

Research on the Calatrava's Architecture Design of Public Space

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ABSTRACT

Among the different art design categories, architectural design that combines technology, aesthetics and function is the most complex one. Social space should be taken into discussion, and rethink the significance of architecture in modern design from a macroscopic perspective. Focusing on the architectural design of Santiago Calatrava, this article tries to talk about the functionality, practicality, artistry, and sociality of contemporary public spaces. In addition to basic survival needs, the architectural design should focus on the publicity and individuality at the same time. Form, content, and function of public space are ways to create new sensibility which helps in the modern society.

Keywords: Calatrava, Architectural design, Form, New sensibility, Public space.

1. INTRODUCTION

As one of the most renowned architects in the world, Santiago Calatrava uses an unique architectural language. The main contents are movement and form, combining unique aesthetic concepts with numerous engineering and technical knowledge. His architectural design can not only meet the requirements of functions but also blaze a trail in terms of the aesthetic feeling. Dual identity of architect and engineer enable him to grasp the design needs from society keenly. The aesthetic practice of Calatrava represents a new round of modernity of the public space. Besides, he has made bold attempts in aesthetic practice of public space.

2. DESIGN CONVERSION OF FUNCTION FOLLOWING FORM

Since the 20th century, an unprecedented revolution in modernity has broken out in art. Graphic art, for example, has abandoned meaningful themes and concentrated on exploring a way back to the medium. However, unlike graphic art, the functional requirements have brought the modern architectural design to another extreme end. The famous architect, Ludwig Mies Van der Rohe once said, "Less is more." Since classicism, the

demand for artistic decoration has gradually declined after reaching its peak. From Baroque to Rococo, to crafts, then to Bauhaus, the function has become the main purpose with the clean and simple design.

After Le Corbusier made a breakthrough in traditional academic architecture, modern architecture has grown into one kind of design, where the functions follow the form based on minimalist. This is the most distinctive feature of Calatrava's architectural design, which has three characteristics: steel structure, bionic, and force movement.

In terms of material, Calatrava favorites the perfect combination of steel and concrete. Unlike most modern buildings that use reinforced concrete as the framework support, the use of steel by him is simple and direct. The steel is fully assembled with the nodes exposed and visible. The huge building has become a frame-like main body arranged by connected steel structures. The World Trade Center and City of Arts and Sciences in Valencia are typical examples. The folding arrangement of steel components creates a series of rational structural postures. The decoration of the component itself is perfectly combined with light and shadow. He put forward the theory of foldability of space frames, trying to transform a three-dimensional space

structure into a one-dimensional structure by continuous folding. His practice proved that the complex and changeable spatial forms can be realized by rational and geometric means. It lives the steel structure with a sense of rhythm by arrangement and combination.

Due to the worship of nature, Calatrava believes that architecture is human intervention and it cannot be compared with nature. But architecture is also one of the most emotional media in daily life. Therefore, the bionic and symbolic appearance are outstanding features in his design. The Ernes warehouse in Germany, built in 1985, whose door presents a state from "smiling" to "laughing" during the process of opening. The main body of the Malmö Rotating Building in Sweden simulates the torsion of human. Each floor is composed of an irregular pentagonal steel frame structure rotating around the central axis, making the main high-rise building no longer rigid and boring. World Trade Center in New York is an abstract image of wings, inspired by the flying dove.

Calatrava is good at applying force's movement trends to architecture. "But the real force is not necessarily beautiful. What is beautiful is only the visual sense of force. This is the essence of force performance." (Wang, 2004)[8]. Therefore, with amazing engineering mechanics talent, Calatrava had completed a series of visual "impossibility". The inclination of the Alamiro Bridge("Figure 1") in Seville reaches 58 degrees, and the 142-meter-high tower is used to balance the bridge deck. The shape of the bridge resembles a noble and elegant fairy harp, with a tendency to collapse instantly. The structure is static and stable, but there is a tendency to fly or fall, which brings a strong sense of tension visually. Sonnis calls this aesthetic state "the gestation moment", which means that change is about to happen. This statement is similar to the concept of "inclusive moment" proposed in Lessing's "Laocoon", which mostly expresses the temporal momentary scenes appeared in painting and sculpture art, allowing people to feel the moment before and after.



