

Parameters for Enhancing Biophilic Value in Biophilic Design

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Abstract

Biophilic design is a significant ecological paradigm that contributes to sustainability by strengthening the human–nature relationship. However, the limited biophilic value observed in human–nature–space interactions may result from designers' misinterpretation of the concept. As Kellert, one of the founders of the biophilic design paradigm, emphasized, biophilic design is not simply the addition of trees, plants, or natural décor to spaces. Although previous studies have investigated biophilic environments using virtual reality, they have primarily focused on their cognitive, neurocognitive, and wellness effects. This study re-examines the biophilic design paradigm by exploring Modernism's approaches to establishing connections between nature and architecture. Le Corbusier's proposals provide a key theoretical framework, emphasizing the understanding, interpretation, and abstraction of nature's laws rather than their direct imitation. The study investigates how these concepts correspond with specific parameters of biophilic design and how biophilic value can be enhanced through architecture. It proposes that integrating elements of biophilic design models with architectural paradigms can support a more comprehensive and accurate approach to biophilic design and ultimately enhance its value within architectural practice.

Keywords: Biophilic Design, Le Corbusier, Biophilic Parameters, Modernism.

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1. Introduction

1.1 Biophilia and Architectural Context

Biophilia is a hypothesis, put forward by Edward O. Wilson, about a "universal and intrinsic connection to nature"; this hypothesis describes the human tendency to form an emotional and physical bond with nature. According to Wilson, humans are evolutionarily predisposed to interact with natural processes and living systems, and severing this bond can lead to negative physical and psychological consequences. (Zhong, W., Schröder, T., & Bekkering, J. (2022).

Stephen R. Kellert and his colleagues were among the first scientists to apply this hypothesis to architecture as biophilic design. According to Kellert, biophilic design aims to make the built environment a "good habitat for the human biological organism," and in this process, it brings together the physical, sensory, and symbolic elements of nature. (Kellert, Calabrese, 2015).

Biophilic architecture is an approach that aims to strengthen the intrinsic, instinctive bond that humans have with nature (biophilia) through spatial design. In this context, elements such as natural light, air, greenery, water, material texture, and spatial continuity come to the forefront (Kellert, Heerwagen & Mador, 2008). Although Le Corbusier and Mies van der Rohe did not consciously treat biophilic architecture as a theory, their architectural approaches produced spatial potentials that coincided with this concept.

Modernist spatial principles, while not directly intended for biophilic purposes, offer a structural infrastructure that supports biophilic experience through spatial continuity, light access, and environmental permeability. For example, Pilotis elevates the structure, transforming the ground into an ecological and social interface. The open plan enhances the individual's capacity to perceive their environment, fostering a sense of biophilic security. Strip windows create an uninterrupted visual connection with nature, enhancing physiological and psychological well-being. The roof garden directly generates biophilia by transforming the modernist structure into an ecological surface. Therefore, Modernist architecture, without directly aiming for biophilic causes, may produce a latent infrastructure that enables biophilic experience through spatial organization. Rather than positioning modernism as antithetical to nature, this study argues that its spatial principles—particularly pilotis, spatial organization, and ribbon windows—constitute a latent biophilic framework that enhances environmental perception, daylight penetration, and ecological continuity when interpreted through contemporary biophilic design theory.

Recent studies demonstrate that biophilic design enhances well-being through spatial parameters such as daylight access, natural ventilation, and indoor–outdoor connectivity. (Zhong et al, 2022). While these parameters are typically discussed within contemporary sustainability frameworks, this paper argues that they are not exclusive to recent paradigms. Instead, modernist architectural principles—such as pilotis, free plan, and ribbon windows—already produce these environmental conditions. Therefore, modernism can be reinterpreted not as an anti-nature paradigm, but as a latent biophilic framework that spatially enables human–nature interaction.

Although extensive research exists on biophilic design and modernist architecture independently, their systematic integration remains underexplored. This study reframes modernism not as a rupture from nature, but as an overlooked spatial system capable of supporting biophilic experience when interpreted through contemporary environmental psychology. Recent studies have demonstrated that spatial parameters such as daylight, natural ventilation, and visual connection to nature significantly enhance human well-being (Zhong et al., 2022; Zhang et al., 2022). Furthermore, biophilic environments have been shown to reduce stress and improve cognitive and physiological performance (González-Lezcano et al., 2024; Valor et al., 2024). In this context, the value of biophilia is expected to increase as interactions with nature and connection to nature meet the parameters of biophilic design. Current studies on architectural implications and biophilic design parameters are progressing by drawing support from Kellert's biophilic design models.

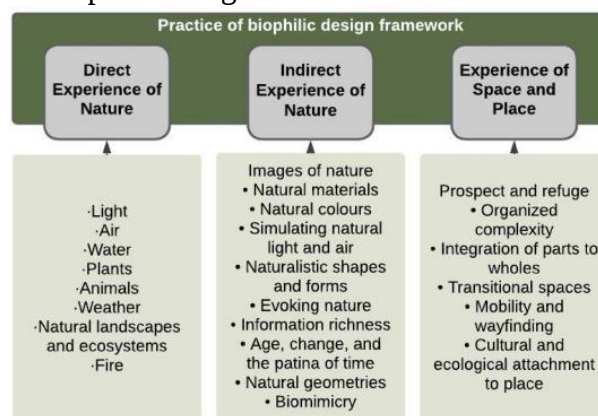


Figure 1. Kellert's Biophilic Design Model (Kellert, 2008).

1.2 Problem Statement and Research Gap

This study employs a qualitative research methodology combining qualitative content analysis, comparative case study, and interpretative phenomenological analysis (IPA). Modernist architectural

principles developed by Mies van der Rohe and Le Corbusier are systematically re-evaluated through a biophilic framework. Selected architectural works are analyzed using a coding scheme derived from biophilic design parameters, including visual connection with nature, spatial fluidity, natural light, and materiality. The findings are further interpreted through a phenomenological lens to reveal the experiential transformation from perceptual estrangement to biophilic awareness. This multi-layered qualitative approach enables a theoretical re-reading of modernism as a latent biophilic system.

