DOI: 10.23817/2026.defarch.3-14

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ARCHITECTURE AND SENSORY HYPERSENSITIVITY

ARCHITEKTURA A NADWRAŻLIWOŚĆ SENSORYCZNA

Abstract

Architecture engages many senses simultaneously, while sensitivity and susceptibility to stimuli are highly individual. The method consists of literature analysis and interpretation of selected architectural examples. The article examines sensory overload in the context of design, without reducing sensory-aware design to stimulus reduction. What matters are the accumulation, intensity and interaction of stimuli. Knowledge of multisensory perception should support design, not restrict it.

Keywords: *architectural design, architecture, multisensory perception, sensory overload, sensory sensitivity*

Streszczenie

Architektura oddziałuje na wiele zmysłów równocześnie, a wrażliwość i podatność na bodźce są silnie zindywidualizowane. W niniejszej pracy zastosowano metody analizy literatury i interpretacji wybranych przykładów architektury. Artykuł analizuje przeciążenie sensoryczne w kontekście projektowania, bez sprowadzania *sensory-aware design* do redukcji bodźców. Istotne są kumulacja, intensywność i wzajemne oddziaływanie bodźców. Wiedza o percepcji wielozmysłowej powinna wspierać projektowanie, a nie je ograniczać.

Słowa kluczowe: *architektura, percepcja wielozmysłowa, projektowanie architektoniczne, przeciążenie sensoryczne, wrażliwość sensoryczna*

1. INTRODUCTION

Architecture engages many senses simultaneously, although sight is one of the main tools we architects use in our work and in analysing architecture. Composition, proportions of volumes, their size and mutual relations, near and distant planes, open and enclosed interiors. Colour and material. Sequences of spaces and detail. This is, in essence, the elementary vocabulary of our work, the basis of our education. Working with light, sunlight, shading, chiaroscuro. Here too, we operate within concepts that are familiar to us and well defined. We are aware, and we also know, that this does not exhaust all the possibilities of experiencing architecture. Temperature, air movement and sound propagation are not unfamiliar concepts to us and are increasingly entering the designer's working vocabulary. More in-depth research points to individual differences between users in their sensitivity

and reactivity to environmental stimuli. This has finally allowed us to draw attention to the problem of sensory overload, which is particularly important in the case of people with sensory hypersensitivity. Sensory overload in the experience of architecture is not only an interesting subject of research, but also a real problem for many users. The aim of this article is to draw attention to the need for a broader consideration of such concepts as sensory inclusivity or the design of sensory-friendly environments. This should not, however, automatically lead to the conclusion that less means better. The author wishes to examine the issue more broadly, in terms of the conscious engagement of multiple senses, without assuming a single universal model of the user. Where an enriched sensory experience may be particularly attractive to some users, for others reduction, predictability and the possibility of regulating the intensity of stimuli will be a condition for comfort.[1]

The author wishes to draw attention to an imbalance in the state of knowledge: while many individual environmental parameters have a well-developed research and design basis, the overall multisensory experience of space and interactions between modalities are much less well integrated into design knowledge. Starting from the needs of people with sensory hypersensitivity, the author at the same time argues that deeper knowledge of the multisensory perception of space should not become a set of design restrictions or rules of inclusivity, but rather an opportunity to develop a new way of thinking about architecture, providing additional tools for consciously shaping the experience of architecture.

2. SENSORY SENSITIVITY AND OVERLOAD – CONCEPTUAL FRAMEWORK

Before moving on to further considerations, it is worth organising the language and terminology. We will be working across the fields of psychology, psychiatry, perception research, built environment studies and, finally, neuroarchitecture. Each of these uses several concepts describing different aspects of responses to stimuli. Some of them are commonly used interchangeably, although scientifically they mean different things.

