

# Analysis on Interior Effect Creation of Natural Light and Shadow

## Taking Exhibition Hall as an Example

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**Abstract**—The expression of natural light and shadow in interior design is to give people certain effect in the way of visual transmission. Light is often ignored in the interior design, because light is the object not limited in a certain form. Light has no entity; it cannot be touched, but can be seen with eyes. In addition, light is accompanied by shadow. Light and shadow are inseparable, and shadow changes along with the change of light. The combination of light and shadow has endless creativity. After we understand light and shadow, we will feel the different surprise brought by natural light and shadow to our design. The atmosphere created by light and shadow to the whole space can manifest space's sense of depth and vitality more obviously. The object image in space atmosphere can only be sensed by human's visual nerve under the illumination of light. The light and shadow applied appropriately can strengthen the space modeling's third dimension and improve artistic effect. This paper is written by consulting relevant data as well as research and investigation, aiming to elaborate the effect creation method of natural light and shadow in interior design, and the influence on interior design by application of natural light.

**Keywords**—*natural light and shadow; architectural space; interior design*

### I. INTRODUCTION

With the overall progress of science and technology, the application of natural light and shadow in interior design of building appears constantly. Such design not only can provide people with appropriate lighting, but also save energy, and it can also satisfy people's pursuit of enjoying sunshine and exposure to nature.

### II. PURPOSE AND SIGNIFICANCE OF RESEARCH

The lighting method in architectural design can be divided into two kinds, namely natural lighting and manual lighting. Natural light is limited by time and space due to changes in relative position of the sun and the earth as well as in the earth itself. Manual lighting does not have that many limitations. Therefore, the open window of the building will be freer in architectural design, and the natural lighting will be gradually neglected.

Along with the constant deepening of scientific research, the pursuit of natural light seems to have become human's

nature, and it even influences people's emotion, mentality, working efficiency and health. In addition, the energy sources on the earth are about to be used up, so energy-saving of building is also a new topic at present. The application of natural light in interior building is drawing more and more attention. Natural light and shadow are the important compositions of the interior space of building, as human spend most of their time in interior space. It can be said that the natural light in architectural design is mainly used in interior space. As a result, this paper will discuss the role of natural light and shadow in architectural interior design from multiple perspectives.

In addition, ecological architectural design has become an inevitable tendency internationally. As the important composition of ecological construction, the natural position of light in architectural design is more and more important, but the researches and practices in this field are relative weak. In China, the knowledge reserve of designers in these fields is not quite enough, so sorting the actual effect of natural light and shadow in architectural interior design is another research purpose of this paper.

### III. NATURAL LIGHT AND SHADOW AND INTERIOR SPACE

At present, the application of large amount of manual light has reduced the antagonistic relation between light and shadow and neglected natural beauty of the building. Only by applying natural light and shadow to architectural space can it be called the architectural philosophy for harmonious coexistence of architectural technology and natural art.

#### A. Visual Artistic Language of Natural Light and Shadow

Designers have obtained significant achievement by using natural light and shadow in the design in terms of drawing, figure, industrial design and animation. Such successful cases should also draw the attention of architectural designers to natural light and shadow. In addition to its role of lighting, we shall also pursue the spiritual value by virtue of the spiritual affect brought to people by applying natural light and shadow to interior design. The application of light and shadow in architectural interior space can strengthen the connotation of space. Natural elements should not be totally replaced by technological products. Designers can make use of natural

light and shadow through modern design method. The ingenious application of natural light and shadow can bring new vitality to interior space design, and create unique emotional atmosphere.

### *B. Molding of Space by Natural Light and Shadow*

It should be acknowledged that light and shadow are indeed the magicians of architectural space. The changeable light and shadow make it impossible for people to imagine. Reasonable utilization of natural light and shadow can make interior structure more complex visually, and it can also create the hazy feeling, bringing a different experience to people.

Both natural light and manual lighting in the interior effect creation are indispensable. Natural light enable us to see object appearance clearly, and shadow enables us to feel the third dimension of object. Brightness and darkness are mutually depended and complemented. At the initial stage of sketch, the training of plaster statue is essential. The process of describing white plaster molding is more of drawing light and shadow changes than making the statue. The stronger the light is, the stronger the shadow will be, and object reflected is more stereoscopic. The portraying process will be more difficult with poor light, and the third dimension will be weak if any small detail change is neglected. Space is no exception. The interior space will be short of the sense of depth and structure if natural light and shadow are absent, making the space duller.

