

The Infiltration of Science and Technology in the Modernist Architectural Thought

Junwei Feng

School of Architecture, Soochow University Suzhou, Jiangsu, 215123, China

Abstract

Modernist architects pursue the general principle of scientific and technological rationality, and eliminate the distance between science and technology and human beings through various specific aesthetic techniques in the size and small pattern. Build mass production housing at small level; conduct urban planning at macro level, try to integrate science and technology at entity level and endorse science and technology at symbolic level. This paper takes science and technology as the clue, from the four aspects of space, structure, function and form, to contribute to the discussion of modern architectural thought.

Keywords

Modernist Architecture; Space; Structure; Function; Form.

1. Introduction

The emergence of modernist architectural thought has a profound background of society, politics, economy, culture and technology. As an important component of modernist culture, modernist architecture developed into an internationalist design style especially after World War II. It spread throughout the world with its unstoppable potential, deeply changing the way of human life and even the way of survival.[1] In terms of discussing the nature of architecture, In the 20th century, architects, architectural historians and theorists in addition to attacking the basic ideas of the three elements of Vitruvius architecture, And has transformed them into ", form, function, structure," beyond such a modern language, The most revolutionary change was the discovery and formation of the concept of "architectural space", Taking "space" as the first essential element of architecture, As the protagonist of the architecture, Space integrates the three major elements of "form, function and structure", Together with them, they constitute the four major elements of exploring modern architecture, The Development of science and the industrial revolution, Turning technology from simple experience-based simple tools, hand-making to applied scientific theory, Modern technology with machines as the entity and procedural knowledge as the process, There has the following aspects of penetration with modernist architectural thought.

2. Space of Modernist Architecture

Modernist architectural thought believes that architectural space and entity are the unity of positive and negative inversion and reverse symbiosis. The organization logic of spatial structure, the entity surrounding space is the most basic, changeable and the most important element in the spatial composition. As the basic element of the constituent space, the entity itself has an insurmountable organizational law in itself. Therefore, it is very important to study the composition and form of the space. Regarding architectural space, in general, the vast majority of architects advocate to understand and design architectural space from the long, wide, and high three-dimensional Euclidean geometry. The space theory of the modernist architectural thought also understands and defines the architectural space from the abstract

mathematical space and the objective physical space. This science-based architectural space theory is essentially based on technology, which depends not only on the mechanical combination of geometric space, but also in the relationship between science and technology.[2]

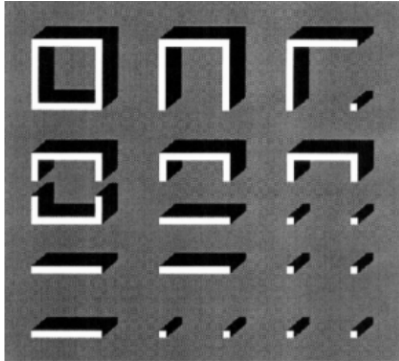


Fig 1. Diagram diagram of nine-grid space

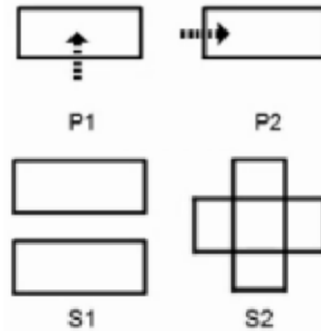


Fig 2. Spatial structure S and spatial path P

In the world of modernist architecture, any space is under a specific material organization, with a specific size and form. In theory, any space can be reduced to nine basic prototypes. The spatial structure can also be divided into two types, S1 with the middle axis as the main line and S2 with the main body type. The same spatial path can be summarized in two types, P1 of transverse type and P2 of longitudinal type. The plane composition of space is the product of western rational thinking after the infiltration of modernism. The plane and facade composition of many classical buildings are based on precise geometric relations. Through the modulus, control line and other analysis means, we can clearly restore the beauty of the scale and proportion implied in the building space.