1.3 Objectives and Hypotheses

In this study, Rohe and Le Corbusier's approaches, which have the potential to increase biophilic value, have been evaluated as biophilic parameters. Le Corbusier's Five Points of a New Architecture Manifesto, in particular, has been evaluated in a biophilic context as an enhancing pattern. These questions were examined step-by-step in the research methodology:

In what ways does Le Corbusier's perspective align with the parameters of biophilic design?

How can Le Corbusier's perspective contribute to enhancing biophilic value?

How have Le Corbusier's contemporaries in the modern era approached architecture in the context of establishing a relationship with nature?

Can we find parameters in Rohe's modernist approaches that could enhance biophilic value?

How can the modern approach be interpreted in the postmodern era to enhance biophilic value?

The study is limited to the modernist approach of the two architects and modernism related to the biophilic design paradigm of Kellert, etc.

1.4 Significance and Structure of the Paper

This research establishes a conceptual framework that reinterprets modernist spatial parameters through a biophilic lens, revealing previously unarticulated relationships between architectural form and human–nature interaction. While biophilic design research has extensively identified environmental factors such as daylight, ventilation, and visual connectivity as essential to well-being, these parameters have rarely been examined in relation to modernist spatial logic. By mapping modernist principles—such as pilotis, free plan, and ribbon windows—to biophilic performance criteria, this study demonstrates that modernism inherently produces spatial conditions aligned with biophilic design. This reinterpretation not only generates new theoretical insight but also offers practical design strategies for integrating biophilic performance into contemporary architectural practice.

The study introduces the notion that modernist architecture contains a latent biophilic capacity, which becomes visible when evaluated through environmental psychology and biophilic design frameworks.

The findings translate into actionable design strategies, suggesting that reinterpreting modernist elements such as elevating buildings to enhance ground-level permeability or maximizing horizontal openings for daylight continuity can serve as effective tools for achieving biophilic performance without necessitating additional formal complexity.

The study adopts an analytical mapping method that correlates spatial properties derived from modernist principles with empirically validated biophilic parameters, enabling a cross-disciplinary synthesis between architectural theory and environmental psychology.

This study contributes to the literature by proposing a novel mapping framework that links modernist spatial principles with biophilic design parameters, thereby reframing modernism as a latent environmental system capable of supporting human well-being.

Table 1. Le Corbusier's architectural approaches aimed at strengthening the relationship between humans and nature

The Five Points of a New Architecture (1927)	As a Biophilic Approach
Pilotis (columns/stilts)	Lifting the structure off the ground and freeing the soil

Free plan	Flexible relationship of the space with nature
Free façade	Free relationship with landscape and light
Ribbon windows (veya <i>horizontal windows</i>)	Continuous nature view
Roof garden	Recovering the nature lost within the building

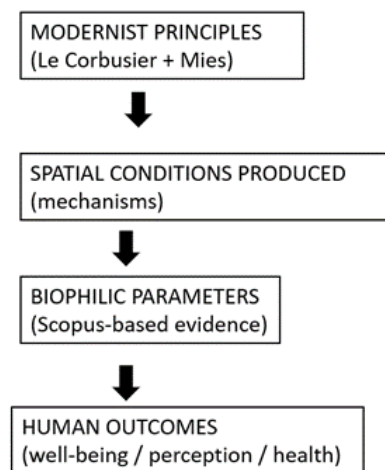


Figure 2. Structure of the Study.

1.5 Stages at Le Corbusier's Modernism

Modernist architecture, as articulated by Le Corbusier and Ludwig Mies van der Rohe, has traditionally been associated with functionalism, abstraction, and technological rationality. Canonical principles such as pilotis, free plan, ribbon windows, and free façade have been extensively analyzed in terms of structural innovation and spatial efficiency. However, modernism is frequently critiqued for its perceived detachment from nature and its role in reinforcing the separation between built and natural environments. This interpretation, while influential, overlooks the environmental and spatial consequences of modernist design strategies. For instance, features such as large horizontal openings, open floor plans, and elevated structures inherently enhance daylight penetration, visual continuity, and airflow—conditions that contemporary research identifies as core components of biophilic design. Yet, these overlaps remain largely unexamined within the literature.

Although extensive research exists on both biophilic design and modernist architecture, these domains have largely evolved in parallel rather than in dialogue. Current literature lacks a systematic framework that maps modernist spatial principles onto empirically validated biophilic parameters. As a result, the potential alignment between modernist spatial logic and biophilic performance remains underexplored.

This gap is particularly significant given the growing demand for sustainable and human-centered design strategies. Existing studies tend to frame biophilic design as a contemporary intervention, often requiring additional technological or ecological systems. However, the possibility that historical architectural paradigms may already embody biophilic potentials has not been sufficiently investigated.

Addressing this gap requires a conceptual shift from viewing biophilic design as a set of applied strategies to understanding it as a spatial condition that can emerge from architectural organization itself. Recent literature calls for integrative approaches that bridge environmental psychology and architectural theory, enabling a more holistic understanding of human–environment interaction.

In response, this study proposes a mapping framework that links modernist architectural principles with biophilic spatial parameters. By establishing correlations between design strategies such as pilotis, free plan, and ribbon windows and environmental conditions such as airflow continuity,

daylight access, and visual permeability, the research aims to reveal a previously unarticulated relationship between modernism and biophilic design.

Through this integrative perspective, modernist architecture can be reconsidered not merely as a historical movement, but as a latent spatial system capable of supporting biophilic experience. This reframing provides both a theoretical contribution to architectural discourse and a practical foundation for developing design strategies that enhance human well-being within contemporary built environments

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1.5.1 Pilot lifts the structure off the ground, freeing up the soil.

