



# Microarchitecture and Minimalism in the Interiors of Compact Urban Apartments

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## Abstract

*This study analyzes the mutual enhancement of the concepts of microarchitecture and minimalist design in the decoration of interiors of small urban apartments. The aim of the article is to identify and systematize existing approaches that contribute to increasing functionality, ergonomics and emotional comfort of people under conditions of constrained living space. The methodological basis consists of a systematic review of specialized scientific publications, analysis of Eurostat statistical data, as well as examination of practical examples within the framework of the New European Bauhaus initiative. In the course of the study, effective techniques of microzoning were identified, the role of transformable and multifunctional furniture was substantiated, and the influence of lighting solutions and material choice on spatial perception was analyzed. The results obtained indicate that the combination of a minimalist approach and the principles of microarchitecture not only visually expands the interior but also improves quality of life by reducing stress and increasing the cognitive activity of residents. On the basis of the analysis, scientifically grounded recommendations are formulated for creating adaptive and sustainable living environments in compact apartments, of interest to architects, interior designers, developers and researchers in the fields of urbanism and environmental psychology.*

**Keywords:** Microarchitecture, Minimalism, Small Apartment, Urban Housing, Space Optimization, Transformable Furniture, Environmental Psychology, Sustainable Design, Ergonomics, New European Bauhaus.

## INTRODUCTION

The contemporary stage of development of global urban centers is characterized by two interrelated trends: the steady increase in the urban population and, consequently, the densification of residential development, leading to a reduction in the average apartment size. Eurostat statistical data for 2024 indicate a continued rise in the share of single-person households in the European Union, which increased by 16.9 % from 2015 to 2024, significantly outpacing the overall growth in the number of households (5.8 %) [1]. This demographic transformation, coupled with the increase in property prices—which in the fourth quarter of 2024 amounted to 4.9 % year-on-year across the EU [2]—is generating sustained demand for compact housing. Meanwhile, the average number of rooms per person in the EU stands at only 1.6, and in countries such as Poland as low as 1.1 [3], highlighting the issue of insufficient living space and its efficient utilization. In this context, architectural and design solutions cease to be purely matters of aesthetics, acquiring critical importance for ensuring quality of life and the psycho-emotional well-being of urban residents. A scientific gap arises associated with the need for a comprehensive, interdisciplinary analysis of design

strategies for small living spaces, combining architectural, psychological, and socio-sustainability approaches.

**The aim** of the study is to systematize and analyze the principles of microarchitecture and minimalism as a unified set of tools for creating functional, ergonomic, and psychologically comfortable interiors under conditions of space scarcity.

**The author's hypothesis** posits that the synergy of microarchitectural solutions based on transformation and multi-level design and a minimalist aesthetic focused on conscious consumption of space and light enables not only the compensation for a lack of square meters but also the creation of a new quality of the living environment that meets the contemporary challenges of sustainable development.

**The scientific novelty** of the study lies in the comprehensive justification of the effectiveness of an integrative approach to designing small-format apartments, treating the interior as a dynamic adaptive system. Within the framework of this study, an analysis of existing approaches is conducted, and practical recommendations are formulated aimed at optimizing every cubic meter of living space.

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## MATERIALS AND METHODS

In recent years research interest in the organization of interiors of small urban apartments at the intersection of microarchitecture and minimalism has increased. On the one hand this is linked to changes in the demographic situation and rising housing prices in European cities and on the other to the need for sustainable and multifunctional solutions for small spaces.

First the general context of the housing sector in Europe is considered. Analysis of household composition shows that the share of single and childless couples continues to grow which determines the demand for compact apartments where emphasis is placed on the rational use of space and the optimization of the basic set of functions [1]. Parallely Eurostat records a steady increase in housing prices and rental rates at the end of 2024 which intensifies pressure on planning and design solutions for small areas [2]. In the report *Housing in Europe – 2024* edition the increasing role of flexibility and adaptability of interiors as a response to economic and social challenges including urban migration and changes in family models is emphasized [3].