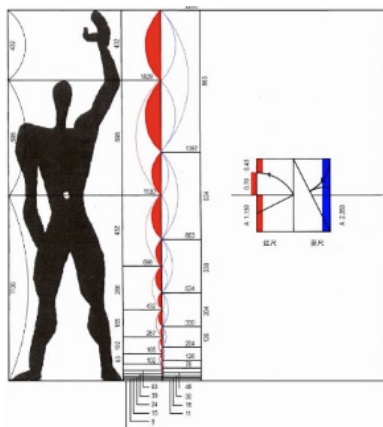


Fig 3. Module coefficient

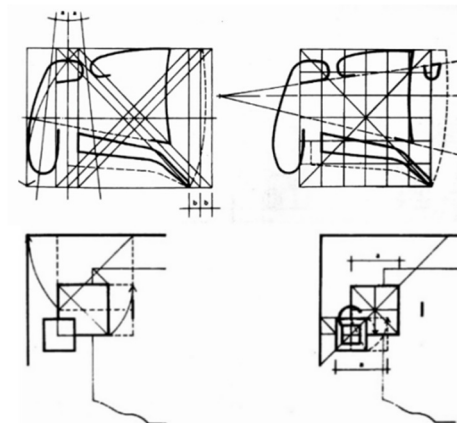


Fig 4. The Lang Xiang Church and the Water Church

Wright in organic building six principles on space as the ontology of building, in the water villa design, not with classical building hexahedral enclosed to limit the form of building, to achieve the overall space experience, but let space between architecture and architecture, building and environment, with never stop, flow of streams and waterfalls, make it part of the building, abandon the classical technique, make the building become an eternal object.

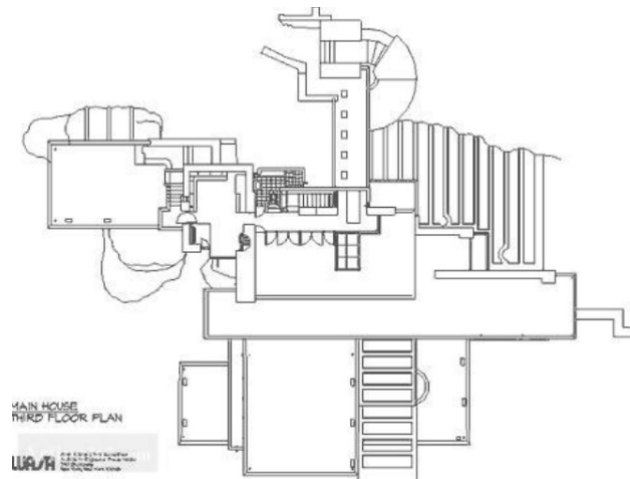


Fig 5. General Plan of Running Water Villa

In *Towards a New Building*, Le Corbusier argued that design and manufacturing should follow "the same principles as the Ford I bought", asking architects to put aside outdated decoration and historical styles and create simple functional buildings for this machine age. In the space design of the Savoy villa, the principle of machine aesthetics is strictly followed: pure geometric sculpture, the body shape adopts simple geometry, the ramp increases the continuity of the space, the total body shape is simple and the internal space is complex. Through the gray space, enter the indoor, the first and second floor ramps are connected, weakening the sense of division between the two layers, from the second floor indoor to the outdoor, once again from closed to open, open ramp and broad vision make the second and third floors visually connected together, to realize the flow of space.

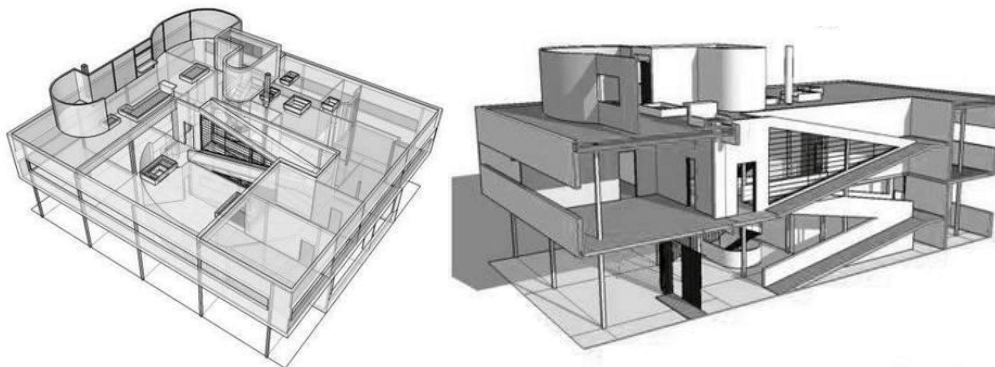


Fig 6. Villa Savoy

Modern building space composition is based on the essence of scientific space theory, on the premise of the classical architectural space and physical interdependence, the perception of space by the natural and humanities factors, the acquisition of space and the nature of people itself has a comprehensive connection, the study of space becomes very extensive. According to Heidegger, science precedes technology, but in essence, science is developed in a pre-existing technological framework. In the period of science and technology, it is not difficult to understand the modernist architectural space based on technology. Similarly, the modernist architectural space theory based on science is essentially a reasonable inference based on modern technology.[3]

3. The Structure of Modernist Architecture

In any space in the thought of modernist architecture, based on the choice of material entity has its specific construction logic, and this logic is always combined with specific cultural regional environment, or, build the logic expression method reflects the cultural connotation of specific region, thus forming the construction of modernist architecture culture. In the construction of culture, the first characteristic is that the supporting jade is supported system. If the structure of the support system is not designed, it itself is not expressive. In addition, as the part that is supported often assumes more artistic expression role. Therefore, the separation and reorganization of these two systems has become an important issue of understanding and construction.