Le Corbusier's approach of elevating the structure above ground level and treating it as a platform is a significant step in a biophilic context. This method contributes to the sustainability of the natural habitat on the ground because the structure does not come into contact with the soil when construction occurs in nature. Even with the structure rising above, the soil can still breathe. Since wind and air circulation continue through the gaps between the structure and the ground, the ecology of the area is not significantly affected by this construction.

The organisms in the habitat can take shelter under the structure, live under it or underground if their living conditions are suitable, and use it as a sheltered area to store food. This can function as an ecological pocket for them, serving as a refuge and observation area. This can be interpreted as an adaptation of Kellert and Ryan's "prospect and refuge" concept for humans in biophilic design, applied to living organisms. In reality, this space (in between), which we might call a "lost space" for the human species, can serve other living organisms in a biophilic context.

The structure's interruption of the soil's connection with the sun can increase the area's values, such as wind pressure and humidity, potentially allowing it to host different species of living things that did not previously inhabit the area. The species that grow in the interstitial space can contribute to the region's ecological biodiversity. Even mushroom species that can grow in the area could offer opportunities for new bio-innovation projects in an ecological context. While the structure's relationship with the climate may not be applicable in every region (e.g., hot climates), when considered within the context of a building block, it can contribute to the formation of microclimatic areas and sustainability.

While Villa Savoye (1929) is the most prominent example of pilotis, the Unité d'Habitation project presents the idea of pilotis on an urban scale. These structures, in the context of the building's relationship with the environment and people, allow for increased environmental mobility (circulation of living things and people) and free movement on the ground floor by leaving the ground floor empty. In an ecological context, the building's hesitant approach to touching the soil highlights the architect's ecological responsibilities in this interaction.



Figure 3. (a) Villa Savoye; (b)- Unité d'Habitation.

Table 2. Comparison of two of Le Corbusier's works from the perspective of their natural and theoretical approaches.

Criteria	Villa Savoye	Unité d'Habitation
Role of Nature	View / Landscape	Part of everyday life
Mode of Relationship	Framing	Reproduction / Re-creation
Scale	Individual	Collective
Theoretical Approach	Early Modernism	Social Modernism

According to Alan Colquhoun, the difference between these two projects lies in Le Corbusier's effort to move nature from being merely an aesthetic or framing reference in architecture to becoming a social foundation. William J. R. Curtis describes the Unité d'Habitation project as the most prominent example of Le Corbusier's effort to "concentrate nature within a vertical city." When examined within the framework of biophilic design, an approach that allows nature to flow into the building, rather than viewing nature as a landscape, offers a higher biophilic value in terms of ecological and social sustainability.

Methodologically, the study employs an analytical mapping approach that correlates modernist architectural principles with established biophilic parameters derived from recent scientific literature. By constructing a relational framework between these domains, the research identifies how specific spatial mechanisms—such as elevating structures to enhance ground-level permeability or maximizing horizontal openings for visual continuity—translate into measurable environmental and experiential outcomes. This cross-disciplinary synthesis enables a more nuanced understanding of how architectural form mediates human–environment interaction.

The contribution of this study is twofold. First, it offers a novel conceptual framework that bridges modernist architectural theory and biophilic design research, addressing a gap in the current literature where these domains remain largely disconnected. Second, it translates this theoretical insight into practical design strategies, demonstrating how reinterpretations of modernist elements can inform contemporary architectural practice without necessitating additional formal complexity. In doing so, the paper reframes modernism as an overlooked environmental system, capable of supporting human well-being through its inherent spatial logic.

By repositioning modernist architecture within the discourse of biophilic design, this research not only expands the theoretical boundaries of both fields but also provides a critical foundation for re-evaluating existing architectural paradigms in light of contemporary environmental and human-centered design priorities.

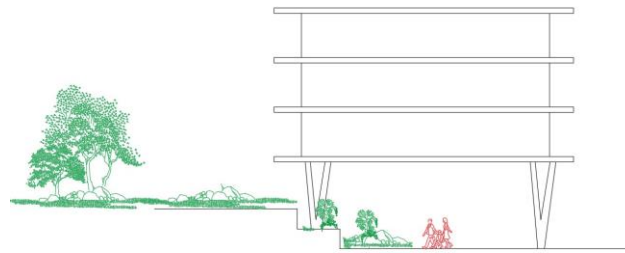


Figure 4. The integration of nature into the building, engagement with nature in lower basement levels

1.5.2 Free plan

Le Corbusier's free-plan approach holds the potential to be a functional, rational, and producible model of modern life. Mies van der Rohe's free-plan approach, on the other hand, offers a timeless and abstract architectural language reduced to the essence of space (Schulze & Windhorst, 2012). Both models form the basis of modern architecture; however, one prioritizes programmatic freedom, while the other prioritizes spatial experience.

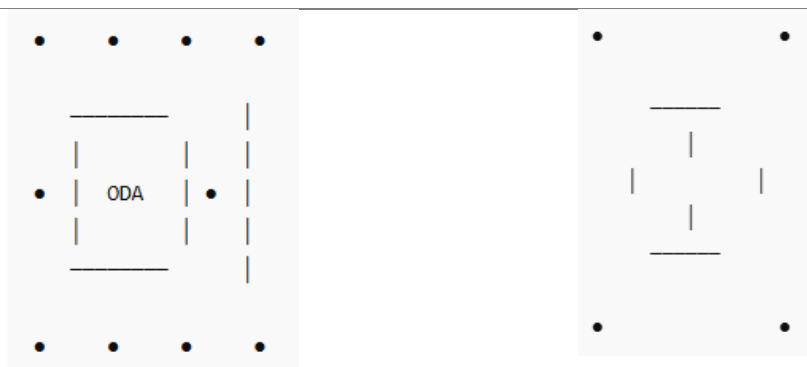
Table 3. Comparison of Le Corbusier's and Rohe Free Plan Approach

Le Corbusier	Mies van der Rohe
Prominent column grid	Recessed columns
Function-oriented plan	Perception-oriented space
Active partition walls	Free planes
Rational organization	Spatial continuity

Le Corbusier's concept of a free plan is based on resolving the load-bearing system as a column-slab skeleton, thereby freeing interior partition walls from their load-bearing function. This allows the plan to be conceived independently of structural necessities. Mies van der Rohe's free plan, unlike Le Corbusier's, focuses more on spatial experience than functional diagrams. The load-bearing system is legible; however, the interior space is defined by free-standing planes rather than fixed rooms. Rohe defines this approach as "Architecture is the will of an epoch translated into space."