For the author, an important impulse for these considerations was the question of how architecture, and specific formal and spatial solutions, may affect a neurodivergent person. How can we respond to the needs of users characterised by Sensory Over-responsivity (SOR), that is, a response to stimuli that is faster, stronger or longer-lasting than is typical? Which characteristics of architectural space most often lead to sensory overload, cause discomfort or require increased cognitive effort? How does sensory overload translate into the emotional experience of space, into anxiety, tension, a sense of threat, disorientation or loss of control? While analysing the issue, however, the author noticed that it is much broader and cannot be reduced only to a set of sensory-friendly guidelines for a particular

[1] C. Spence, *Senses of place: architectural design for the multisensory mind*, "Cognitive Research: Principles and Implications" 2020, no. 5(1), art. 46, https://doi.org/10.1186/s41235-020-00243-4; C.U; Greven et al., *Sensory Processing Sensitivity in the context of Environmental Sensitivity: A critical review and development of research agenda*, "Neuroscience & Biobehavioral Reviews" 2019, no. 98, pp. 287–305, https://doi.org/10.1016/j.neubiorev.2019.01.009; S. Weyn et al., *Sensory processing sensitivity and overstimulation in daily life: an experience sampling method study*, "Scientific Reports" 2026, no. 16, art. 2015, https://doi.org/10.1038/s41598-025-31629-3.

and relatively narrow group of users. Differences in sensitivity to stimuli are widespread, while Sensory Processing Sensitivity (SPS), understood as greater responsiveness, depth of processing, emotional reactivity and sensitivity to subtleties in the environment, together with the related susceptibility to overstimulation, is also found across the population and is dimensional in nature. Of particular interest here will be a greater susceptibility to overstimulation in response to stimuli arising from architecture, both positive and negative. This leads directly to the proposition that, under certain circumstances, especially when multiple stimuli coincide and their intensity and unpredictability exceed an individual's momentary processing capacity, a state of sensory overload is not limited exclusively to clinical groups and may also occur in the general population. Although temporary symptoms may be very similar, sensory overload should not be confused with SOR.[2]

In the remainder of the article, the term "sensory overload" will be used as a broad term for a state of overload caused by stimuli, without assigning it exclusively to a specific clinical group.[3]

3. POTENTIAL SOURCES OF SENSORY OVERLOAD IN ARCHITECTURE

It should be emphasised that not every sensory modality has the same status in architectural practice or the same degree of design control. The very nature of architecture imposes, also for practical reasons, a certain hierarchy in this respect. Thus, spatial and visual stimuli, the composition of volumes, rhythm, accents, dominant elements, compositional complexity, view axes, symmetry, asymmetry, spaciousness, spatial hierarchy, clarity of entrances and exits, or wayfinding are concepts belonging to the basic vocabulary of every designer. Working with light, both in a purely ergonomic sense and as a means of enriching expression through chiaroscuro, reflections or the changing character of architecture over the course of the day, as well as the precise use of material, colour and texture, which are integral to the structure, are also inseparable components of architecture. Issues of acoustics, sound propagation, reverberation, and the location and separation of sources appear in design practice mainly from a purely utilitarian and functional perspective. We therefore have tools and a scientific basis for designing specific functions in which the clarity and manner of sound propagation are closely related to function. Temperature, air movement and the tactile properties of materials are usually addressed in projects mainly in technical terms and in relation to comfort. In analysing the above, it should be noted that the hierarchy outlined here does not in any way reflect a hierarchy of stimuli in terms of their influence on sensory overload. Overload should not, however, be analysed solely as an effect of a single measurable parameter. The co-occurrence of stimuli, their intensity, accumulation, variability, unpredictability and interactions between modalities may all be significant.

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[2] C.A. Conelea, A.C. Carter, J.B. Freeman, *Sensory over-responsivity in a sample of children seeking treatment for anxiety*, "Journal of Developmental & Behavioral Pediatrics" 2014, no. 35(8), pp. 510–521, https://doi.org/10.1097/DBP.0000000000000092; C.U. Greven et al., *op. cit.*; S. Weyn et al., *op. cit.*

[3] S. Scheydt et al., *Sensory overload: A concept analysis*, "International Journal of Mental Health Nursing" 2017, no. 26(2), pp. 110–120, https://doi.org/10.1111/inm.12303.

4. MECHANISMS OF SENSORY OVERLOAD IN ARCHITECTURE

An excess of competing elements, patterns and contrasts, together with variety and richness of detail, may lead to visual overload. Lack of spatial clarity and predictability, uncontrolled acoustic phenomena such as incidental reverberation and echo, harsh light whose colour and excessive intensity may cause glare or, conversely, insufficient light that makes orientation in space more difficult, inadequate isolation from adverse external sound stimuli, and finally strong olfactory stimuli increase the risk of adverse cognitive reactions such as reduced concentration, difficulties in separating stimuli, disorientation or problems with spatial orientation.