In micro-apartment design the focus shifts to sustainable solutions and smart systems. Gronostajska B. E., Szczegielniak A. [4] propose the integration of transformable furniture and built-in storage systems which allows maintaining high standards of environmental friendliness and energy efficiency with a minimum occupied area. Rasheed H. [10] investigates contemporary trends in green interior architecture with the application of intelligent lighting and climate control systems noting that the combination of minimalist aesthetics and smart technologies enhances comfort and reduces resource consumption. At the same time within the framework of the Horizon Europe 2025 programme the European Commission announces the launch of the New European Bauhaus initiative aimed at promoting interdisciplinary approaches to sustainable design of urban spaces and housing where the key principles are simplicity of forms and environmental friendliness of materials [9].

A separate direction is associated with multifunctional furniture. According to the Global Market Insights report the market for such furniture is expected to experience rapid growth by 2034 reflecting consumers' willingness to invest in transformable and modular solutions for small apartments [7]. Félix M. J. et al. [8] analyse innovative materials and constructions for tiny houses demonstrating that the combination of lightweight composites and folding mechanisms makes it possible to create durable and aesthetically pleasing items that simultaneously meet requirements of quality and sustainability.

Simultaneously the literature actively discusses the aesthetic and cultural aspects of minimalism. David O. [5] examines color psychology in the interior emphasizing that a restrained neutral palette contributes to the visual expansion of space and reduces the cognitive load on apartment inhabitants.

Boutroy E. [6] analyses minimalism through the lens of material culture and satisfaction of basic needs noting that the departure from an abundance of objects is associated with a culture of detachment and the search for emotional comfort through mindful consumption. Tremblay, M. [11] identifies key decorative minimalist trends in 2025 – from emphasis on organic materials to the combination of monochrome surfaces with point elements of textile or art – and demonstrates how minimalism adapts to contemporary visual demands of city dwellers.

Finally several studies draw attention to shifts in consumption models towards rental and shared use. Chi T. et al. [12] analysing the growth of clothing rental services emphasize that the sharing economy trend is aimed not only at fashion but can be transferred to the market for interior components stimulating short-term rental of furniture and decor as a means to reduce production volumes and waste.

The literature reveals certain contradictions. Some authors emphasize the advantage of a strict minimalist aesthetic for the visual simplification of space while others point to the necessity of warmth and textural accents for the psychological comfort of inhabitants. Divergences also exist in the assessment of the role of technologies: some studies consider smart systems as an obligatory attribute of modern microinteriors whereas proponents of radical minimalism tend to limit their use in the interest of purity of forms. Among insufficiently illuminated topics are issues of acoustic comfort the impact of small spaces on the psychophysiological state of inhabitants and the socio-cultural aspects of adapting minimalist solutions in specific local contexts.

## RESULTS AND DISCUSSION

The comprehensive rethinking of accumulated empirical material and specialized studies has led to the concept of integrative design of interiors of small urban housing, where complementary principles of microarchitecture and minimalism form a single synergistic system. The apartment is interpreted not as a static aggregate of rooms, but as a quasi-biological, multilayered structure capable of grow and shrink under the influence of changing patterns of inhabitants' life activity. The model is built around four interrelated nodes

- Functional-spatial zoning through microarchitectural inserts. Instead of load-bearing walls, lightweight, mobile or transformable partitions—organoids—podiums and mezzanines are introduced, which not only divide the volume but also take on storage, traffic flow logistics and the formation of subspaces.
- Smart transformation. Engineering units with hidden mechanics (sliding blocks, lifting systems, rotating panels) ensure rapid reconfiguration: the daytime living room easily transforms into a nighttime sleeping module, and the workstation into a guest reception area.
- Perceptual correction and behavioral ergonomics. Techniques of light modelling, color gradation and

counterform contribute to the visual stretching of boundaries, reducing the claustrophobic effect of confinement; at the same time the neuropsychological aspect of field-of-view limitation is taken into account

- Sustainable material balance. Renewable or recoverable materials with a low carbon footprint are used, minimizing the environmental impact throughout the full life cycle of the object.

The objective justification of the necessity for such solutions is confirmed by demographic statistics: the share of households consisting of one- to two-person units in EU countries grows annually, while the average usable area per resident steadily decreases [3]. Under conditions of shrinking square meters, the traditional room-corridor-kitchen scheme proves to be structurally redundant.

