

# Comfortable Architecture

## Redesigning How We Think About Comfort

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**Abstract** Comfort has been a cornerstone of architectural design, shaping how spaces influence human well-being physically, emotionally, and socially. This paper examines comfort as a dynamic and multidimensional concept, exploring its variations across different climates and the challenges associated with its excessive pursuit, such as isolation, stagnation, and environmental strain. The transformative role of discomfort is highlighted as a means to foster resilience, creativity, and connection. Furthermore, the paper discusses architectural strategies that balance comfort with sustainability, using case studies from tropical, temperate, and arid regions to provide actionable insights for reimagining comfort in the built environment.

**Index Terms**— Comfort, Discomfort, Adaptability, Sustainability, Rethinking

### I. INTRODUCTION

The concept of comfort has evolved alongside human civilization, adapting to the needs, climates, and cultures of different eras. What began as a necessity to protect against the elements has grown into a multifaceted idea, encompassing physical ease, emotional well-being, and cultural expression. While comfort has undoubtedly improved quality of life, its pursuit raises critical questions about affordability, equity, and sustainability. In a world facing environmental challenges and economic disparity, one pressing question emerges: *Can we still afford comfort?*

### II. LITERATURE REVIEW

The literature provides a comprehensive foundation for analyzing the topic of comfort in architecture by integrating various physical, cultural, and emotional aspects and addressing both traditional and modern perspectives. M. Santamouris, in *Cooling the Buildings – Past, Present and Future* (2016), offers an overview of the development of cooling systems in buildings, emphasizing the importance of energy efficiency and climate adaptation for the physical dimension of comfort. Simultaneously, A. Rapoport, in *The Meaning of the Built Environment: A Nonverbal Communication Approach* (1982), expands the discussion

by analyzing the built environment as a medium of nonverbal communication, demonstrating how cultural and emotional factors influence well-being.

B. Givoni, in *Passive and Low Energy Cooling of Buildings* (1992), presents practical approaches to passive and energy-efficient design, particularly focusing on traditional cooling techniques across different climate zones. This work complements the perspectives of B. Edwards in *Rough Guide to Sustainability: A Design Primer* (2014), who focuses on ecological materials and energy-efficient construction methods, emphasizing the relevance of sustainable architecture for comfort. Another focal point is the psychological aspect of comfort, addressed by M. Csikszentmihalyi in *Flow: The Psychology of Optimal Experience* (1990), which links the concept of "flow" with architectural features that enhance users' cognitive well-being.

The cultural dimension of comfort is highlighted by the Balinese philosophy of *Tri Hita Karana*, which emphasizes a harmonious relationship between humans, nature, and the divine. This principle is reflected in traditional Balinese architecture, characterized by open spaces, natural materials, and adaptation to the tropical climate. Additionally, the case study of the *Moriyama House* illustrates how deliberately incorporated elements of discomfort can foster social interaction and creativity.

C. Brown, in *Get Out of Your Comfort Zone: Externalization in Architecture to Increase Social and*

*Environmental Connectivity* (2021), explores the significance of externalization in architecture, demonstrating how spaces can be designed to strengthen social and ecological connections. Complementing this, S. R. Kellert, J. Heerwagen, and M. Mador, in *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (2008), emphasize the integration of natural elements into architecture to enhance aesthetic quality and improve user well-being.

Another critical aspect is discussed in M. Santamouris' *Urban Heat Islands: Understanding the Climate Impact of Cities* (2015), which examines the impact of urban heat islands on comfort and proposes passive cooling strategies as a sustainable solution. Finally, the article *Entanglements of Architecture and Comfort beyond the Temperate Zone* (2021) addresses the challenges and opportunities of designing for comfort in extreme climates, highlighting the need for context-sensitive approaches.

This literature thus provides an interdisciplinary perspective, connecting physical, emotional, cultural, and ecological aspects of comfort in architecture.

### III. METHOD

To derive the findings of the analysis on the topic of comfort in architecture, a systematic approach was adopted that critically examined various sources and placed them within a holistic context. The study focused on identifying and analyzing the key dimensions of comfort: physical, emotional, cultural, and ecological. These categories served as a framework for engaging with the referenced materials.

