Analysis of the Interior Design of a Waterfront Villa

Yongtao Xu*, Jie Zhang, Ke Xie
Soochow University, Suzhou, Jiangsu, China.

How to cite this paper: Yongtao Xu, Jie Zhang, Ke Xie. (2023) Analysis of the Interior Design of a Waterfront Villa. Engineering Advances, 3(4), 328-331. DOI: 10.26855/ea.2023.08.010

Received: July 12, 2023
Accepted: August 9, 2023
Published: September 8, 2023

*Corresponding author: Yongtao Xu, Soochow University, Suzhou, Jiangsu, China.

Abstract
In the traditional sense, "organic architecture" can be classified as a member of the modernist architectonic array, represented by a group of American architects including Sullivan and Wright. This movement believes that architectural form and composition can be inspired by nature, starting from the inner elements rather than simply imitating biological nature. The meaning of "organic architecture" emphasizes more on drawing living forms from nature and forming a concept that can penetrate every detail of the building, according to the unique functions and conditions of the space, making the building an interdependent and inseparable entity. This article provides a brief overview of the background of Wright's representative work, the Fallingwater house, and analyzes the interior space design of the Fallingwater house from three aspects: spatial organization, interface design, and furniture layout. It concludes and summarizes the characteristics of the Fallingwater house, hoping to provide reference examples for contemporary architectural design and urban environmental art design.

Keywords
Frank Wright, Falling Water Villa, Interior design

1. Building background
1.1 Organic architecture concept
The key points of organic architecture design can be approached from four perspectives: drawing natural textures, organically organizing some basic forms, integrating the building into the environment seamlessly, and allowing spaces to blend and compromise with functional needs.

The Dao De Jing mentions, "To make a room, cut out an opening for doors and windows, and the usefulness of the room comes from the emptiness within. Thus, it is said that the advantage of a house lies in its empty space, and its doors and windows make it useful" [1]. This implies that without openings for entrance, ventilation, and lighting, a building cannot function properly. From a philosophical perspective, this highlights the interdependent and interactive relationship between "existence" and "non-existence", where seemingly imperceptible details can play a crucial role.

It is important to note that in the term "organic architecture", the term "organic" does not refer to biology, but rather is borrowed from the biological sciences and used to mean "integral". American architect Louis Sullivan incorporated the concept of "organic" into architecture, marking the beginning of exploring the relationship between architecture and nature. Frank Lloyd Wright interpreted the connection between architecture and nature through the concept of "organic architecture" [2]. In organic architecture, the aesthetics of nature serve as inspiration for designers, providing new freedoms and directions for architectural thinking and development. Subsequently, the theory and practice of organic architecture have developed in different contexts, with each architect interpreting it in their own way.

1.2 Project Basic Information
Fallingwater, located on Bear Run in the suburbs of Fayette County, Pennsylvania, USA, is not situated by the stream
but suspended over the waterfall. Its interior space extends freely, interweaving with each other and the indoor and outdoor space blend together seamlessly. Fallingwater has three floors with an area of approximately 380 square meters. The exterior of the villa emphasizes the combination of the mass, and the building as a whole has a distinctive sculptural sense, which is a model of organic architecture and occupies a crucial position in the history of modern architecture.

Fallingwater is one of Frank Lloyd Wright's important representative works and enjoys a reputation worldwide, attracting tens of thousands of tourists every year. When designing and building this structure, Wright was already 67 years old, and was in a period of declining fame and near bankruptcy with no design work for a long time. Wright urgently needed a significant architectural project to help him make a comeback, and Edgar Kaufmann was such a client who possessed a significant amount of wealth and extraordinary sites, and would not excessively interfere with Wright's design. The two quickly reached an agreement, and in 1934, Kaufmann commissioned Wright to design his weekend vacation villa, Fallingwater, located in the southeast suburbs of Pennsylvania.

