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Light – Creating Drama in Space: The Role of Natural and Artificial Light in Creating Space

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Abstract: Light, as energy of environment is an essential element, which helps to see things. With the help of the reflected light, eyes the important communication channel – like cameras control the process of seeing objects and thus light holds a key position in all the visual arts, particularly in Architecture.Lighting condition effects human being emotionally also. The change in the quality of light brings a change in the mood of the observer. The space inside a building can be dramatized or emphasized with the proper use of light. Depending on this aspect various spaces require various quality of lighting, which is largely determined by the activity to be performed in that space. In recent days light is not only a prerequisite to observe things but also adds a philosophical aura in Architecture.

We prefer natural light to artificial lighting for various reasons but in absence of natural light, artificial or supplementary lighting is required to improve illumination of the room to achieve satisfactory level of light for certain tasks. Whether emitted by a natural or artificial source, changes in the concentration of light, or in the general characteristics of light emission, often induce subconscious response in the observer. It is this emotional aspect of the lighting problem that provides the real challenge to the imagination and creative judgment of the designer, which extends beyond the scope of simple illumination.This paper focuses a literature study of the performance of natural light in various spaces giving special attention to some spaces designed by Louis I. Kahn and some of his techniques of bringing in light sensitively to create certain moods in specific spaces.

Keywords: ***Memory, Place, Space, Urban, Manifestation***

Introduction

The major source of natural light is the sun. From which we receive also a large amount of thermal radiation together with the light. In bright sunshine the illumination is around 100 K Lux (100,000 lux), the intensity of thermal radiation is about 1 KW/m^2 (Koenigsberger, et al, 1978) . Here we need a filter so that heat is admitted limitedly while abundantly admitting light. The building envelope is thought as a barrier between the controlled indoor environment and the external environment. The indoor environment is within the control of the designer but the external environment is beyond human being's control. So Architects play an important role here to create such a barrier that filters the unwanted elements (like rain, heat, dust) and admits the desirable elements like light, air into the internal environment.

For the obvious relationship between light and visibility of work, some designers and engineers had considered light as a necessary mechanical feature, but light has qualities other than simple illumination. Almost every one has felt the holding power of a spotlight on a stage or reacted to the mood of a beautiful sunset or sunrise – conditions created by the changes in lighting. Similarly bright lights create the excitement. Designers are aware of the dynamic quality of light, but the significance of these changes is sometimes overlooked or underestimated. Light can have a strengthening or reinforcing effect similar to that of background music in creating an appropriate emotional environment and a complementary psychological setting. (Flynn and Mills, 1962) The impression of pleasantness and well being that an individual receives in a space may influence his attitude, which is a major factor in performing a task or an activity. In this sense the visual impression induced by the lighting systems are fundamental in planning and design and they become a functional part of the activity.

Light Used in Historical Periods

Architects and Designers have been trying to create impact inside the buildings from a long time. In Classical Roman Architecture in Pantheon, light is used in such a way to make a special effect inside the space. The great dome of Pantheon of 142^{I}-6^{II} diameter had only one circular unglazed opening at the top of 27^{I}-0^{II} in the crown of the dome through which light enters and floods the whole space and cascades over the surface of the dome.[i] The changing quality of natural light brings a change in light inside the space and dramatizes the internal space. The endlessly changing quality of natural light makes the space different every second of the day.

Lighting in Church

Form the origin of church building; light has been treated very carefully to create a mystic and overpowering mood. In the Basilican churches in Early Christian period in around 300 AD to 800 AD, clerestory lightings were used to bring lateral light inside the nave by making the nave height and aisles height different. In later in Romanesque period with the development of vaulting system, the height increased and in Gothic period the flying buttresses allowed the walls to become curtain walls and free from bearing the load of the roof and vault. Thus it could be glazed hugely and used for bringing in light.

Gothic Cathedral with their traceried clerestory openings, rose windows and other stained glass work presented a picturesque quality of light and color inside the lofty cathedral interiors.

The Use of Light

Design of the lighting system must provide for the observer's ability to see and perform the physical aspects of the activity. In simplest form, a single spotlight or luminous element in a room might provide very high illumination over a confined and concentrated area. This will however, leave the rest of the room in relative darkness. At the other extreme, the lighting system may be designed for general diffusion to provide the required quantity of light over the entire space. Light, therefore, is a variable factor and changes in color, direction and diffusion affect the subjective impression of the environment.