*1) Natural light and shadow to limit space:* Space is called space because its scope is limited, and only in the circumstances with limitation can it have certain significance. We are in such limited interior space every day. However, the natural light and shadow design is the new favorite of modern interior space, and is often used in the design items in the frontier. Natural light and shadow reflects the effect by comparison. With the comparison of brightness and darkness, people can differentiate the difference of regions. The inherent space of object also has clearer outline under the comparison of shadow and brightness. For example, in the outdoor space at noon, people rest under the shade of tree and the space where they locate is the scope of tree's shadow. Tree's shadow is the virtual space divided by natural light and shadow. The brightness and darkness division of middle hall in exhibition building follows the same principle. Natural light shines in the interior space directly through transparent ceiling and dome, forming distinct comparison with other objects in darkness. And this place is naturally limited as the open space for leisure.

With such "limitation", the division and outlining of space by natural light and shadow is obviously different from the space divided by other entities, as natural light is invisible, having no specific boundary line and form. When the natural light is shielded by objects, its shadow will be manifested in the form of line undoubtedly. The gap is of nature of line, and the ray of light is the best method to limit space and restore essence, because this line stresses that the margin of space is the most primitive method to limit space.

### *2) Natural light and shadow to enrich interior space:*

Each building which leaves people with profound impression is indispensable from "light"; light must be accompanied by shadow and they complement each other. With the passage of time, the application of natural light and shadow progresses along with the development of architectural design history. It creates the sense of structure, texture, emotion and atmosphere in the interior space of building. The atmosphere and emotion created by natural light and shadow maintains harmony between architectural space and human. The abundant application of light and shadow in space makes the space more fascinating. As a result, natural light and shadow have been used as a kind of architectural material, but not merely decoration. It also plays the role of setting off the atmosphere in interior space of building, revealing the layer and artistic conception of interior space of the building.

The intensity of light and shadow affects people's feeling towards object; the changes in irradiating path of sunshine result in different distribution of light and shadow. At this time, the effect of people's perception towards object will also change along with it, thus the varied and colorful images will be shaped.

### *C. Natural Light and Shadow and Material*

The surface of different objects will be expressed differently by the irradiation of natural light. For example, when natural light passes through different objects, such as wood, porcelain or metal, it will be absorbed or reflected, or expressed in different forms as transparent or non-transparent. The unique texture and color of the object itself also display its unique artistic charm through the illuminating of natural light.

Different materials will have different reactions towards natural light, including mirror reflection, scattering reflection, transmission and semi-transmission. Material's defects can be avoided by taking full advantage of material's reflection characteristics. For example, the application of large amount of wood material in interior space has higher requirement for the quality of wood. At this time, natural light's illumination on it from small angle can present the sense of texture and concave-convex of wood in a better way. To express the texture of wood in a more truthful way can show the quality and connotation of interior space better.

### *D. Expression of Natural Light and Shadow in Different Spiritual Space*

The role of natural light and shadow in interior space is similar to that of color, providing space with its own emotion and temperature. In interior space, warm light will make the space more warm and sweet. For instance, when the sunlight at noon illuminates in the interior space, people will feel comfortable and warm; on the contrary, cold light will make people feel calm and cold, and if the natural light in a cloudy day illuminates in the interior space, people will feel calm or low-spirited.

*1) Tranquil and soft interior atmosphere:* People feel calm, comfortable and relax in spatial artistic atmosphere. Such environment will not only help people to concentrate

their attention, improve efficiency and it also contributes to the relief of fatigue. Direct and strong sunlight often make people exciting. Therefore, while creating quiet space atmosphere, direct illuminating of external natural light into the room should be avoided. After the distinct comparison within the space is avoided, brightness of light and shadow should also be observed and studied. Gray tone shall be preferred to prevent dazzling light. The space should take full advantage of the characteristics of natural light and shadow to make the interior space in order and tranquil. Net is a way commonly used and easy to be achieved. For instance, the light window of Hananda Church in Sweden locates at the south side of entrance porch. This is the defense line from sunlight illuminating in and adopts wooden grille as the shading fence. Light illuminates in the church through the grids, and thus the ordered shadow arrangement is created. Such design of natural light and shadow make the whole church softer; moreover, it appears to be more of sense of depth with respect to design and it consolidates the tranquil atmosphere in the church, which is seeking quietness in movement.