Figure 1 Alamiro Bridge.¹

Calatrava's architectural designs are often dubbed the New Structural expressionism, the New Classical Revival and the New Gothic. Take Gothic architecture as an example, its most obvious feature is Ogive. As an ancient oriental decoration, it was introduced to the west for decorative buildings in the 11th century. (Grodecki, 2000, p5) [2] Columns, spires, mountain flowers, and multi-leaf styles have become the unique ethnic and regional attributes of Gothic architecture. Compared with the Orient Station ("Figure 2") of Calatrava, the palm-like crown of the top structure is similar to the dome structure of the Gothic building("Figure 3"). The continuous deep arrangement can also be found similar in the equal rhythmic distribution of the French Gothic church. However, Calatrava's design is essentially different from Gothic architecture. It eliminates the national and decorative meanings of the architectural form, abstracting the complicated quasi-Gothic arrangements into highly simplified geometrical composition. Calatrava's formal design can be attributed to his excavation of architectural symbolism while modern architecture always ignores the inherent symbolic role of architecture. According to the view of the famous Japanese architect Kengo Kuma, "Japanese symbolism is equal to the symbolism centered on the place. In a sense, it can be said to be the symbolic meaning of 'borrowed things'." (Kuma, 2000, p21)[5] If one kind of architecture borrows the meaning of another thing, the process of "borrowing" makes the existence of both things meaningful, and the meaning is interlinked. That is, "What determines the symbolic meaning of things is the relationship between the two 'places'." (Kuma, 2000, p21)[5] Whether it is the abstract borrowing of the revival of the classical Gothic style, or the bionic shape designs, the creation of architecture is essentially the achievement of a symbolic relationship. This

1. Cited from the link: https://www.sxsgjgqh.org/?p=news_show&cid=46&c_id=54&lanmu=10

symbol is not a simple imitation, but an external awakening and practice of spiritual resonance in human spirit.



Figure 2 Orient Station of Calatrava.²



Figure 3 The dome structure of the Gothic building.³

Calatrava's architectures triumph in forms firstly. People are amazed by the form beauty. The coordinated use of architectural functions is only a part of it. Form has created an unprecedented sensory experience, and the public's instinct towards sensory beauty has resulted in the pursuit of form. The accumulation of forms causes the accumulation of people. Human activities bring the accumulation of industries, commercial and cultural

center. This is the most intuitive benefit brought by the design change of function following form. The New York World Trade Center is a successful case. New large urban buildings have greatly realized functional clustering and expansion.

3. ATTEMPT TO CREATE NEW SENSIBILITY IN THE FIELD OF ARCHITECTURE

After the 20th century, the expectation for super-high and large buildings has been intensified. The visual pursuit continues to create more visual wonders. As if the size of the building is larger, the GDP is more considerable. The Chengdu Global Center, known as the world's largest single building, is a negative case. At the beginning of its completion, the huge body gained much attention. Due to the poor management in recent years, the super-large space has almost been abandoned, making it difficult to create more financial profit. Keynes provided a theoretical basis for the popularity of "big construction". "He believes that financial investment in public buildings and civil engineering materials can promote social prosperity and activate the economy. He believes that effective demand will be generated at multiples of financial investment; In the long run, it will accompany economic prosperity to fill up the deficit in fiscal investment in the form of increased taxation; and he insist that construction and civil engineering have such potential capabilities." (Kuma, 2008, p23)[6] However, from design to destruction, it is an extremely long and complicated process accompanied by huge material costs. As far as the transformation of its modernity is concerned, unlike other art categories, the functionality of architecture cannot be eliminated. Paintings can return to the plane, while architecture cannot. Architecture without functionality cannot stand on its own. With Bauhaus' design concept developing to the extreme, factories and engineering techniques have made modern buildings uniform and massed. From Baudrillard's perspective, in front of huge buildings in modern society, people often feel an unavoidable sense of depression.

The development of the commodity economy has gradually pushed the alienation of humans to the extreme. The need to establish a new sensibility is imminent. Calatrava's architectural design is a powerful attempt to establish new sensibility, which can be seen from the following three aspects.