Light is essential not only to facilitate the performance of visual tasks but also for other reasons too. Light is a narrow wavelength band of electromagnetic radiation form about 380 nm to 780 nm. (1 nm = 10^{-9}m) and due to different wavelength it is of different colours.

Light defines certain spaces according to its nature. For example,

Classroom, office spaces ⟶ uniformly lighted,
Restaurant, museum ⟶ spot lighting and high contrast environment.
Lobby, bedroom etc. ⟶ generally lit or low lighted.

The hierarchy of lights can define hierarchy of the space. Bright and high contrast light creates lively environment while low, dull and low contrast light creates gloomy environment. Directional light with high contrast and focus is used in the museum and theatre. Directional light breaks monotony and boredom and stimulating environment can be created where as low contrast non-directional light, which cannot cast shadow, creates a monotonous environment with no focus. The lighted space tends to dominate the observer, directly and holding his attention and interest.

A lighting system that reduces or eliminates contrast produces a diffused environment. For casual circulation, congregation and assembly the diffuse lighting approach produces a more desired environment.

Light casts shade and shadow of forms and creates a three-dimensional quality in a surface. In addition to altering the visual characteristics of the space itself, the light condition also affects visual perception of surfaces and objects in the room. Three-dimensional form is " seen" as a relationship between high light and shadow. It changes the visual impression of depth and form.[ii] Light character and distribution influences the surface texture, sculptural form and the visual characteristics of materials. High light and shadow reinforces the impression of natural textures and sculptural relief and all the blemishes and errors in workmanship on the surfaces become clearly visible. Conversely a more diffused lighting condition will reduce the visibility of surface flaws, giving an impression of flatness and surface unity.
The presence of shadow in the high contrast lighting condition, in the working environment may be the cause of distraction. In some cases these shadows may be the cause of irritation like while writing under a concentrated light source. The excessive

concentration and constant re-adaptation required of the worker in such a situation can, over a period of time, result in visual fatigue, accident and errors.

Above all, light creates a spiritual effect. In the churches and mosques light is brought from high above to create a flood of light inside and a heavenly quality.

Indirect Lighting i Architecture

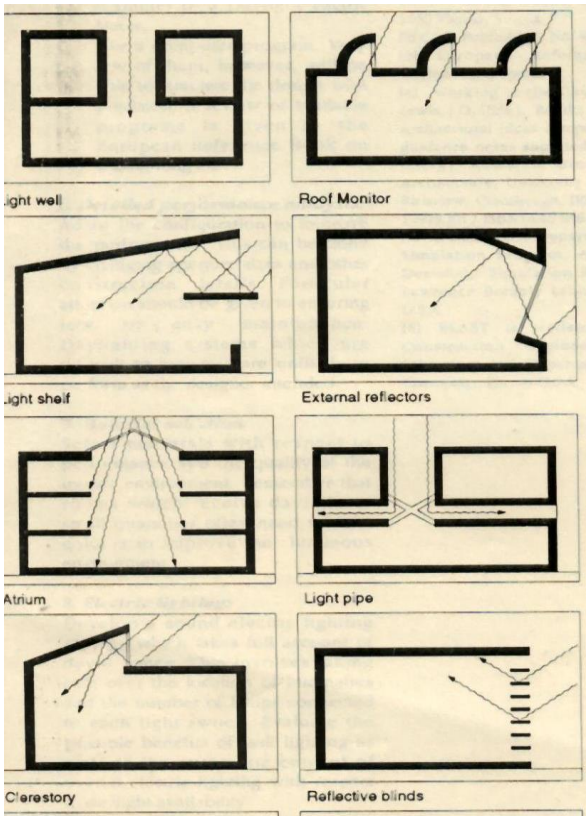
Light creates life in Architecture. It creates shade shadows and this shade shadow plays a great role in changing the mood of the observer. The natural light with its changing quality gives character to a space.

There are mainly two kinds of light –

- Direct and
- Indirect light.

Most of the time Architects use indirect light because of its softness and glare free nature. Direct light also produces heat.

Figure X:



Source: Goulding et al, ????? , 124

In the commercial zones because of the scarcity of land and its high price office buildings are of deep plan, where it is difficult to bring light in the central areas. So in lighting a large space or deep area indirect lighting is effective. If the sunlight is diffused or brought indirectly by reflecting it onto the ceiling or walls then it can make a worthy contribution to lighting requirements.