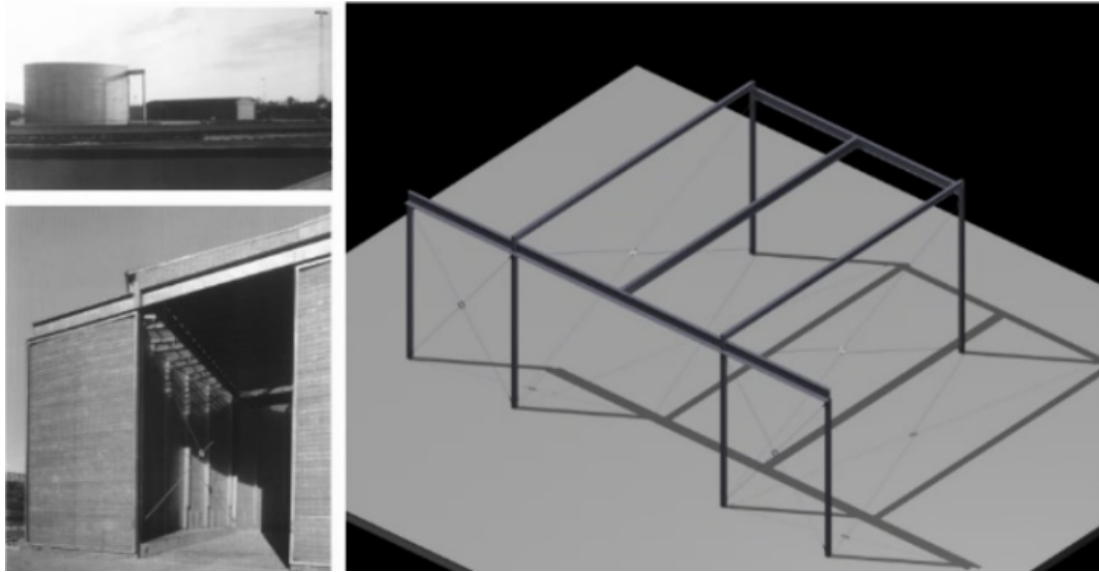


Fig 7. The Lorry Garage

In traditional architecture, technology as a means is associated with architecture only through the element of "firmness". When modern technology to structural mechanics, engineering theory alternative experience, to cement, glass, steel and other industrial building materials instead of stone, wood, brick, tile these natural materials, with reinforced concrete structure, steel structure, suspension structure and other modern structure instead of traditional building stone, brick and wood structure, to use a large number of prefabricated, field assembly and using large mechanical equipment construction replace traditional manual construction, water, heating, electric technology equipment invention and application..... These earth-shaking changes make the technology as a means appear, the construction process become a technical process, into the process of engineering scientific management, and the structure into the technology itself.[4] building should create unprecedented space and form with the structure, write the reinforced concrete poems, and express the structure and materials, that is, the modern technology.

4. The Function of Modernist Architecture

Function is an important link in architectural design, and space is its most important carrier. The understanding of function can be both the specific activities contained in the space, and it can be regarded as a discussion of the relationship between function and space. In the design of modern architecture, it is a creative trend of thought that takes practicality as the main content of aesthetics and function as the goal of architecture. The Chicago architect Saarinen was the

founder of functionalism. Put forward the slogan of "the form obeys the function". The focus of early functionalism was to solve the human physiological needs of people, which was designed to be completed gradually "from the inside out". In the late development of functionalism. Human psychological needs are introduced into the architectural design, and the architectural form becomes an integral part of the function. Modernist architecture has gradually evolved into the physiological needs and spiritual needs, the interaction between man and architecture, and the connection between man and nature and man through the function of architectural function. The needs of people can be divided into physiological, psychological, personal, social, behavioral, conceptual and so on. Its material structure divides and creates architectural space from the natural space to meet the needs of human beings, so that the architectural function constitutes the utility relationship between people and buildings. In the relationship between man and the natural environment, the basic function of the building is to control the environment, become the "filter" of the environment and climate, and create an "artificial space" suitable for human production and life. In the relationship between people, the basic function of architecture is to provide communication space for people's production, life and various social activities.[5]