Table 4. Comparison of Le Corbusier's and Mies van der Rohe's Free Plan Approach

<i>Le Corbusier's Free Plan</i>	<i>Mies van der Rohe's Free Plan</i>
• Minimum structure • Planes defining space instead of walls • Interior-exterior continuity	• Steel columns (positioned at the periphery or rear) • Lines: Non-load-bearing, space-directing surfaces • The space is not divided into individual rooms • Visual and spatial continuity is essential



In Mies's free plan, load-bearing columns are mostly positioned in a way that does not disrupt spatial perception; the interior space is guided by non-load-bearing free planes (glass, wood, or stone surfaces). These planes create a fluid spatial unity rather than dividing the space. This approach forms the basis of Mies's concept of "universal space" (Frampton, 2007).

This approach involves enhancing biophilic value through materials. At the same time, the perception of space as a whole contributes to the individual's experience of a more protected and free space, making it a highly biophilic proposition.

In Rohe's plan diagrams, closed room schemes are replaced by spaces with blurred boundaries and visually interconnected spaces. In the Barcelona Pavilion, the plan is read not through walls, but through the positioning of material surfaces and the relationship between emptiness and solidity. The blurring of boundaries between interior and exterior spaces strengthens the perceptual dimension of the free plan (Curtis, 1996). Le Corbusier's free-plan concept addresses the relationship with nature within a controlled and rational framework. By removing load-bearing walls from the interior, the free-plan allows daylight and air to spread more deeply within the space. This aligns with the concept of indirect experience of nature as defined in biophilic architecture (Kellert, 2008).

In the case of Villa Savoye, spaces are visually connected through a free plan; nature is experienced within an architectural framework through horizontal band windows and terrace gardens. However, this relationship is conceived as a composition controlled by the architect, rather than the spontaneity of nature. In Le Corbusier, nature is often incorporated into the architectural order as a geometric and idealized element (Curtis, 1996).

Mies van der Rohe's free plan approach establishes a more direct and perceptual relationship with biophilic architecture. The fact that the space is not limited by fixed walls leads to the blurring of boundaries between interior and exterior spaces. This situation shows a strong parallel with the concept of direct experience of nature defined in biophilic design (Kellert et al., 2008).

In the case of Farnsworth House, the plan is almost entirely resolved within a transparent shell; nature becomes not a landscape around the building, but an integral component of the space. Thanks to the free plan, the user experiences the landscape in a visual continuity uninterrupted by structural elements. Mies's conception of space produces integration and awareness with nature in a biophilic context (Frampton, 2007). However, this approach also has a critical dimension. The fact that Farnsworth House is problematic in terms of climatic comfort and user needs shows that biophilic design should not be limited only to visual relationships. This situation reveals that Mies's free plan has a strong, but limited, biophilic potential (Schulze & Windhorst, 2012).

When evaluated in a biophilic context:

- Le Corbusier treated nature as a controlled part of the architectural order; he used the free plan as a tool to rationally incorporate light, air, and greenery into the space.

- Mies van der Rohe, on the other hand, made nature an active element defining the boundaries of space through the free plan; he tried to establish a more direct relationship with nature by minimizing the distinction between inside and outside. Therefore, the free plan has an indirect and regulatory quality from a biophilic perspective in Le Corbusier, while it has a direct and perceptual quality in Mies.

Table 5. A comparison of Le Corbusier and Mies van der Rohe's approaches within modern architecture — particularly in terms of their relationship with nature and spatial design.

Criteria	Le Corbusier	Mies van der Rohe
Relationship with Nature	Indirect / controlled	Direct / permeable
Role of the Free Plan	Regulative / organizing	Interface
Biophilic Experience	Movement and sequence	Perception and continuity
Modernist Approach	Rational	Minimalist

Table 6. Different Spatial and Biophilic Design Strategies of Le Corbusier and Mies Van der Rohe

Le Corbusier	Mies van der Rohe
☐ Column grid	☐ Minimal structure
☐ Wall + plan	☐ Surface + flow
☐ Nature → filter → space	☐ Nature ⇌ space
☐ Indirect biophilic relationship	☐ Direct biophilic relationship

Designers apply the free-plan approach in biophilic designs. However, especially in projects with high floor areas, they address this by placing greenery and green elements in the central areas of the plan. At this point, it still cannot go beyond being a visual element. However, allowing nature to flow into the structure (through atriums, galleries), nourishing the green texture and establishing a relationship with light, and treating it as living nature will increase the biophilic value.

Presenting the floor height in living spaces as double the height with galleries will strengthen the perception of light and human circulation in the space. Individuals will be able to perceive other individuals and living things more clearly and uninterruptedly, preventing them from feeling alone in the space. Therefore, these are proposals with high biophilic value.

Terraces and winter gardens, as observable areas, offer a visual green relationship with the spaces, which are proposals with high biophilic value. (Figure 3). The observability of circulation elements such as stairs and ramps emphasizes the dynamism of the space and encourages movement by allowing people to see movement, thus presenting nature within the structure in an open-plan concept, which is a proposal with high biophilic value. In a free-plan design, solutions with galleries and upper atriums are highly biophilic in nature, enhancing mobility and a green aesthetic. (Figure 3,b,c).