2. Characteristics of Interior Design

2.1 Spatial organization

Wright believed that the internal space of a building should not be defined and isolated by the six faces of a square box; rather, spaces should be interconnected and continuous, both within and outside of the building [3]. In the design of the Fallingwater, he aimed to break down the traditional box-like spaces and create a flowing and interconnected interior. To achieve this, he deconstructed individual spaces and reorganized them using a grid-based organization system, allowing for interpenetration and permeation between different spaces. For example, in the living room on the ground floor, there are no walls separating the large space. Instead, fixed furniture such as shelves and tables are used to divide the space, creating a continuous connection between the living room and dining room. Additionally, the living room has large glass windows, blurring the boundaries between the indoor and outdoor spaces and creating a flowing and continuous architectural space.

Inside the building, there are numerous small steps that either elevate or lower the spaces, placing different units at varying heights. This overlapping of individual spaces allows for the free expansion of the interior, enabling a flow and overlap of spaces.

The interior spaces of the villa exhibit a clear diagonal sequence. One prominent diagonal line connects the narrow entrance with the sunlit west-facing balcony, providing a sensory experience that transition from darkness to light. The entrance porch is small and dimly lit, surrounded by stone walls, just enough to accommodate a small table and chairs, with a simple area for hanging clothes. After passing through the porch and turning left, three steps lead to the spacious living room, creating a sudden sense of openness. The visitor's gaze is drawn to the open balcony located at the diagonal line from the narrow entrance, with ample natural light shining into the living room, creating a distinct contrast to the porch. Therefore, this diagonal line can be seen as a sequence from darkness to light. The other diagonal line connects the fireplace with three sets of grille openings that lead horizontally to Bear Run. The fireplace can be used to warm wine and fire up in a cold winter, adding warmth to the interior. Beyond the desk in the living room, through the cabin-like "convenience door" and down the stairs, one arrives beneath the flower box where, after opening two small doors, the attic and the flowing stream below come into view. This diagonal line extends from fire to water, creating a very interesting spatial experience [4].

2.2 Interface Design

The spatial interface of Fallingwater villa features separation and displacement, with walls being blurred or eliminated at overlapping functional areas [5]. This characteristic is particularly evident in the living room space. The bookshelf and bench near the entrance form a relaxing reading space, and the boundary between this informal space and the formal living room should have been perceived as two separate units. However, the wall disappears at the intersection of these spaces, creating a continuous space. Similarly, the continuous interface between the dining room and the living room is also eliminated, making the internal boundaries difficult to perceive.

In addition, as a representative of organic architecture, Wright's selection of unified interior and exterior materials is also a major feature of the Fallingwater villa. He emphasizes the integration between architecture and the environment and prefers natural materials such as stone and wood. Therefore, the stone building materials used in Fallingwater villa are sourced from local quarries and Wright deliberately preserved the natural texture of the rocks. The walls are constructed with natural stones that are hardly polished, and the floors are laid with the same stone material. The waxed stone flooring in the living room resembles the smooth riverbed stones that have been washed by water outside the house. The stone floor extends from the indoor to the outdoor balcony, creating a sense of continuity between the indoor and outdoor environments. In addition, to achieve the best effect, the fireplace inside the building also uses the same stones from the quarry as Fallingwater villa. The shelving and cabinet-style furniture embedded in the wall are made of
walnut wood as the main material, blending with the wall and becoming part of the interface, presenting a natural sense of closeness.

Figure 1. Diagonal sequence of a waterfall villa (Image source: "Waterfall Villa").

2.3 Furniture Layout

In the flowing villa, embedded fixed furniture is extensively used. Organic architecture emphasizes the unity of the interior and exterior, and furniture is equally an important component of the internal environment. Therefore, to ensure the overall and local unity, a large number of furniture in the flowing villa is personally designed by Wright, such as walnut shelves, sofas, and coffee tables in the living room. The four major design themes that run through the villa - horizontal lines, cantilevers, circles and semicircles, and stepped elements - can all be reflected in the furniture, creating a harmonious correspondence between the interior and exterior. For example, the coffee table and bookshelf in the living room do not adopt the conventional supporting method, but rather correspond to the external cantilevered architectural form. They have a small support surface and a very thin tabletop with chamfered edges. The long sofa leans against the brick wall, with no visible support underneath, appearing to float in the air. The embedded shelves in the wall integrate the cantilever and semicircular design elements, matching the architectural form.