First, a thematic literature review was conducted to establish the foundations of comfort design. Texts such as Santamouris' *Cooling the Buildings* (2016) and Givoni's *Passive and Low Energy Cooling of Buildings* (1992) provided practical approaches to climatic and energy-efficient optimization. Rapoport's *The Meaning of the Built Environment* (1982) offered deeper insights into the cultural and communicative aspects of architecture. These theoretical insights were connected with specific case studies, such as traditional Balinese houses and the Moriyama House, to demonstrate practical relevance.

A central methodological step involved the comparative analysis of approaches across different climatic zones and cultural contexts. Traditional techniques, such as windcatchers in arid regions and natural ventilation in tropical climates, were juxtaposed with modern technologies like Passive House architecture. This comparison revealed both developments and continuities in the design of sustainable and context-sensitive architecture.

Furthermore, the role of emotions and social dynamics in shaping comfort was explored. Concepts like "Flow" (Csikszentmihalyi, 1990) and biophilia (Kellert et al., 2008) were utilized to illustrate how architectural elements can enhance cognitive and social well-being. This perspective was supplemented with practical examples, such as interactive spaces and flexible layouts, which promote both creativity and community spirit.

The investigation also addressed critical questions about the impact of excessive comfort orientation on the environment and society. Overuse of artificial systems, as discussed by Santamouris (2015), was linked to ecological challenges such as the urban heat island effect. Simultaneously, the inequities in access to comfortable living spaces were highlighted, emphasizing the need for affordable and sustainable solutions.

The findings were ultimately synthesized into a well-structured argument. Beginning with the definition and significance of comfort, the discussion transitioned to its adaptation to various climatic zones, before addressing challenges, the potential benefits of discomfort, and sustainable strategies. This methodological approach enabled a nuanced and contextualized analysis that bridged theoretical insights with practical relevance.

## IV. RESULTS AND DISCUSSION

### A. Defining Comfort and Its Importance

Comfort in architecture is a multidimensional concept that encompasses physical, emotional, and cultural dimensions. At its core, physical comfort involves maintaining optimal conditions for temperature, lighting, and ventilation. These factors directly affect how people interact with their environment and their ability to perform daily tasks. For instance, studies have shown that improper lighting can lead to eye strain and reduced productivity, while poorly ventilated spaces can cause discomfort, fatigue, and even long-term health issues (Santamouris, 2016). Emotional comfort goes beyond physical conditions, fostering feelings of safety, relaxation, and belonging. This dimension is often shaped by factors such as spatial layout, material choices, and acoustics. For example, warm colors, natural materials like wood, and soft lighting can evoke a sense of tranquility, while open layouts promote a feeling of spaciousness and freedom. Cultural comfort reflects the alignment of architectural design with local traditions, norms, and lifestyles. In tropical regions like Bali, comfort is deeply connected to harmony with nature, as exemplified by the concept of Tri Hita Karana. This philosophy emphasizes the balance between humans, their environment, and the divine, influencing the design of traditional Balinese homes with features like open courtyards and large roof overhangs. The importance of comfort lies in its ability to enhance quality of life. Comfortable environments reduce stress, support physical and mental health, and foster social cohesion. However, achieving comfort is not a one-size-fits-all endeavor. It requires architects to consider diverse human needs and adapt their designs to the specific climatic and cultural contexts in which they operate.

### B. Comfort in Different Climates

Architectural responses to comfort vary significantly depending on regional climates. Each climatic zone presents unique challenges and opportunities for design. In tropical regions, comfort often revolves around

mitigating heat and humidity. Traditional Balinese homes provide a prime example of how architecture can harmonize with the environment. These homes utilize lightweight materials like bamboo and thatch, which allow for natural ventilation, reducing the need for artificial cooling systems while also being resistant to earthquakes. Open layouts encourage airflow, while large roof overhangs offer shade and protect against heavy rainfall. Elevated platforms prevent dampness and improve air circulation beneath the structure. These design elements are not merely practical but also culturally significant, reflecting the Balinese philosophy of living in harmony with nature.

In temperate climates, comfort is achieved through a balance of insulation and ventilation. Modern Passivhaus designs in Europe illustrate how technology and traditional principles can combine to create energy-efficient homes. These buildings feature advanced insulation, triple-glazed windows, and airtight construction to minimize heat loss in winter and overheating in summer. Controlled ventilation systems ensure consistent indoor air quality and temperature. Additionally, renewable energy sources, such as solar panels, further enhance sustainability without compromising comfort.