The overload accompanying such a configuration of stimuli is associated, for some users, with adverse emotional reactions. Depending on individual predispositions and their current physical and psychological state, it may create tension, anxiety, discomfort or irritation.

The complexity of a space, when it reduces its legibility, may in some users produce a sense of loss of control and the anxiety associated with it.

Individual differences should be emphasised here. The same configuration of stimuli does not produce the same response. The response depends not only on the individual characteristics of the user and their susceptibility to particular stimuli, but also on their state at a given moment.

Despite the complexity of the process, the available literature allows an attempt to define the mechanism of sensory overload, with the caveat that this is the author's working synthesis: stimuli that are difficult to integrate and select can overwhelm perceptual and processing capacity, which in turn leads to adverse reactions at the cognitive, emotional and physiological levels. It should also be noted that overload rarely results from a single stimulus, but rather from the accumulation of multiple variables, their interference, and the individual processing capacities of a particular user.[4]

5. CHARACTERISTICS OF SPACE AND THE ARCHITECT'S TOOLS

The architect does not control the user's response, but can shape the conditions of experience. Clarity of composition, sequencing of spatial planes, order. The possibility of reducing stimuli, of withdrawal. But also contrast, ambiguity, complexity, intensity, variability. These tools, when used consciously, form the foundation of many iconic works. Let us therefore try to define them.

Spatial organisation and sequence. It does not have to be limited only to rhythm, repetition, symmetry and modularity, although these are undoubtedly concepts associated with ordering space. The range of possibilities is much broader, while still being subordinated to a primary principle: the clarity of the layout that reduces unpredictability and cognitive load. Spatial hierarchy, clarity of function, clear visual axes, wayfinding. Predictability. The possibility of taking in the interior visually, and of skilfully balancing exposure with the possibility of retreat. These can provide a sense of control over space, have a calming

[4] S. Scheydt et al., *op. cit.*; S. Weyn et al., *op. cit.*; C. Valentine, *The impact of architectural form on physiological stress: a systematic review*, "Frontiers in Computer Science" 2024, no. 5, art. 1237531, https://doi.org/10.3389/fcomp.2023.1237531.

or even soothing effect, as in Toyo Ito's White U, which was created in response to a particular family situation. The house was designed for the architect's sister and her daughters after the death of her husband, consciously limiting contact with the surroundings while precisely working with light and the sequencing of interiors. In Ito's own words, referring directly to White U, the curvature causes the space to reveal itself gradually, and before seeing it, a person perceives the flow of light, air and sound, allowing them to sense the activity of other household members further away. Later accounts and studies concerning the residents' experience indicate, beyond the focus on visual perception, the acoustic qualities of the house as one of the remembered elements. The organisation of space, its deliberate curved geometry and light serve here to build the character of the experience with precision.[5]

Intensity and contrast of stimuli. The skilful combination of contrasts offers enormous possibilities, but requires particular discipline from the designer. Smiljan Radić's extraordinary House for the Poem of the Right Angle may serve as an illustration. It was inspired by Le Corbusier's work from the series of abstract prints Le Poème de l'angle droit, depicting a kneeling woman, known as "Body". The richness of the means of expression used by Radić is not limited here only to the precise handling of form, enclosed and open interior space, light, or opening towards the surrounding forest while maintaining a sense of intimacy. The multisensory character of the stimuli is complemented by the smell of wood, contact with nature, the seasonal variability of the surrounding forest view, and skylights framing the treetops. Studied forms, carefully considered openings, the appropriate choice of material. Selection, sequencing, contrast. A conscious, multimodal experience.[6]

Control, predictability, possibility of choice. Scape House by Kouichi Kimura Architects provides a clear illustration of the control of exposure and protection of privacy. It is a conscious definition of the relationship with the surroundings through precise framing of what the user is to see and what they are not. The windows are precise frames, while the architect controls the conditions of exposure and at the same time limits unwanted views into the interior. Nothing here is left to chance: the sequence of interiors and views is strictly subordinated to an imposed functional requirement and to a conscious decision, resulting from spatial conditions, about where to close off and where to open towards the surroundings. This contact with the surroundings is not uniform. Individual framed views have different functions, allowing residents to choose how they engage with their surroundings. Looking, eating, reading, sitting. Everything precisely defined through niches, tables, benches or shelves integrated with particular openings. The architect designs not only the stimulus itself, but also the conditions of its availability.[7]