Recent studies indicate that open-plan spatial configurations have a measurable impact on psychological and cognitive outcomes, although these effects are highly dependent on environmental conditions. In biophilic open-plan environments, exposure to natural elements such as daylight, vegetation, and external views has been shown to enhance well-being, increase vigor, and improve cognitive performance (Valor et al., 2024; Bianchi et al., 2024). Conversely, poorly configured open-plan layouts—characterized by high density, lack of privacy, and acoustic disturbance—can negatively affect attention and increase stress levels. These findings suggest that the impact of free-plan modernist spatial logic is not inherent to openness itself, but rather to the environmental qualities it enables, particularly visual continuity, spatial legibility, and connection to nature.

1.5.3 Free facade - Direct relationship with landscape and light.

“For Le Corbusier, the free facade is less a technological freedom and more a means of establishing architectural order.” (Curtis, 1986) Mies’s conception of the free facade, unlike Le Corbusier’s, is phenomenological, not compositional. “Le Corbusier orders the facade, while Mies tries to eliminate it.” (Frampton, 1995, 2001)

Table 7. Free Façade Strategies of Le Corbusier and Mies Van der Rohe

FEATURE	LE CORBUSIER	MIES VAN DER ROHE
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Functional Role	Façade independent yet used as an instrument of ordered composition	Façade almost disappears or becomes a fully transparent screen
Structural Solution	Pilotis + reinforced concrete frame separating structure from façade	Steel / steel-and-glass skeleton allowing maximum openness
Aesthetic Aim	Expressive and compositional freedom	Spatial transparency and minimal form
Spatial Perception	Interior–exterior distinction remains clear	Boundaries between interior and exterior become blurred
Example	Modernist houses such as Villa Savoye	Minimalist spaces such as Barcelona Pavilion

In the Barcelona Pavilion, the facade is completely separate from the load-bearing system; the glass, as a separating element, ensures the continuity of the interior space. The facade is part of the spatial experience, not a surface. Therefore, in Mies, the free facade produces transparency and spatial flow. In Mies van der Rohe, the free facade is not merely a structural result, but an ontological architectural problem: a spatial answer to the question, "What is architecture?" Detlef Mertins describes Mies' approach as follows: "In Mies, the facade is not the face of the building; it is the boundary condition of space." (Mertins, Mies, 2014) In Le Corbusier, the free facade is the transformation of structural freedom into architectural composition. In Mies van der Rohe, the free facade is the transformation of structural freedom into spatial experience. Therefore, both architects use the "free facade"; however, Le Corbusier establishes order, Mies dissolves boundaries. "While Le Corbusier represents modernism, Mies questions modernism." (Colquhoun, 2002)

Table 8 Foundations of Le Corbusier and Mies Van der Rohe related to Biophilic Context

Criteria	Le Corbusier	Mies van der Rohe
Theoretical Aim	Architectural order and proportion	Spatial clarity
Role of the Façade	Compositional plane	Spatial boundary
Interior–Exterior Relationship	Separated	Continuity
Aesthetic Approach	Plastic and ordered	Minimal and abstract
Philosophical Background	Rationalist modernism	Phenomenological modernism

The impact of biophilic design is not limited to interior applications; through the exterior facade, natural light, natural views, and connection with nature positively influence the adaptation of space users to their environment. (Zhong 2022) Building facades enriched with natural elements can offer benefits such as reducing stress levels, increasing psychological well-being, and enhancing aesthetic experience for individuals within the building. (Zhong 2022)

The modernist concept of a free facade, on the other hand, provides richness in architectural composition by separating the structure from the facade. When combined with a biophilic perspective, this free surface can transform into a "nature interface" that strengthens human health and psychology; thus, aesthetic, technical, and bio-psychological benefits can be considered together. This connection with nature is achieved not only through plant or green surface applications but also through the holistic integration of light, air, natural forms, and sensory elements. (Kellert 1995) In this context, while green architecture adds greenery to the free-standing facade, planning this interface as an ecological interface that lives in symbiosis with living organisms, where living organisms can reside and seek refuge when necessary, will increase its biophilic value.

1.5.4 Ribbon window

The horizontal band window arrangement was introduced in Le Corbusier's 1926 manifesto, *Five Points of a New Architecture*. Horizontal windows offer lighting and panoramic views by eliminating load-bearing walls. Le Corbusier did not see horizontal windows as merely an aesthetic preference in modern architecture. In his manifesto, he defines this principle as a result of the new facade design where the wall is eliminated; this allows the interior space to better interact with light and enriches the user experience (Benton, 1987).

In modern architecture, the facade is considered not as a "load-bearing surface" but as a thin shell (Benevolo, 1971). It functions as a parameter that allows the relationship between light and landscape to be transferred to the space. Establishing an uninterrupted relationship with the landscape is a step that will increase the biophilic value. However, the step that will truly increase the biophilic value is to use the window not only as a biophilic tool that connects with the landscape and light, but also as a tool that allows nature to permeate the interior. Nature infiltrates the interior of all types of structures by creating voids in their lower levels.

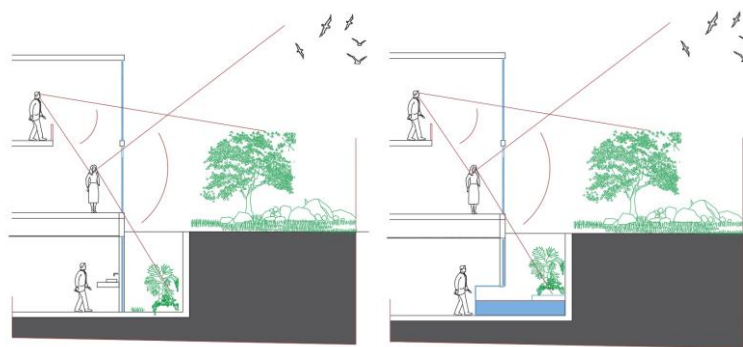


Figure 5. In the lower levels and in the bathrooms on the lower levels, the lowering of the floors allows nature to seep into the lower levels, enabling biophilic objects such as pools to infiltrate the space and transform into furniture.