Arid regions present a different set of challenges, primarily related to extreme heat and limited water resources. Traditional Middle Eastern architecture demonstrates how passive cooling techniques can maintain comfort in such environments. Windcatchers, or malqafs, are a hallmark of this design approach. These structures channel cool air into buildings, creating natural ventilation that reduces indoor temperatures. Thick stone or mud walls act as thermal mass, absorbing heat during the day and releasing it at night, maintaining a stable indoor climate. These strategies exemplify how traditional methods can address modern concerns about energy efficiency and environmental impact. The diversity of these approaches highlights the adaptability of comfort to regional needs and underscores the importance of context-sensitive design in achieving sustainable living environments.

### *C. Challenges Associated with Comfort*

While comfort is essential for human well-being, its excessive pursuit can lead to significant challenges. These issues often arise from over-reliance on artificial systems and a narrow focus on physical ease.

Modern architecture, particularly in urban settings, has increasingly favored climate-controlled, enclosed environments. While these spaces provide consistent comfort, they often disconnect occupants from the natural world and their communities. For example, high-rise apartments with sealed windows and centralized air conditioning limit opportunities for interaction with neighbors or outdoor spaces. This isolation can contribute to feelings of loneliness and a diminished sense of belonging.

Excessive comfort can also lead to psychological stagnation. Environments designed to eliminate challenges

often reduce the need for adaptation and problem-solving. Over time, this can erode resilience and creativity, as individuals become accustomed to predictable and controlled conditions. For instance, smart home technologies that automate tasks may improve convenience but can also diminish opportunities for engagement and skill development.

The environmental impact of comfort systems is another critical concern. Air conditioning, artificial lighting, and other energy-intensive technologies significantly contribute to greenhouse gas emissions. Urban heat islands, exacerbated by extensive use of cooling systems, further strain local ecosystems and increase energy demands.

Achieving comfort often requires substantial material resources, adding another layer of environmental strain. Insulation materials, while critical for improving energy efficiency, often come with high embodied carbon. Products like polystyrene and polyurethane, widely used for insulation, require energy-intensive manufacturing processes and are challenging to recycle, contributing to long-term waste management issues. Over-insulation can exacerbate these problems, where the environmental cost of producing and disposing of insulation materials may outweigh the operational energy savings over the building's lifecycle. These effects highlight the urgent need for sustainable alternatives that balance comfort with environmental responsibility.

Comfort in architecture often comes at a significant cost, making it an inaccessible luxury for many around the world. Advanced systems like air conditioning, high-performance insulation, and automated technologies require substantial financial investment, both in construction and maintenance. This economic barrier disproportionately affects low-income communities, where basic shelter needs often take precedence over comfort-enhancing features. The unequal distribution of resources highlights the global disparity in access to comfortable living environments, emphasizing the need for affordable solutions that balance comfort with equity and sustainability. Addressing this issue requires architects to design spaces that prioritize inclusivity, leveraging cost-effective and locally available materials to ensure comfort is not reserved for the privileged few.

### *D. The Role of Discomfort in Architectural Design*

Discomfort, though often viewed negatively, is an essential component of growth and adaptation. Architectural designs that incorporate elements of discomfort can foster resilience, creativity, and social connection.

Discomfort encourages individuals to adapt to changing conditions, building resilience over time. For example, spaces that require manual adjustments, such as operable windows or adjustable shading devices, engage occupants in managing their environment. This interaction fosters a sense of agency and connection to the space.

Apart from that, discomfort can also stimulate creativity by challenging individuals to think outside conventional

frameworks. Interactive spaces, such as flexible work environments or adaptive play areas, encourage users to explore and innovate. These designs often feature modular furniture or reconfigurable layouts, providing opportunities for experimentation and customization.

Unavoidable movement and fresh air can lead to the inhabitants feeling more alive. A great example of this is the Moriyama House.

Shared experiences of discomfort, such as communal living arrangements or collaborative workspaces, can strengthen social bonds. For instance, co-housing communities that prioritize shared kitchens or gardens promote interaction and cooperation among residents. These spaces balance individual needs with collective well-being, fostering a sense of community.