The issues listed above, undoubtedly interesting tools for controlling and organising the conditions of experience, should not lead us to the hasty conclusion that sensory-aware design, or an aesthetic of quietness, neutrality and minimalism, is the only appropriate means

[5] The Hyatt Foundation, *Toyo Ito – Biography*, "The Pritzker Architecture Prize", https://www.pritzkerprize.com/laureates/2013 (access: 14.09.2026); T. Ito*, Boundaries Are a Social Phenomenon*, "Oris" 2013, no. 80, pp. 16–17, https://oris.hr/files/pdf/zastita/27/Oris.80_intervju.ToyoIto.pdf (access: 14.09.2026).

[6] S. Radić, *Casa para el poema del ángulo recto, Vilches, Chile*, "ARQ (Santiago)" 2012, no. 82, pp. 68–75, https://doi.org/10.4067/S0717-69962012000300013.

[7] Kouichi Kimura, Yoshihiro Asada, *Scape House*, "FORM / Kouichi Kimura Architects", https://www.form-kimura.com/works/038/ (access: 14.09.2026).

of expression. In doing so, we would invalidate not only individual works, but entire architectural styles. This is not the subject of the author's inquiry.

The conscious intensification of stimuli, complexity of form, dissonance, tension, ambiguity or a high degree of formal complexity are not only the basis of many iconic works, but have also become permanently embedded in established movements and styles of contemporary architecture. The architect, the creator, may consciously evoke surprise, tension or even a sense of discomfort. These are not design errors, but means of artistic expression. Frank Gehry takes this approach exceptionally far. "I approach each building as a sculptural object, a spatial container, a space with light and air…" he says, while treating the Winton Guest House almost as a sculpture. Each function of the pavilion is given its own form, additionally distinguished by a separate material and colour. Considerable spatial variability, formal ambiguity creating the impression of a collection of autonomous figures, material heterogeneity, different degrees of light reflection. This complexity is intentional. Characteristics that in another context might be interpreted as a potentially unfavourable increase in sensory load are used here consciously as an element of architectural expression. Complexity becomes a value and a means of expression.[8]

This leads us to the conclusion that awareness of the sensory consequences of particular means of expression should lead us not so much towards eliminating tension, contrast and complexity, but towards understanding and defining the purpose they are intended to serve, and using them consciously.

6. STATE OF RESEARCH AND THE GAP IN DESIGN KNOWLEDGE

The tradition of architectural theory has long dealt with the perception of form, composition, relationships between volumes, as well as tension and order. Referring, for example, to the now classic treatise by Juliusz Żórawski, we can confidently state that architecture has long had its own language and its own tools for describing the perception of form, even if it did not use concepts such as sensory overload, SPS, SOR or multisensory integration. Wayfinding and legibility have also appeared repeatedly within this perspective, although under different terms.[9]

Lighting, acoustics and thermal comfort are likewise well-established issues, to a large extent codified and standardised.

Practice is beginning to respond to newer issues, including, for example, neuroinclusive design and the British technical guidance standard PAS 6463.[10]

A clear imbalance in the current state of knowledge should, however, be noted. Many individual environmental and spatial parameters have a well-developed research and design basis, while the integration of modalities and their mutual interactions are considerably less well understood.[11]

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[8] The Hyatt Foundation, *Frank Gehry*, "The Pritzker Architecture Prize", https://www.pritzkerprize.com/laureates/1989 (access: 14.09.2026).

[9] J. Żórawski, *O budowie formy architektonicznej*, Arkady, Warszawa 1962.

[10] British Standards Institution, *PAS 6463:2022. Design for the mind. Neurodiversity and the built environment. Guide*, BSI, London 2022, https://doi.org/10.3403/30411154.

[11] Y. Zhao, D. Li, *Multi-domain indoor environmental quality in buildings: A review of their interaction and combined effects on occupant satisfaction*, "Building and Environment" 2023, no. 228, art. 109844, https://doi.org/10.1016/j.buildenv.2022.109844; C. Valentine, *op. cit.*

This gap can be considered on several levels.