Some methods, which allow sunlight to the deep internal spaces, without glare, are shown in the following figures:

Though most of the greatest Architects have their own concept or philosophy on light still they emphasize greatly on their effective use. Among those who have worked with light brilliantly in their design, Louis I. Kahn's name is worthy of mention. A few of his works on light will be discussed here to find out the techniques of bringing in light in his designs and ultimately how light changes the character of space by adding a separate philosophy in building environment. According to him, *Light is the giver of all presence*[iii]*;* No space is really an architectural space unless there is natural light in it with its changing quality.

Philip Exeter Academy, Library (1966-1968)

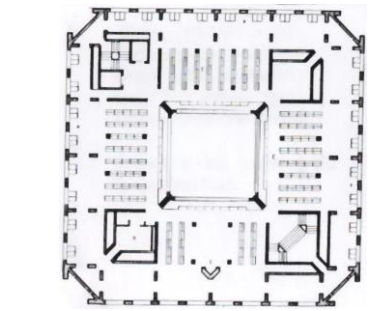
"*A man with a book goes to the light, a library begins that way*" – Kahn.

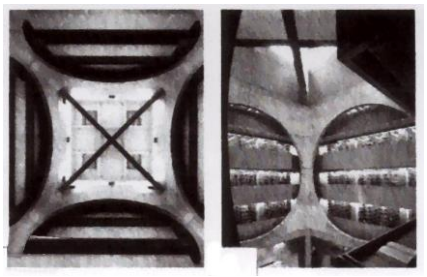
This is an example of a simple plan, filled with light, expressing the basic idea of the space – functionally a library, but spiritually a sanctuary where books are offerings. There upon a simple plan be erected a great room filled with light. The diffused light is coming from the ceiling. Philip Exeter library is a square space defined by structure and light circles of concrete frame each interior elevation, bracing the main piers at the corners, and the sun entered from above to bathe the whole in brightness. Around the central space on all sides are the book stacks. At the perimeter of the building, the individual reading area receives daylight through the external windows, which also provides pleasant view to the individuals.

The committee's desire was to provide daylight intelligently wherever possible, since artificial light lacks the color range of natural light. As a result Kahn's library was a combination of

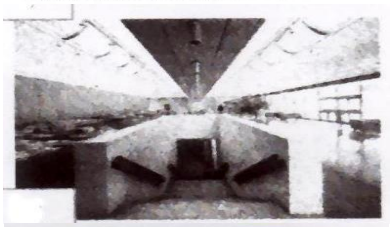
1. A grand public hall surrounded by books and lighted with overhead divine light.

2. An intimate space for reading and connecting visually with the outdoor.





Sketch section. Inscribed September 22, 1967.



Source:

Kimbel Art Museum, Texas.

"Structure is the maker of light, because structure releases the space between and that is light giving".[iv]

At Kimbell, it was the roof, not the wall that was parted. Each vault split along the full length at its crown and acts skylight. Kimbell Art Museum is a building of domestic scale. The basic unit of the whole composition is the barrel-vaulted space. The natural lighting in each gallery provided the sense of totality of the galleries. Kahn thought that sky lighting of the galleries would give a comforting feeling of knowing the time of the day. The whole plan is composed of a number of rectangular rooms with cycloid vaults.

Kahn considered the fact that the painting and objects that may fade in direct bright light should be lighted modestly. Therefore he created a vaulted roof with a slit opening at its crown towards the sky, with a reflector to spread the light on the sides of the vault. This light will give a touch of silver to the room without touching the objects directly. At the same time the changing quality of natural light will comfort the human being inside, without creating glare. He thought that wall is a precious thing in a gallery and a window is a source of glare and disturbance to the eye. So he avoided windows on the wall generally and introduced opening at the top of the vaulted roofs. He even positioned the artificial light so that in absence of natural light same affect is created with artificial lights.

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The National Assembly Building, at Sher-e-Bangla Nagar, Dhaka.