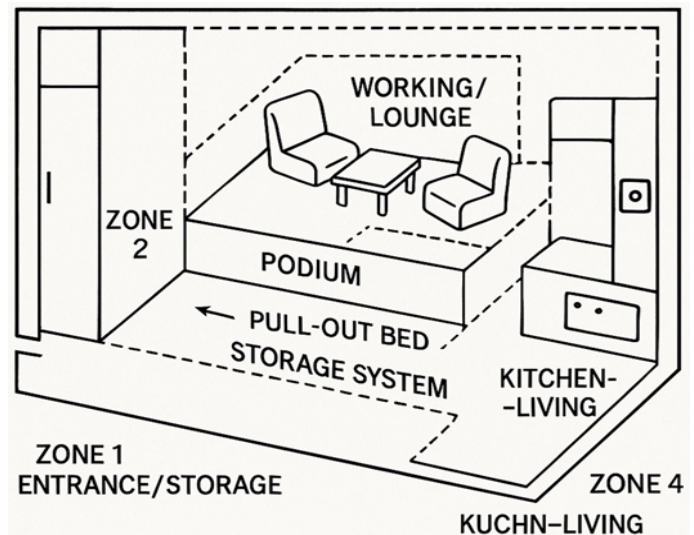
A classic example of microarchitectural intervention is a multifunctional podium at the core of the apartment. Its volume accumulates a pull-out bed or a compact storage system, while the upper horizontal transforms into a desk stand or a lounge platform. Vertical layering of this kind is critical for compensating the deficit of horizontal expansion: according to targeted experimental measurements, multi-level solutions increase the actual useful space index by 15–20 % without changing the external perimeter of the dwelling. Illustration of the described approach is shown in Fig. 1.

**Table 1.** Classification and effectiveness of transformable furniture in small spaces (compiled by the author based on [7, 8])

Type of furniture	Functional combination	Gain in usable area (estimate, %)	Psychological effect
Bed-wardrobe/wall	Sleeping place + storage system/workspace	30–40 % of bedroom area	Creates a sense of order, hides personal zone
Sliding table	Dining table + coffee/work table	50–70 % of table area	Increases flexibility of living room usage
Modular sofa	Seating + guest sleeping place + storage	15–25 %	Adaptability to number of guests, organization
Folding chairs/tables	---	up to 90 %	Minimization of visual noise, freeing passageways

The implementation of the described solutions indeed entails high start-up costs. Nevertheless, in the long term they are compensated by a noticeable increase in the functional capacity of the dwelling, which is in fact equivalent to an expansion of its usable area.

A key role in perceptual correction of confined space is played by the minimalist methodology. It has been experimentally confirmed that visual overload and informational noise intensify the cognitive fatigue of inhabitants and subjectively constrict the walls of the room, causing a feeling of claustrophobia [6]. Minimalism, on the contrary, is built upon the strategy of spatial editing under the motto less is more: the basic tools become the chromatic palette and lighting technology. Light monochrome surfaces of walls



**Fig. 1.** Scheme of micro-architectural zoning of a small-sized apartment (compiled by the author based on [1, 3, 7, 8]).

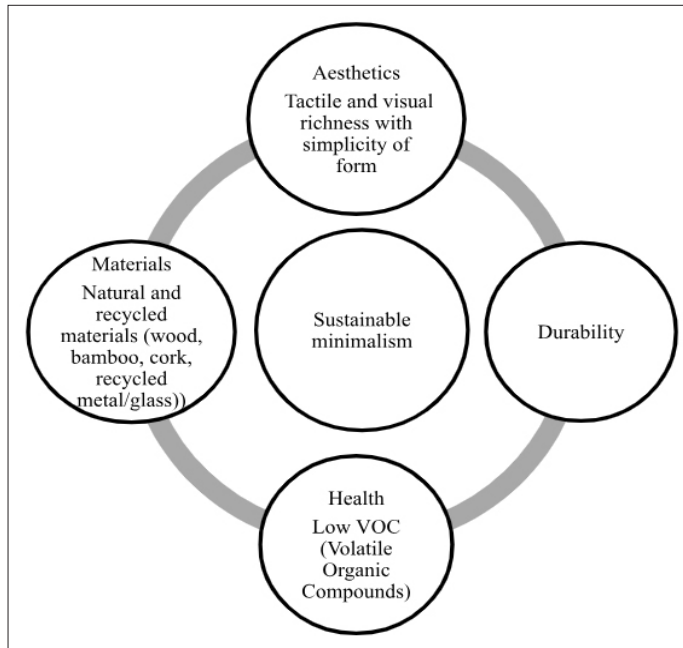
In a scenario-flexible apartment, transformable furniture plays a key role: its purpose goes far beyond the mere saving of square meters. In essence, it is an engineering-design response to the multifunctional rhythm of life of an urban resident, for whom the same room successively becomes a bedroom, a home office, a living room, or a space for informal communication. A comprehensive analysis of market offerings and specialized studies [7, 8] allows extracting and systematizing the main typological categories of such furniture, their structural representation is given in Table 1.