1.5.6 Rooftop gardens and ecological terraces

For Le Corbusier, the rooftop garden is defined as "a direct space for relating to nature through plants, the sky, and the sun"; a connection is established where the urban and natural environments merge. This shows that the rooftop garden goes beyond being "just a roof" and becomes a space that integrates both mind and body with nature (Como, Perrota, 2017). In a biophilic context, considering the rooftop terrace not merely as an aesthetic or functional extension, but as "an architectural tool for establishing contact with nature," is an approach with high biophilic value.

When examined in an ecological context, according to Benton (2012), Le Corbusier observed the natural development of plants left to their own devices with seeds carried by birds on the rooftop soil, and this experience created a significant intellectual transformation for him, leading him to consider rooftop gardens as active landscapes that allow nature to continue its own processes. At this point, the user can interpret the nature experience as a *simsiosis* space where they witness the process as a platform for interaction with other living things. In the context of ecological experience, the rooftop terrace is organized as a space for natural processes. (Sentkiewicz, 2019). This is also a parameter with high biophilic value. This rooftop garden concept emphasizes that the architectural space is not merely a boundary between the building and the environment, but an interface between two worlds — the city and nature. To enhance the biophilic value of this interface, the terrace extends beyond being just a space on the roof to all planes (vertically as well) where it can harmonize.

Terraces enhance the biophilic value as eco-planes where wind flow is experienced, the control of the sun and climate is experienced, and ecological biodiversity is located (where living things nest). If necessary, a second building shell (mesh) can be proposed as an interface symbiosis area in buildings

to maintain the continuity of the flow of nature into the city. This approach will also increase the biophilic value because it diversifies the area ecologically.

1.5.7 Cultural Context

The findings of this study suggest that modernist spatial principles can be reinterpreted as a latent framework capable of supporting biophilic performance. However, this reinterpretation raises a critical question regarding the universality of such a framework when applied across diverse environmental and cultural contexts. While the mapping model establishes a consistent relationship between spatial configurations and biophilic parameters, its effectiveness is not uniform and must be understood as context-dependent.

From a climatic perspective, the performance of spatial parameters such as openness, permeability, and daylight access varies significantly across environmental conditions. Previous research has demonstrated that biophilic design strategies, including natural ventilation and daylight optimization, are highly sensitive to climatic variables such as temperature, humidity, and solar exposure (Zhang et al., 2022; Zhong et al., 2022). For example, while pilotis and open ground planes can enhance airflow and thermal comfort in hot-humid climates, these same features may lead to heat loss and reduced comfort in colder regions. Similarly, extensive horizontal glazing—aligned with the modernist principle of ribbon windows—has been associated with improved well-being through daylight access and visual connection to nature, yet can also introduce glare and overheating if not carefully moderated (Zhang et al., 2022). These findings indicate that the biophilic potential of modernist parameters is contingent upon environmental calibration rather than inherent spatial properties alone.

Beyond environmental factors, cultural variability plays an equally significant role in shaping spatial perception and biophilic experience. Environmental psychology research emphasizes that spatial preferences, perceptions of comfort, and interpretations of openness are deeply influenced by socio-cultural norms and behavioral patterns (González-Lezcano et al., 2024). While modernist architecture privileges transparency, fluidity, and visual continuity, these qualities are not universally associated with well-being. In certain cultural contexts, spatial enclosure, gradation, and layered thresholds are essential to creating a sense of security and belonging. This challenges the implicit assumption that openness and visual exposure—often linked to the concept of prospect—are universally desirable. Instead, the balance between prospect and refuge must be understood as culturally mediated, requiring adaptive interpretations of spatial configurations.

Furthermore, vernacular architectural traditions across different regions already embody climate-responsive and biophilic principles through spatial strategies such as courtyards, shaded semi-open spaces, and transitional zones. Recent studies have highlighted the importance of these intermediate spaces in fostering environmental connection and enhancing thermal comfort (Fisher, 2024). Integrating the proposed mapping framework with such vernacular logics offers a pathway toward increasing its contextual relevance. Rather than positioning modernism as a universal solution, the framework can be understood as a complementary analytical lens that reveals underlying spatial relationships shared across different architectural traditions.

This perspective shifts the focus from formal universality to relational adaptability. The key contribution of the framework lies not in prescribing specific architectural forms, but in identifying transferable spatial conditions—such as airflow continuity, daylight modulation, and visual connectivity—that can be achieved through multiple design approaches. In this sense, the framework aligns with recent calls in the literature for more integrative and context-sensitive models of biophilic design that move beyond standardized applications (Zhong et al., 2022).

At the same time, the discussion highlights a limitation in the current study: the absence of empirical validation across diverse geographic and cultural settings. While the theoretical mapping establishes a plausible relationship between modernist spatial principles and biophilic parameters, its contextual performance remains to be tested. Future research should therefore adopt comparative methodologies, including cross-climatic case studies, post-occupancy evaluations, and user-centered assessments, to examine how these relationships manifest in different environments. Such approaches would enable a

more nuanced understanding of how spatial configurations interact with local conditions and user perceptions.

Ultimately, the findings suggest that the universality of the proposed framework should not be understood as a fixed or homogeneous applicability, but rather as a capacity for adaptation. By reframing modernist architecture as a system of spatial potentials rather than a set of rigid formal prescriptions, the study contributes to a broader discourse that emphasizes flexibility, responsiveness, and contextual integration in architectural design. This reinforces the notion that biophilic design is not a universal aesthetic language, but a dynamic process shaped by environmental, cultural, and perceptual factors.

4. Discussion

As illustrated in Figure 6, spatial conditions produced by modernist principles—such as airflow continuity and daylight access—are directly supported by recent empirical studies in building science. For example, cross-ventilation and natural airflow have been shown to significantly improve indoor air quality and thermal comfort (Zhang et al., 2022), while access to daylight and natural views contributes to stress reduction and enhanced well-being (Zhang et al., 2022). These findings confirm that the spatial mechanisms embedded in modernist architecture correspond closely to validated biophilic parameters.