While designing the National Assembly Building, Kahn made a thought study of the climate, environment and light quality of this region and reached a decision that light in the designs of this region should be softened and at the same time precious breeze is to be allowed. As a result of his elaborate studies several lighting techniques and design decision were used which gradually became the guidelines to define a space. In deep plans the central space does not receive direct light from the external walls. In those spaces light is to be taken inside at some points from over head plane and this spaces act as light as well distributing light to the adjacent to the inner areas. The techniques that are used in National Assembly Building, Sher-e-Bangla Nagar, Dhaka are discussed below:

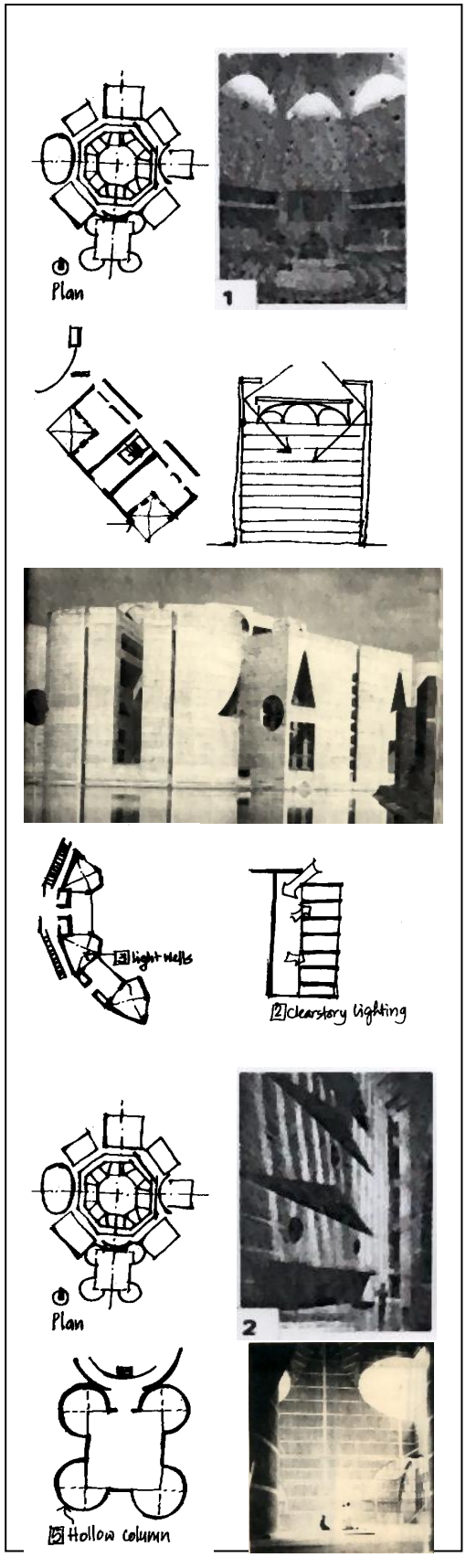
1. *Use of Screen Wall*
   The outer shell of concrete is perforated with large openings, which allow the breeze and light to flow inside the office spaces through window openings, which are placed on a recessed wall. Thus strong light is softened without shutting the breeze.

2. *Clear Story Opening*
   The ambulatory – an inner street open to the ceiling 7 stories above – is lighted through glass strips on overhead ceiling.

3. Light Wells
   A number of open to sky light wells acts as light source to the inner space of the rooms adjacent to the central assembly room. The overhead light illuminates the vertical plane of the concrete walls of the light well, which in turn acts as the source to an internal space. The internal rooms have window openings towards these light wells. The changing nature of the light on the vertical plane presents the picture of environment although these rooms are detached from external environment.

4. Lighting in the Assembly Chamber
   The main Assembly Hall is placed at the centre, the heart of the total octagonal plan and there is no way of receiving light from external wall opening directly. So Kahn here again brought light from overhead level and distributed it indirectly through out the whole chamber.

5. Hollow Column
   To bring natural light to the interior space, Kahn developed the hollow columns, which are something like a light well. Kahn said, "*In the plan of the assembly, I have introduced a light giving element to the interior of the plan. The columns as solids frame the space of light. Now think of it just in reverse and much bigger and their walls can themselves give light, then the voids are rooms and the column is the maker of light*".



Conclusion

In this above study we found that light, the energy of environment, which is essential for seeing things also adds a philosophy in Architecture. Light creates a link between the indoor space and outdoor environment. It changes with the change of nature and environment. And this changing quality of light makes it interesting and adds a drama in space. A space that is static can be dramatized with the accentuation of light and shadow.

The famous Architect Louis I. Kahn made extensive study with light in his designs. In some of his works light is marvelously used to create a particular mood and spirituality. He came up with several decisions which acts as guidelines for future Architects who wishes to explore more and use this natural resources as a strong element of their own designs.

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