and ceilings, large-format mirrors, glossy textures and the eschewal of heavy draperies blur the boundaries of the premises, visually increasing the volume. Priority is given to natural illumination, therefore window openings are maximally unencumbered. The artificial lighting system is hierarchical: general (ceiling), functional (localized above work zones) and accent lighting (illumination of niches and art objects) allow flexible management of atmosphere and subdivision of the interior into semantic clusters. Changing only the lighting scheme and wall colour scheme leads respondents to evaluate the same space as more spacious and psychologically comfortable [4].

Finally, sustainability constitutes an integral link of the Microarchitecture & Minimalism concept. It manifests itself



both in the selection of materials and in the most ascetic attitude towards consumption. The popularization of renewable, recyclable and durable materials — wood, cork, natural stone, metal — satisfies environmental regulations [9, 10] and simultaneously resonates with the ethical stance of minimalism, which values honest texture and tactile authenticity. The complementary nature of these aspects is illustrated in Figure 2.



**Fig. 2.** Synergy of the principles of minimalism and sustainability in materials (compiled by the author based on [5, 8, 11, 12]).

Systematic reduction of consumption volumes, conscious renunciation of interior fast fashion and prioritization of high-quality, transformable items with an extended life cycle constitute a strategy that simultaneously reduces total household expenditures and minimizes the ecological footprint. Correlational analysis of consumer trends demonstrates that it is precisely the younger generation with an elevated level of environmental sensitivity that sets the vector toward sustainability, transforming the eco-friendliness criterion into a key parameter for the selection of goods [12].

Thus the integrative paradigm proposed in this work forms a comprehensive response to the challenges of designing compact housing: the emphasis shifts from superficial ornamentation to a meticulous spatial-functional logic in which each component possesses a multiplicity of use scenarios, and the holistic architectural-plastic system is subordinated to a single strategic objective — enhancing the quality of life of the urban resident within the dense fabric of the metropolis.

## CONCLUSION

The results of the present study demonstrate that the creation of interiors for compact urban apartments requires not simple decorating, but comprehensive design based on

the synthesis of microarchitectural strategies and minimalist aesthetics. This synthesis forms a scientifically grounded and technologically feasible methodology that simultaneously meets the ergonomic, psychological and social needs of occupants.

The microarchitectural component of the research revealed that the placement of podiums, mezzanines and mobile partitions unlocks the potential of the vertical volume of a space and effectively expands the functional scope of the apartment without altering its geometric boundaries. Multifunctional furniture assumed key importance: convertible sofa-beds, foldable workstations and modular storage systems flexibly adapt to changing life scenarios — from remote work to hosting guests — which is especially significant against the backdrop of the steady reduction in average dwelling sizes in European megacities.

The minimalist paradigm, regarded not only as a stylistic framework but also as a cognitive-psychological tool, contributes to the visual alleviation of space. A light neutral palette, multi-level natural and artificial lighting, thoughtful use of reflective surfaces and the deliberate rejection of visual noise minimize cognitive load and enhance the sense of spaciousness and tranquility. At the same time contemporary minimalism is organically aligned with the principles of sustainable development: the preference for durable, environmentally benign and recyclable materials advances the idea of conscious consumption and fosters a healthy indoor microclimate.

Testing the original hypothesis that the synergy of microarchitectural solutions and minimalist aesthetics creates a qualitatively new living environment confirmed its viability. The developed integrative concept Microarchitecture & Minimalism describes the interior as an adaptive dynamic system capable of compensating for space deficits and elevating the everyday comfort of urban residents. Thus the study makes a significant contribution both to the theory of architecture and interior design and to the practice of housing design for high-density urban contexts, offering a holistic response to one of the most pressing challenges of the modern metropolis.

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