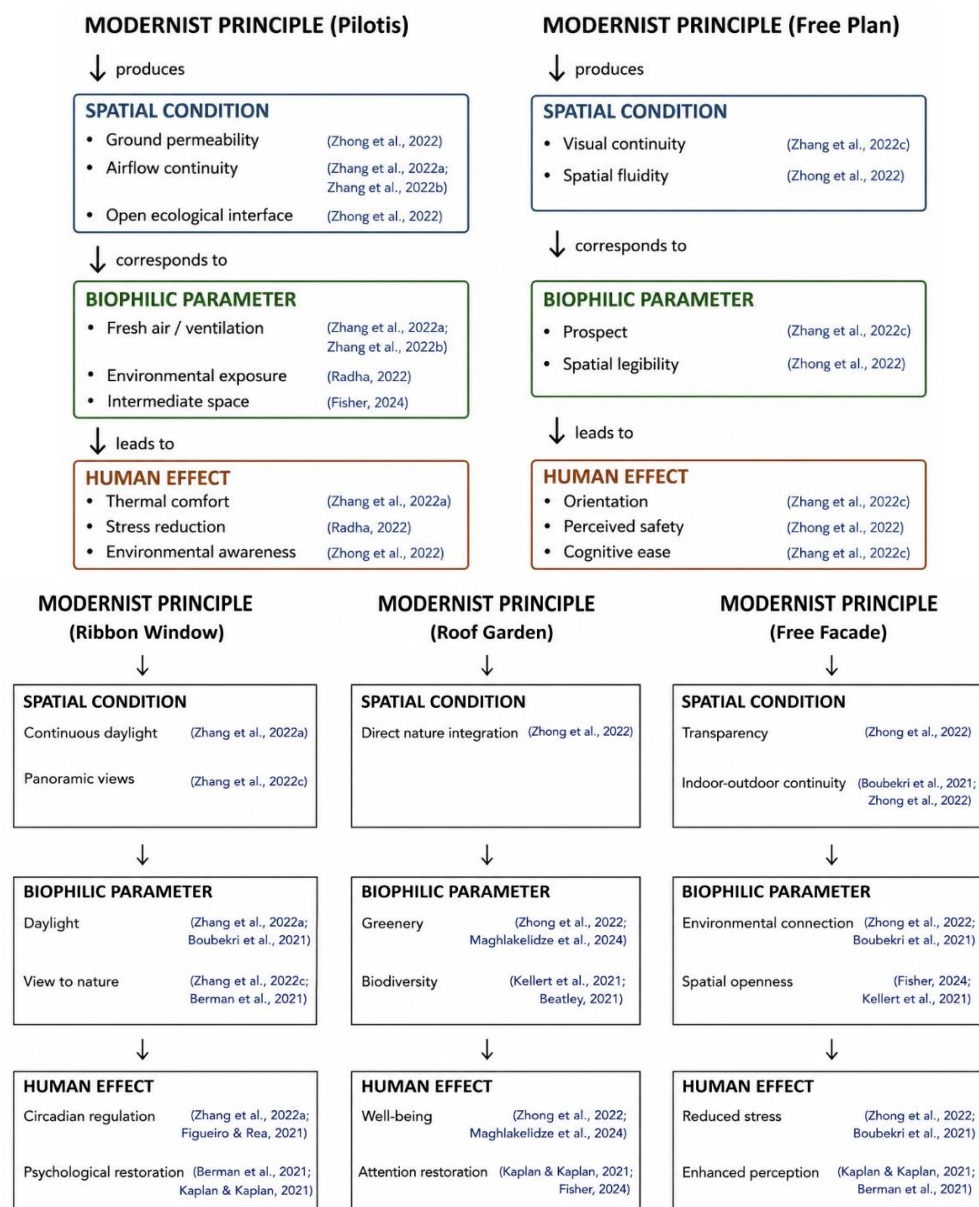


Figure 6. Evidence-Based Biophilic Mapping of Modernist Spatial Principles

Annotated mapping of modernist architectural principles to biophilic parameters with supporting empirical evidence. Spatial conditions such as airflow continuity, daylight access, and visual permeability are supported by recent building science and environmental psychology studies (Zhang et al., 2022; Zhong et al., 2022), demonstrating their measurable impact on thermal comfort, stress reduction, and cognitive performance. The diagram highlights how modernist spatial strategies align with scientifically validated biophilic parameters, reinforcing the argument that modernism contains a latent biophilic capacity.

In modernism, the "less is more" approach transforms structure into an almost entirely transparent organism. In an ecological and local context, this transparent organism is vulnerable. The purity of forms in nature is discussed, but nature, in its patterns, textures, weaves, and relationships, contains forms and relationships that differ from purity, sometimes complex. These forms can be associated with mathematical patterns and parameters, manifesting themselves in the parametric and numerical design expressions of the postmodern era. However, modernism's attitude of ignoring details, ornaments, and patterns, viewing them as superfluous or even a crime, contradicts biophilic design.

When we move from a superficial ecological perspective to a deep ecological consciousness, we see that the complexity of patterns, designs, and camouflage in nature and its living beings often develops as a process of camouflage and adaptation to nature. The simplicity and minimalism accepted in the modern era were reflections of the socio-economic and historical industrial transition process of that period. However, the postmodern era is an age of unpredictability, diversity, and complexity in relationships and patterns. Rather than criticizing the modernist period in the face of the realities of this era, it is important to be able to adapt its efforts towards establishing a relationship with nature to our time.

The modern architectural understanding is based on the ideals of rationality, universality, and industrial production. However, this approach has been seriously questioned, especially by ecological architecture theories that have developed since the 1970s. The criticisms are clearly focused on the fact that modernism's relationship with nature is abstract, reductionist, and detached from the local context (Frampton, 2007). However, Kellert's biophilic design proposals, which incorporate locality, can offer highly valuable contributions in biophilic design. Le Corbusier is also seen to have used sunshades, etc., in his later works.