#### *E. Strategies for Sustainable Comfort*

Architectural strategies that balance comfort and sustainability are critical for addressing contemporary challenges. These approaches integrate passive design principles, natural elements, and flexible layouts to create environments that are both comfortable and ecologically responsible.

Biophilic design incorporates natural elements, such as plants, water features, and daylight, into built environments. This approach not only enhances aesthetic appeal but also improves air quality, reduces stress, and promotes a sense of connection to nature. For example, green walls and rooftop gardens can mitigate urban heat islands while providing visual and thermal comfort.

Designing spaces that adapt to changing needs encourages long-term sustainability. Multi-functional areas, such as rooms that can transition from living spaces to workstations, reduce the need for additional construction and resource use. This adaptability also promotes user engagement, as occupants can personalize their environment.

Passive design strategies, such as shading, natural ventilation, and thermal mass, minimize reliance on energy-intensive systems. These techniques are particularly effective in climates with extreme temperatures, offering sustainable solutions that align with local conditions. For example, traditional Balinese homes and Middle Eastern windcatchers demonstrate how passive strategies can achieve comfort without environmental strain.

Shared spaces, such as courtyards, gardens, and communal kitchens, encourage interaction and reduce resource consumption. These areas not only enhance social connectivity but also promote sustainable practices, such as shared energy use and waste reduction.

## V. CONCLUSION

### *A. Rethinking Comfort for a Sustainable Future*

Comfort has always been central to architectural design, serving as a measure of how effectively spaces cater to human well-being. However, as this paper has

demonstrated, the contemporary pursuit of comfort presents challenges ranging from environmental degradation and resource inequality to social isolation and psychological stagnation. The question posed in the introduction—*Can we still afford comfort?*—finds a nuanced answer here. The traditional model of comfort, with its reliance on energy-intensive systems and rigid notions of physical ease, is unsustainable. Yet, comfort itself remains indispensable, making it imperative to reimagine how it is achieved.

### *B. The Necessity of New Approaches to Comfort*

The unsustainable aspects of comfort—its environmental cost, resource inequity, and societal effects—demand innovative solutions. Discomfort, rather than being entirely avoided, can play a transformative role. By introducing elements of adaptability and challenge into design, discomfort fosters resilience, creativity, and social connection. This reframing shifts comfort from a static state of ease to a dynamic equilibrium, negotiated between individuals and their environments.

### *C. Towards Sustainable Comfort*

Balancing comfort with sustainability necessitates a multifaceted approach that integrates cultural, environmental, and economic considerations. Passive design strategies, rooted in local traditions and natural systems, offer a promising starting point. Examples such as the windcatchers of arid regions, open-plan Balinese homes, and insulated Passive Houses show how architecture can harmonize with its context to achieve comfort without reliance on artificial systems. These strategies not only mitigate environmental impact but also enhance the cultural relevance of designs.

Biophilic design further emphasizes integrating natural elements to create spaces that support both well-being and ecological stewardship. Features like green walls, rooftop gardens, and daylight optimization improve thermal and psychological comfort while addressing urban environmental challenges such as heat islands.

Adaptability is another key principle. Spaces that can evolve with their occupants' needs reduce the environmental and financial costs of reconfiguration. Multi-functional areas and flexible layouts encourage user engagement and ensure comfort remains accessible and relevant.

### *D. Equity and Inclusion in Comfort*

Affordability must also be central to rethinking comfort. The disparities in access to comfortable living spaces highlight the need for cost-effective and context-sensitive solutions. Locally sourced materials, simple passive techniques, and communal designs provide pathways to equitable comfort. Shared spaces, such as community kitchens or gardens, foster social bonds while distributing resource consumption, reducing individual burdens.

### *E. A Call for Innovation*

The future of comfort lies in embracing discomfort as an opportunity for growth and designing spaces that align human needs with ecological realities. Architects and designers must prioritize adaptive, context-sensitive approaches that challenge traditional norms and focus on long-term sustainability. This requires reimagining comfort not as a luxury but as a shared responsibility—one that balances human well-being with environmental care.

In conclusion, while the traditional pursuit of comfort is no longer viable, comfort itself remains essential. By adopting innovative strategies that integrate sustainability, adaptability, and equity, we can redefine comfort to meet the challenges of our time. Such a reimagining not only addresses the urgent need for environmental responsibility but also fosters spaces where individuals and communities can thrive, adapt, and grow.

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