Moreover, the fixed furniture in the flowing villa has a strong bite force. Wright enhances the connection between the furniture and the architecture by utilizing the bite between the furniture and the walls, achieving an organic combination of the two. The interior's concave and convex corners are effectively utilized, with furniture such as sofas, cabinets, tables, and shelves tightly biting into the walls. The fireplace is directly constructed with large blocks of stone, serving as both a supporting wall and a heating fireplace, making the architecture and furniture an inseparable whole and creating a more integrated and unified interior and exterior.

The fixed furniture in the flowing villa becomes a part of the spatial composition and also plays a role in organizing the space. It is usually located at the intersection of spaces, blurring the boundaries between the two spaces. It also serves to connect the spaces, achieving coherence between different functional areas. For example, the red steel frame in the interior visually pulls together the scattered parts of the interior. Starting from the left side of the room from the south, the steel frame stretches along the windows. It serves as the mullion, then bends around the fireplace, and finally forms a frame, hovering above the stone wall above the dining table in the north.

2.4 Lighting design

During the day, the villa mainly relies on natural light from outdoors to meet its lighting needs. The large expanse of glass creates a bright and airy indoor space, while areas with insufficient natural light, such as the staircase and bathrooms, require artificial lighting.

Throughout the villa, Wright utilized a significant amount of concealed lighting, integrating it seamlessly into the architecture. Some lights are hidden underneath wooden furniture, while others are concealed behind sheer fabric draped over wall screens. For example, in the music room, fluorescent lights hidden behind wooden panels illuminate the entire
Yongtao Xu, Jie Zhang, Ke Xie

stone wall, and a similar hidden light strip illuminates the bathroom mirrors. The staircase mainly uses embedded small point light sources for lighting, but still appears underlit. A large square lamp is placed in the center of the living room, emitting a warm and bright light to illuminate the entire room at night.

Wright also used fluorescent tubes developed in the 1930s to emit a steady, even light that reflects warm colors and creates a cozy atmosphere [6]. In addition, he scattered small work lamps around Kaufmann's desk and bedside as supplemental lighting for reading and writing.

In conclusion, the interior space design of the Stream Villa is very clever, with a strong sense of flow and coherence created by the interweaving and free extension of space.

The furniture and decoration design incorporates the theme elements of the architecture, creating a complementary relationship between the interior and exterior. The abundant use of natural stone and wood materials seamlessly integrate the building into the surrounding mountain forest, achieving an organic combination of nature and architecture. The sound of flowing water, warm sunlight, and swaying tree shadows convey the vibrancy and vitality of nature even within the interior space.

Although the Stream Villa still has many problems, such as the deflection of the cantilever structure and the breakage of the overhanging beams, which may pose safety risks, extensive funding has been spent on repairs since its construction. During flood season, the interior also experiences water infiltration, making it damp and unsuitable for living. However, the value of this building cannot be overshadowed as it represents an important architecture that achieves mutual dependence between architecture and nature, perfectly embodying the concept of "harmony between man and nature" in organic architecture [7].

3. Conclusion

Just as Sullivan proposed 'Form follows the function, this is a law'. When organizing architectural space, a mere listing of functional spaces is meaningless. Let the function lead the form and ultimately achieve unity. This means that when considering spatial form, one should not be confined by conventional thinking. When the space, like the flesh and blood of a skeleton, enriches the building, the so-called flow lines and functions will circulate and connect like blood and breath, serving the entire building.

Organic architecture is often simplistically understood as 'rural architecture,' or as taking forms from natural beings. It is true that the golden ratio, logarithmic spiral, and basic curves of the life cycle have inspired architects greatly, but limiting the definition of 'organic architecture' to these concepts limits the range of possibilities and interpretations.

Most designs at present tend to focus only on the tangible aspects and their functions, while ignoring the intangible aspects and their functions. However, it is precisely the seemingly insignificant details that form the utilitarian whole. Designing these seemingly small 'voids' to the extreme in architectural design will undoubtedly become a new trend in future architectural design, as they assist the daily operation of the building system.

References