2. Cited from the link: https://www.sxsgjgqh.org/index.php?p=news_show&id=45&c_id=54&lanmu=10

3. Cited from the link: <https://zh.wikipedia.org/wiki/%E5%93%A5%E7%89%B9%E5%BC%8F%E5%BB%BA%E7%AD%91>

3.1 Sense of Material

It is the intuitive feeling of aesthetic objects. It is to put aside the exploration of the inner qualities and functions of objects. When people catch the superficial and intuitive feelings of physical and psychological stimulation of aesthetic objects, it is different from language interpretation but directly refreshes the perceptual cognition through sensory impact. Most of Calatrava's designs are exposed large steel structures, and the spraying is pure white. The use of steel has a strong contradiction: it is popular in the industrial age, and it is the main constituent material of urban architectures. However, how to use steel to break its technical limitations and original features, and to stimulate the artistic emotion behind it, is a difficult problem. Calatrava did it. The texture, structure, and massiveness of steel has become the endorsement of a new type of architecture. In addition to the visual impact caused by the basic form, texture, material, and color of the building, its unique "force" is powerful hit on human mind, and it is also a form of material perception. The "Bow-arch" Structure of the Serpentine Pavilion Beijing, designed by Liu Jiakun, is a set of minimal mechanical devices that use the elasticity of spring steel plates. Tension of steel cables to form a self-stabilizing structure with no support. The mechanical tension of the installation has something in common with Calatrava's design, and the "force" opens up a new perceptual space

3.2 Sense of Strangeness

Aesthetic impression is a kind of strangeness, a hit from the original feeling of the soul. The hollowing form is moving at first, but as the feeling repeats, the freshness will gradually dim. This requires an interactive transformation mechanism. Spatial tension in large public architecture works comes from components. Calatrava's buildings have a groundbreaking inner unfolding geometry. The three-dimensional space is continuously superimposed and copied from countless small spaces, unfolding among the rich levels, with a sense of progress and depth. Besides, the shape, volume, and supporting components of the building are unusual, and the internal space muscles are constructed and copied in the same form, which not only achieves the simplification of elements but also derives rich rhythm and spatial arrangement. This design puts people in the geometrical space of the post-industrial era, giving people unfamiliar experience.

3.3 Sense of Future

It is elusive and flowing. Sense of future is embodied by highly lucid and pure artificial creation, with the feeling of primitive simple substance. It surpasses all the familiar spaces of modern times, but it is not completely as same as the sense of strangeness. It gives people a beautiful yearning. Calatrava's architecture looks very futuristic. The geometric form of the perspective state reflects a sense of time, and the geometric level looks like a time cave, with a post-modern sense of space. The Barcelona Concentration Tower with ring arms, City of Arts and Sciences("Figure 4") in Valencia, the Bilbao Airport with a peculiar skeleton, and the Lyon Airport design like the head of a Transformer may remind people of the scenes in science fiction movies or animations. His design creates cyberspaces such as *Ghost in the Shell* and *Blade Runner*. Futuristic architecture produces fantastic feelings in the living environment, and it also interacts with movies, constantly refreshing people's perception and imagination. The blueprint of human's living environment has quietly changed in the process of form innovation.



Figure 4 City of Arts and Sciences in Valencia.⁴

4. ARTISTIC PRACTICE IN PUBLIC SPACE

On September 11, 2001, 3,000 lives were lost after the twin towers of the World Trade Center collapsed. What is the ultimate goal of architecture except to give a shelter?

As understanding continues to deepen, the interpretation of space has gradually changed. Technology has changed the view of time and space fundamentally. People's perception of the material distance is drawn to infinitely close by

4. Cited from the link: <http://www.bubblemania.fr/zh/2002-la-cite-des-arts-et-des-sciences-valence-espagne/>

electronic media, and space is timed. Virtual and real space interact with each other, making it difficult to distinguish each other, and time is also spatialized. "Time-Space Compression" makes it difficult for people in modern society to become the integrity of their own. The body and mind are coerced by high-speed replacements of time and space, and they are always in the crisis of psychological implosion (Yan, 2011)[9]. Urban planning directly affect people's living and value and function of space depend on public buildings.

From the static internal space of the Roman Pantheon to the unidirectional, multidirectional and dynamic space of Christian architecture, public buildings have changed in appearance and function. Calatrava's architectural design involves important transportation hub sites, sports centers, large commercial buildings and so on. Representative buildings such as the Alameiro Bridge and the City of Arts and Sciences have become new landmarks. These architectures have improved geographical and ecological space, reduced disadvantages, and created unprecedented economic and cultural values. As landscapes, they refresh people's sense of objects and creates a common environmental cognition and collective memory. It is positive on alleviating the crisis of subjective communication.