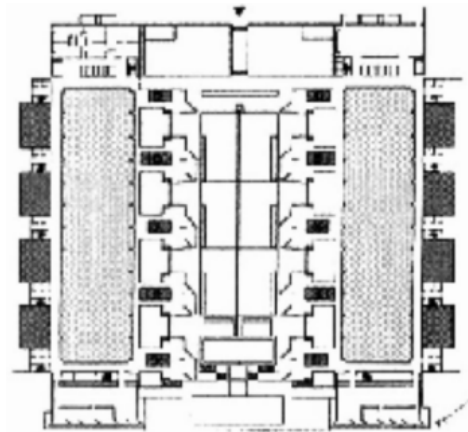
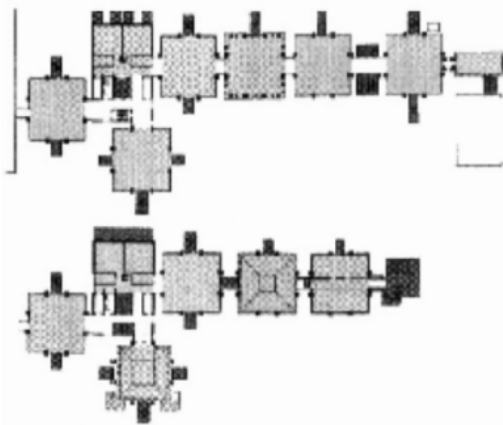


Fig 8. The Richard Medical Research Center **Fig 9.** The Salk Research Center

The attention and emphasis of function (especially material function), highlight the forgotten functions in traditional architecture, return to the standard of the primary purpose of architecture, and advocate serving the public, and so on, are in line with the realistic requirements of social development. In the processing of functional relationship, special emphasis is placed on the application of modern technology, where technology not only brings about the diversity of people's production and life and puts forward new functional requirements, but more importantly, it penetrates into the function and makes the function play a useful role. Scientific and technological progress and the reason contained in it are embodied in an aesthetics that dominates nature. In the view of modernists, the measure of progress, namely, the ability to separate man from nature, is the ability of human beings to overcome nature. Peter Collins distinguished four functionalism in architecture: to biology; to machinery; to cooking; to language. The function of the modernist architectural thought is undoubtedly comparable to the mechanical functionalism, Houses are "living machines", This statement by Le Corbusier is the most typical manifesto of technological functionalism, He summarized the lessons learned from the T-type Ford technology into three points: (1) residential machines for human habitation, A production home should be like a Ford T; (2) The design and manufacture shall adopt "the same principles as the Ford car I bought", Leaving aside outdated decorations and historical styles, Creating simple functional buildings for this machine age (3) The universal principle of modern architects in purifying technological rationality, Through various specific

aesthetic techniques in large and small patterns, To eliminate the distance between technology and humans. Modernists, represented by Corbusier, see cars as a case of mechanical modeling, arguing that buildings should follow the same path.

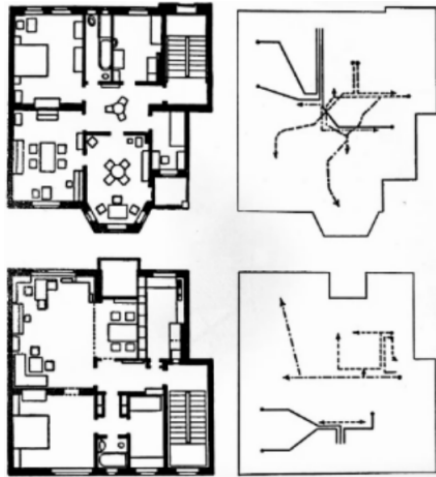


Fig 10. Residential dynamic line analysis

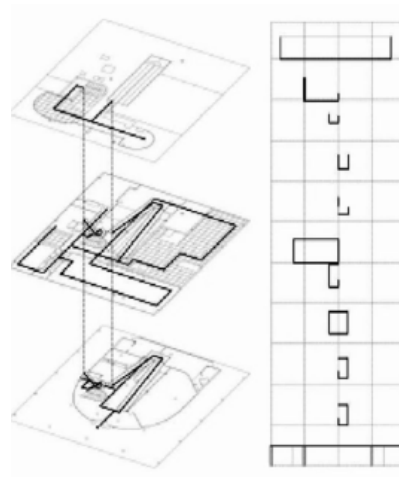


Fig 11. Savoy Villa Space Slices

5. The Form of Modernist Architecture

Form, as the primary purpose in traditional architecture, is now replaced by space, structure and function based on modern technology. Form style not only exits the central position of architecture, but also the traditional style form dominated by decoration, cannot be attached to the modernist architecture to become a decoration, "decoration is evil", they must be completely abandoned.