2) *Lofty and holy interior atmosphere*: Generally, the lofty and holy interior space is reflected in religious architectural space, matching the soaring building. With the illumination of natural light, people will feel they are in the divine region, and this is the strength of light and shadow in interior effect creation. Natural light and shadow interweaves and changes in interior space, making people feel spiritual baptism. People who have experienced long night always look forward to the dawn. The comparison of natural light and shadow is the best method to create interior artistic atmosphere of religious space. The instinct of human to chase light determines that human will always be attracted by the object with distinct comparison and abundant colors in terms of vision. The changes of light and shadow in such space create the sense of the sacred.

#### IV. ANALYSIS OF LIGHT AND SHADOW DESIGN OF FAMOUS EXHIBITION HALLS

##### A. Suzhou Museum

The new museum of Suzhou replaces traditional roof materials with glass and steel. The open gateway and open-type courtyard is the opening of light and shadow space. In the hall, the complicated interior space structure with different levels is formed by open-type lighting of top window, turning of wall surface and architectural line, which has created the climax zone of the whole interior space of the building in "Fig. 1".



Fig. 1. Entrance hall of New Suzhou Museum.

The suspension staircase in front of the main gallery utilizes inclined glass top for light selecting, and natural light and shadow fall in the restrain area on the wall before the climax is formed in "Fig. 2".



Fig. 2. Staircase of New Suzhou Museum.

The inside of gallery receives natural light through top window and high-sided window. Wood grain light-shading strip avoids direct sunlight effectively, and the varied changes form the abundant and natural light and shadow environment of the exhibition hall. There are many crab-eye courtyards in the design of classical gardens in Suzhou. Suzhou Museum adopts such traditional design skill, inserts it in the exhibition hall, and creates changes of light. In addition, they bring about the sense of vividness and jumping to the whole museum exhibition space. The corridor in gallery uses the same inclined glass as the staircase, while the wood with horizontal stripe setting off the atmosphere of the whole museum in "Fig. 3".





Fig. 3. Corridor of New Suzhou Museum.

The landscape garden formed by the enclosing wall of new museum and the north wall of Humble Administrator's Garden is the final climax part in the whole architecture space; the extension landscape of large pool, the stone, bridge, pavilion and bamboo grove have formed a well-shaped landscape space.

#### B. Jewish Museum in Berlin

There are slender windows on the wall of Jewish Museum in Berlin with long and narrow intervals on the wall surface; such design is the channel reserved for natural light. The general square window design will cause loss of vitality of building's interior space, while such design of jumping light-collection creates unique space of natural light and shadow.

The architect Daniel Libeskind is the designer of this museum. The Jewish Museum designed by him is of significance in the architectural design history. Many linear elements are inserted in the museum; such insertion is to create impact in terms of vision to people, and it is the self-expression method of designer towards Jewish history. These lines are found by Daniel Libeskind inspired by map. He draws the drawing by connecting the Jewish residential zones on the map using lines, and designs the straight line segment as the shape of windows, thus the incompatibility between traditional square window and the museum is solved. Libeskind combines the writers, composers, artists and poets in Jewish history by virtue of this method. The natural light projected in linear window and enters into interior space, creating bizarre and unique effect of light and shadow. This has revealed the unyielding life and the vitality to survive in a narrow space, rendering more tension to the whole interior space of building in "Fig. 4".



Fig. 4. Jewish Museum in Berlin.

#### V. CONCLUSION

Natural light and shadow plays an indispensable role in the creation of interior effect of building. The natural light and shadow design is the main design method in today's interior design of building. Natural light can be used in the exhibition hall through various advanced design methods, playing the role of atmosphere creation, space division and spirit expression. Moreover, it can also play the role of energy-saving by responding the sustainable development strategy. In the design of natural light and shadow, the light and shadow environment created by designer using various aesthetics techniques in combination with the characteristics and nature of various designs enables our living space closer to nature and happier.

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