the experience of smell or touch during the design phase remains difficult.

The impact of multisensory experiences on user well-being

An increasing number of studies indicate that the quality of the sensory environment directly impacts the health and well-being of users. A well-designed space can reduce stress, improve concentration, and foster social interaction.

This significance is particularly evident in residential, educational, and healthcare architecture. Spaces with a balanced sensory environment promote restoration and a sense of security, whereas an excess or chaotic array of stimuli can lead to sensory overload.

7. CASE STUDIES: ANALYSIS OF SELECTED ARCHITECTURAL PROJECTS FROM A MULTISENSORY PERSPECTIVE

To deepen the theoretical discussion, it is appropriate to refer to specific architectural projects that consciously engage the user's various senses. The following examples illustrate how multisensory design can be implemented in practice.

Jewish Museum Berlin (Germany), designed by Daniel Libeskind (2001)

The Jewish Museum is an example of architecture in which the sensory experience is inextricably linked to the historical narrative.

- Sight: Sharp angles, a lack of symmetry, and limited light influence the emotional perception of the space.
- Hearing: In the "Holocaust Tower," silence and reverberation intensify the feeling of isolation.
- Touch: The raw nature of the materials (concrete, steel) reinforces the impression of coldness and emptiness.
- Smell: In many spaces, the scent of raw concrete, metal, and dampness is palpable, intensifying the sense of cold, emptiness, and unease; the absence of strong, pleasant aromas directs the visitor's focus toward the atmosphere of the place and the story the building tells.
- Kinesthesia: The building's spatial layout dictates specific movement paths, inducing a sense of disorientation and tension in the user.

This example demonstrates that a multisensory approach can serve as a narrative tool for creating a deeply emotional experience[16].

St. Peter's Basilica (Vatican City), designed by, among others, Donato Bramante, Michelangelo, and Carlo Maderno (16th–17th centuries)

St. Peter's Basilica stands as one of the most significant works of sacred architecture, where the multisensory impact of the space is subordinated to the concepts of transcendence and the manifestation of the Church's power.

[16] D. Libeskind, *Breaking Ground*, Riverhead Books, New York 2004, pp. 25–59.

- Sight: The monumental scale of the interior, the dome designed by Michelangelo, and the richness of the ornamentation (marble, gilding, mosaics) create a visual experience of the sublime. Perspective was deliberately adjusted to heighten the sense of harmony and proportion.
- Hearing: The interior acoustics, characterized by a long reverberation time, amplify liturgical music and the human voice, lending them a solemn quality. Sound becomes a vehicle for the sacred.
- Touch: Contact with cool stone and marble surfaces, along with the presence of sculptures (such as the Pietà), allows for an experience of materiality – whether direct or imagined.
- Smell: The scent of incense and candles evokes strong ritual associations, reinforcing the perception of the space's religious character.
- Kinesthesia: The processional nature of movement – from the square, through the nave, and toward the altar – creates a spatial narrative that guides the visitor toward a focal point of symbolic significance.

The Basilica exemplifies an architectural work in which all the senses are harnessed toward a single goal: evoking an experience of transcendence and spiritual elevation.

Omero State Tactile Museum in Ancona (Italy)

The Omero Museum is a unique example of an institution designed with tactile perception in mind, specifically for blind and visually impaired individuals.

- Touch: Touch is the primary means of perception; the exhibits (sculpture replicas, architectural models) are intended for direct physical contact. The texture, shape, and scale of the objects allow them to be explored through the hands.
- Sight: Although the museum is accessible to sighted visitors, the visual aspect is subordinate to the other senses. Lighting is subdued and does not dominate the experience.
- Hearing: Audio narratives and guides support the interpretation of exhibits, creating an additional layer of understanding.
- Kinesthesia: Movement through the museum space is intuitive, supported by a circulation layout tailored to the needs of people with visual impairments.
- Smell: While less emphasized, the scent of materials and the space itself can aid in orientation and the identification of specific areas.

The Omero Museum serves as a model example of inclusive architecture, where a multisensory approach is not merely an add-on but a fundamental design principle.

Orthodox Church of the Wisdom of God (Hagia Sophia) in Bialystok (Poland), designed by Micha/ Ba/asz (late 20th century)

The Hagia Sophia Orthodox Church in Bialystok represents a contemporary reinterpretation of the Byzantine tradition, directly inspired by the Hagia Sophia in Constantinople. The building is particularly interesting in the context of multisensory perception, as it combines historical models with modern material and spatial solutions[17].

- Sight: The dominant element is the central dome, the form of which alludes to the original in Constantinople. The interior is filled with polychromies and icons, creating

[17] A. Tokajuk, *Kanon w architekturze cerkwi prawosławnej pw. Mądrości Bożej – Hagia Sophia w Białymstoku*, "Teka Komisji Architektury, Urbanistyki i Studiów Krajobrazowych PAN" 2022, no. 18(4), pp. 7–14, https://doi.org/10.35784/teka.3368 (access: 15.07.2026).

a rich, symbolic visual landscape. The color palette – based on gold, blue, and green tones – reinforces the sacred character of the space. Natural light, filtered through the windows of the dome and the drum, creates a soft, diffused illumination conducive to contemplation.