The study of architecture from the perspective of sensory overload is still young enough that no single coherent and widely accepted research framework has yet emerged.

Another issue concerns the diversity of users and the current state of knowledge about how a given configuration of space and stimuli affects people with different sensory profiles, including people with clinically identified conditions. A number of practical guidelines for neuroinclusivity are already available, but there is still no evidence of a universal mechanism of response.

This leads to the conclusion that, from the perspective of architectural design, one of the important gaps today lies not in a lack of knowledge about composition, light or acoustics, but in a lack of sufficiently integrated knowledge about how all these factors, acting together and across multiple modalities, affect users with diverse sensory characteristics. Architects lack a sufficient theoretical basis for determining under what conditions a transition may occur from an intense experience to sensory overload.

7. CONCLUSIONS

Architecture affects the user through multiple senses, and the experience of architecture depends not only on the properties of the space itself, but also on the individual way in which stimuli are processed.

There is no single universal user. The same environment, perceived by some as rich and attractive, may for others become a source of strain and discomfort. Sensory-aware design does not necessarily mean reducing stimuli. What matters is the intensity, combination, predictability and context of the stimuli, as well as the possibility of regulating them. Knowledge of perception should not be treated as a catalogue of restrictions, but as an additional design tool that allows us to better understand the possible effects of the means of expression we use. The architect does not control the user's response, but can control many of the conditions of architectural experience. From a designer's perspective, the most important research gap lies in the integration of knowledge. Not in a lack of research on form, light or acoustics, but in the insufficient understanding of their combined effects on diverse users. And finally, knowledge of multisensory perception does not restrict creativity, but increases control over the tools of artistic expression. Do not design more cautiously; understand better what you are working with.



Ill. 1. White U House, Toyo Ito, Tokyo, 1976. Photo: Koji Taki. Source: Dezeen, https://www.dezeen.com/2013/03/18/key-buildings-projects-toyo-ito-pritzker-prize-2013-winner/ (access: 14.09.2026)



Ill. 2. House for the Poem of the Right Angle, Smiljan Radić, Vilches, Chile, 2012. Photo: Gonzalo Puga. Source: Afasia Archzine, https://afasiaarchzine.com/2016/10/smiljan-radic-16/smiljan-radic-house-for-the-poem-of-the-right-angle-vilches-8/ (access: 14.09.2026)



Ill. 3. Scape House, FORM / Kouichi Kimura Architects, Shiga, Japan, 2014. Photo: Yoshihiro Asada. Source: ArchDaily, https://www.archdaily.com/554828/scape-house-form-kouichi-kimura-architects (access: 14.09.2026)



Ill. 4. Winton Guest House, Frank Gehry, Minnesota, USA, 1987. Image courtesy of Wright. Source: World-Architects, https://world-architects.com/en/architecture-news/headlines/update-gehry-house-sells-for-905000 (access: 14.09.2026)

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[4] Ito T., *Boundaries Are a Social Phenomenon*, "Oris" 2013, no. 80, pp. 12–43, https://oris.hr/files/pdf/zastita/27/Oris.80_intervju.ToyoIto.pdf (access: 14.09.2026).

[5] Kouichi Kimura, Yoshihiro Asada, *Scape House*, "FORM / Kouichi Kimura Architects", https://www.form-kimura.com/works/038/ (access: 14.09.2026).

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[8] Spence C., *Senses of place: architectural design for the multisensory mind*, "Cognitive Research: Principles and Implications" 2020, no. 5(1), art. 46, https://doi.org/10.1186/s41235-020-00243-4.

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[10] The Hyatt Foundation, *Toyo Ito – Biography*, "The Pritzker Architecture Prize", https://www.pritzkerprize.com/laureates/2013 (access: 14.09.2026).

[11] Valentine C., *The impact of architectural form on physiological stress: a systematic review*, "Frontiers in Computer Science" 2024, no. 5, art. 1237531, https://doi.org/10.3389/fcomp.2023.1237531.

[12] Weyn S. et al., *Sensory processing sensitivity and overstimulation in daily life: an experience sampling method study*, "Scientific Reports" 2026, no. 16, art. 2015, https://doi.org/10.1038/s41598-025-31629-3.

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