However, some unsatisfactory design should be focused. Due to mismanagement and lack of funds, the Athens Olympic Stadium in Greece was nearly abandoned. The publicity of the Olympic venues is based on the national public construction. After such a sports event held, the use demand falls to a low point. If there is a lack of organized planning and utilization, the functional value of the building will gradually disappear, and not to mention that the government cannot keep the normal maintenance of this giant. The multiple identities of the new World Trade Center("Figure 5") ensure that it will not suffer like this. First of all, it is a memorial site with cultural significance for disaster. Secondly, it is a functional transportation hub. The huge wing steel structure makes it distinctive in the space. The continuity of time and space is an important principle in the language of modern architecture. "People live in this space and they are affected by it, and in turn, they also affect the space." (Savi, 1986, p51)[7] Design and planning can make space meaningful.



Figure 5 New World Trade Center. ⁵

The designer of the bamboo house of the Great Wall Commune, Japanese architect Kengo Kuma advocates "let the building disappear". He emphasizes the building should be integrated with the environment and nature. Contrast to Calatrava, Ma Yansong of MAD Architects is another new public space designer. In 2006, MAD won the international bidding for the Monroe Building, a super high-rise architecture in Toronto, Canada. Glass is the main exterior material. The soft lines make it dance in the boring urban forest. "People call it 'Monroe' because she is a cultural symbol and represents their emotions. Architecture is integrated into people's lives and becomes a kind of culture." (Zhu, 2011)[11] The Harbin Grand Theater tried to be balanced in the natural wetland landscape and local snow scene. The huge white shell and transparent glass, look like breathing skin which produce great visual impact. They become a specific theatrical whole with the environment and the audience. Each continuous theatrical creation is composed of countless moments. "Chinese gardens link the contradictions of pairs together, which is an in-between space between the eternal paradise and the earth. In this space, the normal space-time category, the social categories and rational categories in daily architectural art and behaviors are all replaced by an 'irrational' or a very difficult way to express words." (Jenks, 1986, p81)[4] MAD attempts to transfer the temperament of ancient Chinese garden architecture to the space of modern public buildings. It has already taken a new step in architectural design. We can see that both east and west designers are making breakthroughs in culture innovation.

5. Cited from the link:
http://www.hbadi.net/news.aspx?news_id=595

5. CONCLUSION

Lefebvre named social space as abstract space, and it can be mainly divided into three aspects: spatial practice, representations of space, and representational spaces. Space practice is the dimension of perceived and material construction, which embodies the production and reproduction of social constituents in social production relations. Space representation is a conceptualized and conceived dimension, a space that represents the interests and existence of rulers, such as urban planning and transformation. Representational spaces mean the personal experience of the spatial truth that criticizes the appearance of space. It is often a complex symbol system connected with art. (Zheng, 2010)[10] Guy Debord believes that modern society is full of landscape composition. "Capital becomes an image. When accumulation reaches this level, the landscape is capital" (Debo, 2006, p10)[1]. Nowadays, architecture acts as a landscape. If buildings keep rigid practice, it can no longer give inspiration for the representational space.

"Creative destruction", put forward by Harvey, is due to the operation of capital and historical needs. Once the geographical landscape is established, and when new needs arise, it will be destroyed or eliminated to maximize the accumulation of benefits. (Harvey, 2009, p83)[3] Space has the correspondence of hierarchy, and hierarchy is fluid and changing. Ecological balance of social space needs to be maintained. Urban construction is facing a transformation crisis, which has higher requirements for the design of public buildings. Large urban public construction is driven by politics, economy, and culture. Artistry should be a powerful means to save modern urban crisis. On the one hand, it is necessary to use artistic means to create new sensibility and refresh the perception of subjectivity. On the other hand, public space needs to be planned and designed more rationally and humanely. Many of Calatrava's designs are formed and improved in commercial competition, but it is not enough for new improvement.

Art design of public space must be under an awareness of the social environment. Use the environment, transform the environment and create the environment. Calatrava is not only an architect but a sociologist, so his design reflects future consciousness and forward-looking ideas. Mies once said, "When technology truly fulfills its mission, it becomes art." Calatrava's architectural

practice is a perfect combination of technology and art, providing us with an example of creating a new sensibility of public space. However, the crisis of modernity is still deepening, and how to resolve the crisis of subjectivity in the construction of public space is still a difficult problem. Superior designers are still needed as well as the coordination and support of the government and society. "Post-modern is like the space of Chinese gardens, where the clear final result is suspended in the air, in order to seek a "route" with a winding path that will never reach a certain goal." (Jenks, 1986, p81)[4] We are still unable to grasp the changes and migrations of space, but artistic exploration will eventually become one of our outlets.

AUTHORS' CONTRIBUTIONS

This paper is independently completed by Ge Zheng.

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