- Hearing: The church's acoustics have been tailored to the Orthodox liturgy, in which a cappella choral singing plays a vital role. The spatial reverberation enhances the harmony of the sounds and creates an impression of being "immersed" in the music. The absence of instruments further highlights the architecture's role as a sound resonator.
- Touch: The materials used in the interior – stone, brick, concrete, and metal elements – create a varied haptic experience. Liturgical furnishings, such as the iconostasis, are of particular significance; through its structure and sculptural details, the iconostasis engages both the visual and tactile senses (in the context of religious practices, such as the veneration of icons by kissing them).
- Smell: The scent of incense is an integral part of the experience of this sacred space. In the Hagia Sophia Orthodox Church in Bialystok, this scent is particularly palpable due to the enclosed nature of the interior and the intensity of the liturgical rites. It evokes strong ritual and emotional associations, reinforcing the sense of the sacred.
- Kinesthesia: The movement of the faithful within the church space is ritualistic and orderly. The absence of pews (typical of the Orthodox tradition) facilitates free movement, pausing before icons, and bodily participation in the liturgy. The spatial layout – with a clear division into zones (nave, sanctuary) – structures the user's experience in a hierarchical manner.

This church exemplifies the deliberate use of multisensory elements in contemporary architecture, where liturgical and symbolic traditions are translated into the language of modern forms and technologies.

8. SYNTHESIS: IMPLICATIONS FOR MULTISENSORY DESIGN

Despite the growing body of research on multisensory perception, architectural practice remains heavily dominated by the visual. This stems from both tradition and the limitations of design tools. Integrating scientific knowledge into the design process and developing methods to evaluate the quality of sensory experiences pose a challenge.

An analysis of the above case studies allows for several key conclusions:

- multisensory quality results from the deliberate integration of various design aspects, rather than being the sum of independent decisions,
- materials play a fundamental role in shaping tactile and acoustic experiences,
- user movement is a key medium for the perception of space,
- light and sound can serve a narrative function, constructing the meaning of a space,
- architectural atmosphere is the result of the synergy of all sensory stimuli.

Particularly significant here are:

- the dematerialization of the structure through light, which influences visual and emotional perception,
- acoustics as a tool for fostering a shared religious experience,
- the variability of the building's function, which alters its sensory dimension (e.g., differing sounds and scents associated with Christian liturgy versus other religions).

Including the Hagia Sophia Orthodox Church in Bialystok among the cases analyzed makes it possible to see how ideas of multisensory perception are adapted within a local and contemporary context. The Hagia Sophia confirms that the multisensory perception of architecture is a phenomenon that is both universal and deeply rooted in its cultural context.
The Bialystok realization of Hagia Sophia:

- consciously reconstructs selected elements of the sensory experience (dome light, acoustics, the scent of incense),
- employs a more controlled scale, adapted to the contemporary needs of users,
- integrates tradition with modern construction technologies.

At the same time, this Orthodox church confirms that sacred architecture remains one of the most complete examples of a multisensory space, in which all stimuli are subordinated to the spiritual experience.

9. SUMMARY

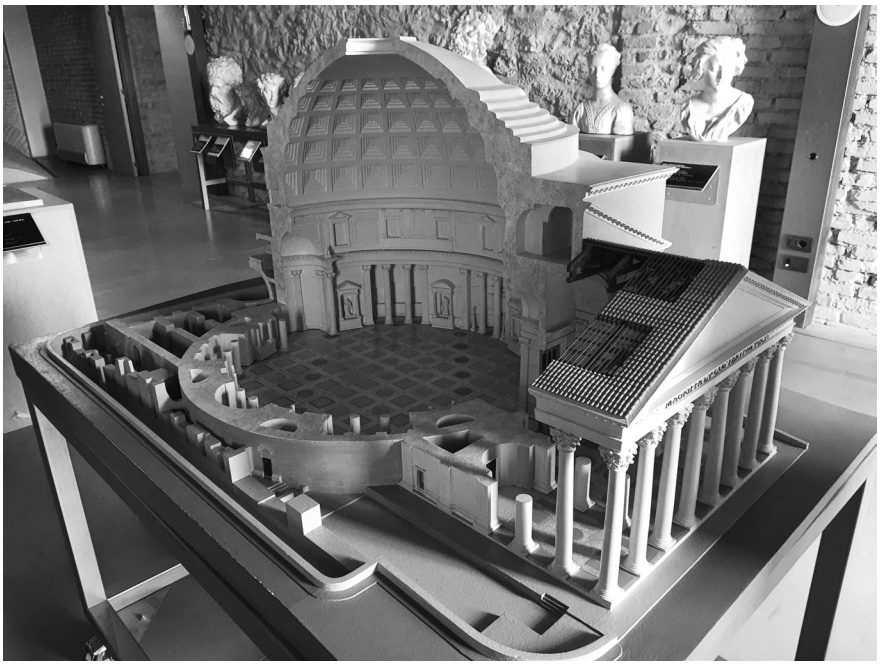
The multisensory perception of architecture is a key area of research for contemporary design theory and practice. Developing research methods and implementing them within the design process can contribute to the creation of architecture that is more human-centric and responsive. The future of this field lies in integrating the human sciences with design practice.



Ill. 1. The Jewish Museum in Berlin – the Tower of Holocaust. Photo: A. Tokajuk



Ill. 2. St. Peter's Basilica in Rome. Photo: A. Tokajuk



Ill. 3. The Omero Museum in Ancona – example of tactile model (Pantheon). Photo: A. Tokajuk



Ill. 4. The Orthodox Church of the Wisdom of God – Hagia Sophia in Bialystok. Photo: A. Tokajuk

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