New buildings call for non-decorative new forms. But where this new form came from was troubled by the pioneers of exploring modernist architecture in the 19th century. The masters of modernist architecture in the 20th century found the source of the new form from the structure and function of the new building itself, and believed that only the form produced from the space, structure and function of the new building itself is the real, healthy and inevitable form. The new form is bound to express the simple geometric form and its mechanical combination of space, structure and function, and is bound to show the texture and color of industrial building materials, and to appear in a single, indifferent and precise way.[6]



Fig 12. Part of the new forms of modernist architecture

Technological updates has also promoted the continuous progress of structural science. Due to structural science, people have a deeper understanding of the internal laws of building structure. Because of this, people can constantly improve the previous structural form, improve the pertinence of the structural form, determine reasonable calculation methods and theories combined with specific projects, and finally build a perfect structural science.[7] In this way, before the construction of the project, the structure can first calculate the stress state, to prepare for the structural design of the house, to make the design more reasonable and safe. As the most critical condition, the technical factors enable the birth of the form of modernist architecture. In the 1840s international office buildings, Chicago skyscrapers and 1895; Sullivan's commercial buildings, standard residential aesthetics, Wright created a unique style; the modern international style of concrete, iron and glass without decoration, to the American, Hong Kong cold tall buildings, from time, the building of an unadorned internationalist style. There are indications that the study of function has go far beyond form. In the social background of industrial production, the final consensus of function first can also be said to be the result of historical promotion.

6. Summary

In the modernist architectural thought, from the world outlook to people themselves and their needs, from the architectural design to the construction process, from the space, structure, function and form of buildings, are fully permeated by modern technology. The essence of modernist architecture and its ideas has changed from the form and style essence of traditional architecture to the essence of modern technology. We can even say that modern architecture has become the technology itself. This is the victory of technology expansion, this is the display of the essence of technology "frame", which is the inevitable result of building technology. In this technical building, in the reinforced concrete urban jungle, cut the history, the context, local, ethnic, eliminate the human emotion and humanistic spirit of building machine, can we settle in here, can we as our home, human will have been in a state of homeless, Heidegger thinks the essence of modern technology is "frame", it to challenge, pushing, custom, regulation, calibration way the nature and people are placed in it, into "save". But in the essence of this "frame" is the danger of alienation: "As a destiny, the frame guides the way of interpretation. Where this order dominates, it drives away the possibility of any other solution... and the threats to humanity come not only from the technical machinery and devices that may be useful. The real threat has touched man in the very nature of man. "Technology brings the essence of the frame to the building, leading to the frame of the building, which will also bring the danger of alienation to the building. Human residence here, will inevitably lead to the alienation of human beings, can not achieve the real sense of settlement, will inevitably fall into a state of homelessness. The modernist architectural thought with technology as its essence was questioned by postmodernists. It is in this doubt and rebellion that postmodernist architecture and its ideas were born.

References

- [1] Temple, Loli. Technology and Modernist Architectural Thought [J]. Science and Technology and Dialectics, 2004 (02): 84-89.
- [2] Lori. The technical nature of modernist architecture [D]. Xi'an University of Architecture and Technology, 2005.
- [3] Wu Yongfa. Technical Ideas and Practice of Regional Architecture Creation [D]. Tongji University, 2006.
- [4] Zhang Qiu Huang. Discussion on the current typical architectural creation concept [D]. Xi'an University of Architecture and Technology, 2006.

- [5] Wu Yong, Su Jihui. Tree a comprehensive, scientific view of architectural technology [J]. Engineering and Construction, 2007 (04): 528-530.
- [6] An Xiaoxiao. Technical analysis of High-tech buildings [D]. Chongqing University, 2009.
- [7] Li Yanlin. Changes and manifestations of the functions and forms of modern architecture and design in various periods [J]. Househouse, 2019 (25): 86.
- [8] Zhang Zhiqing. The comprehensive penetration of technology and modernist architectural thought [J]. Shanxi Construction, 2008 (30): 55-56.