Ecological criticisms regarding pilotis include the idea that they are actions that abstract the soil from the ground, reduce the benefit of the local microclimate, and disrupt the soil-structure interaction. There are ecologists who see pilotis not as integration with nature but as distancing from it (Yeang, 1999). However, from a local perspective, piloti examples exist in the Black Sea regional architecture and in many regions of Switzerland as raised wooden structures on stone foundations. In these regions, raising wood, which is sensitive to moisture, from the ground where snow and humidity are abundant was a regional structural approach that existed even before modernism. Therefore, ecological integrity cannot be predicted solely through the relationship the structure establishes with the land. This contradicts a holistic approach to nature. In Le Corbusier's biophilic design, the ground or soil can exist as planes where the public flows, where life flows, and where life is experienced.

Environmental performance analysts have noted that all-glass facades increase the need for mechanical heating and cooling, leading to excessive heat gain or loss and reducing energy efficiency (Guy & Farmer, 2001). However, these problems have the potential to transform ecological habitats into biophilic planes with layered and mesh facades, providing refuge for living organisms. Modernism's ideal of a glass organism has transformed into a biophilic dream in postmodernism, one in which greenery is positioned. However, this enclosure, this confinement of life, this greenhouse-like approach, is actually biopolitics. Projects like the Amazon Offices project are greenhouse cafes where Kellert's propositions are misunderstood. These are controlled greenhouse cafes in densely populated metropolitan areas where office users can relax. This enclosure on the urban plane does not align with the flow of movement in biophilic design and modernism, nor with the flow of nature.

While modern architecture strives to produce a universal reality, ecological architecture does not align with the idea of universality. It produces solutions that are specialized and localized according to climate, topography, and ecosystem. Kenneth Frampton defines this situation as "placelessness" and criticizes modernism in the context of its production of placelessness (Frampton, 1983).

According to ecological theorists, modernist roof gardens are criticized as an aesthetic representation in which architecture reduces nature to a formal metaphor instead of establishing a genuine relationship with it (Mostafavi & Doherty, 2010). To establish a symbiotic relationship, it is necessary to provide distanced relational spaces where living things and plants can hang, climb, take shelter, and nest. This requires proposing intermediate spaces where a secondary layer, the shell facade, can partially cover the terrace when necessary, supporting life and ecology. A roof garden requires proposing ecological volumes beyond being an ecological plane.

5. Conclusion

The potential of certain practices within modernism to enhance biophilic value in terms of establishing a relationship with nature has brought about a re-examination of modernism in the postmodern era, with its new potential for reality. Approaching the subject from a perspective that is not anthropocentric but rather in harmony with the laws of nature and offers the possibility of symbiosis suggests that architecture, beyond producing box-like structures, should understand the geometry, mathematics, and operating systems of nature, and progress in cooperation with humanity and technology, as a more biophilic act. In particular, in our age of advanced digital design technologies, the failure to consider the relationship with nature while rapidly producing structures is a significant problem. Modernism's failure to connect with place and its tendency towards homogenization contradicts nature's adaptive and diverse qualities, while the experiential possibilities it offers (movement, dynamism) hold the potential to enhance biophilic value.

Limitations of the Study and Future Research

While this study proposes a novel conceptual framework linking modernist architectural principles with biophilic design parameters, it is important to acknowledge its inherent limitations. The primary limitation lies in the predominantly theoretical nature of the analysis. The research is based on a conceptual mapping methodology that correlates spatial characteristics of modernist architecture with biophilic performance criteria derived from existing literature, rather than on direct empirical validation.

Although a growing body of research demonstrates that biophilic design significantly enhances human health, well-being, and environmental perception, these findings are typically grounded in empirical studies focusing on measurable variables such as daylight exposure, natural ventilation, and visual connectivity to nature. For instance, recent studies have shown that access to daylight and natural views can reduce stress, improve thermal comfort, and enhance overall occupant well-being, while systematic reviews confirm that biophilic environments contribute to psychological restoration and health outcomes in built environments. Furthermore, research in environmental psychology emphasizes that biophilic effects emerge from complex multisensory interactions rather than isolated spatial features.

Despite this robust empirical foundation, the present study does not directly measure user responses or environmental performance within modernist spaces. Instead, it extrapolates potential relationships based on established scientific knowledge. As such, the findings should be interpreted as indicative rather than definitive, highlighting correlations rather than causation. This limitation underscores the need for further empirical investigation to validate the proposed framework.

Future research should therefore focus on multi-method approaches that integrate both qualitative and quantitative methodologies. Case study analyses of canonical modernist buildings—such as residential, institutional, or civic structures—could provide valuable insights into how spatial configurations influence user experience in real-world contexts. In addition, post-occupancy evaluations (POE) and user feedback studies could be employed to assess perceived comfort, well-being, and environmental satisfaction within such spaces.

Experimental studies also present a promising direction for validating the proposed relationships. Controlled environments comparing modernist spatial configurations with and without enhanced

biophilic parameters could help isolate the specific contributions of spatial features such as openness, daylight continuity, and airflow. Advances in environmental monitoring technologies, including indoor air quality sensors, daylight simulation tools, and physiological tracking, offer new opportunities for generating measurable data on human–environment interaction.

Moreover, future research could expand the scope of investigation by incorporating interdisciplinary approaches, including neuroscience, environmental psychology, and computational simulation. Such approaches would enable a deeper understanding of how spatial perception, sensory engagement, and cognitive responses are shaped by architectural form. Additionally, longitudinal studies could examine the long-term impact of modernist spatial environments on human health and behavior.

Ultimately, while this study establishes a theoretical foundation for understanding the latent biophilic capacity of modernist architecture, its validation depends on further empirical exploration. By combining conceptual frameworks with evidence-based research methods, future studies can strengthen the link between architectural theory and measurable human outcomes, contributing to the development of more responsive and health-oriented design practices.

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The Author(s) declare(s) that there is no conflict of interest.

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Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Validation; Visualization; Roles/Writing original draft; Writing –

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