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Research Article

The Interaction of Daylight with Design and Place in Religious Buildings According to Modern Architecture

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Abstract

The most important external factor that interferes with the perceptual effect is light. In other words, light is the most effective element for the perception of architectural work. Daylight should be considered as a building element in architectural place design. In this way, it is possible to obtain different and original results in building designs. For this purpose, the use of daylight in the well-known religious buildings of 5 famous architects who lived or still live in the recent period was examined, and the relationship of daylight with design and place was analyzed. This analysis has been compared in terms of the incorporation of daylight into the structure (horizontal-vertical or directly-reflected light) and the way it is used (symbolic-physical). In the religious buildings designed by the selected architects, it has been seen that the light is used in the place by referring to a symbol. It has been observed that these architects used daylight as a design principle, sometimes giving physical and sometimes symbolic meanings in their buildings, and daylight was interpreted as an element that would add richness to the designed place. Therefore, the use of daylight as a design element in religious buildings contributed to the emergence of different meanings and original results in the interior.

Keywords: Daylight, Place, Religious buildings, Modern architecture, Symbolic light, Functional light.

Modern Mimariye Göre Dini Yapılarda Günışığının Tasarım ve Mekânla Etkileşimi

Öz

Algısal etkiye müdahale eden en önemli dış faktör ışıktır. Diğer bir deyişle ışık, mimari eserin algılanmasında en etkili unsurdur. Gün ışığı mimari mekân tasarımında bir yapı elemanı olarak düşünülmelidir. Bu sayede bina tasarımlarında farklı ve özgün sonuçlar elde etmek mümkündür. Bu amaçla son dönemde yaşamış ya da yaşamakta olan 5 ünlü mimarın tanınmış dini yapılarında gün ışığının kullanımı incelenmiş, gün ışığının tasarım ve mekânla ilişkisi analiz edilmiştir. Bu analiz, gün ışığının yapıya dahil edilmesi (yatay-dikey veya doğrudan-yansıyan ışık) ve kullanım şekli (sembolik-fiziksel) açısından karşılaştırılmıştır. Seçilen mimarlar tarafından tasarlanan dini yapılarda ışığın bir sembole atıfta bulunularak mekânda kullanıldığı görülmüştür. Bu mimarların günışığını bir tasarım ilkesi olarak kullandıkları, yapılarında bazen fiziksel bazen de sembolik anlamlar yükledikleri, gün ışığının ise tasarlanan mekâna zenginlik katacak bir unsur olarak yorumlandığı gözlemlenmiştir. Bu nedenle dini yapılarda tasarım öğesi olarak gün ışığının kullanılması, iç mekânlarda farklı anlamların ve özgün sonuçların ortaya çıkmasına katkı sağlamıştır.

Anahtar Kelimeler: Günışığı, Mekân, Dini yapılar, Modern mimari, Simgesel ışık, İşlevsel ışık.

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1. Introduction

Architecture is the arrangement of the physical environment according to human needs in the most general way. Since human existence, various types of structures have emerged in line with their needs. One of them is the religious buildings, one of the most important architectural structures throughout history, where people worship collectively according to their own beliefs. The purpose of religious buildings can be expressed as gathering the believers of the same religion together and creating a suitable worship environment for the worship of the believers. Religious structures have different names according to the religion they represent. For example, religious buildings where Muslims perform their worship are called mosques, religious buildings where Christians worship are called churches, and religious buildings where Jews worship are called synagogues (Ünver, 1985:Ataköy, 2018:Yamamato, 1995, Yıldız, 1995:Yücel, 1981:). Each type of building has been shaped differently within itself in line with the worship styles and needs of the religion it represents. For example, the focal point, which is the most important factor in the positioning of religious buildings and which is considered sacred, differs according to each religion (Ataköy, 2018:Kurtay, 2002:Erarlitepe et. al. 2011:Cengiz, 2022: Efe and Varhan, 2020:Ünver and Enarun, 1998: Ünver and Enarun, 1999:Karabiber et. al. 2001). It is seen that the Churches are planned in the East-West direction, while the mosques are built towards the Kaaba in Mecca and the synagogues are directed towards Jerusalem. In Figure 1, the prayer performed in Diyarbakir Ulucami is in the direction of the Kaaba (Qibla) in Mecca (URL 1,URL 2). In Figure 1, The Kaaba (Qibla) in Mecca and Ulu Mosque of Diyarbakir are seen.

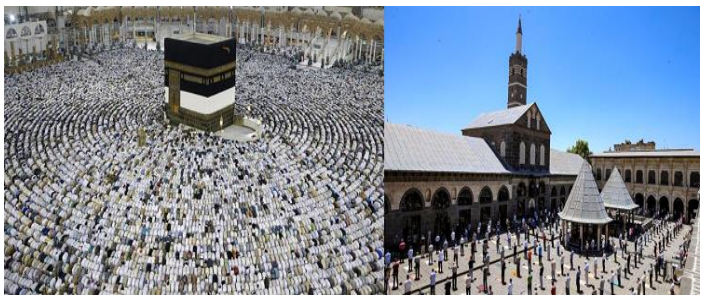

Figure 1. The Kaaba (Qibla) in Mecca and Diyarbakir Ulu Mosque.

Whatever the type of place, light is an important factor for the action to be taken in it. Light is the most important element necessary for the place to be seen, perceived, and used (Cengiz and Cengiz, 2018:Cengiz et. al. 2018:Parlakyıldız et. al. 2020:Palta et. al. 2017:Yaylak et. al. 2017:Akalp et.al. 2021). Considering daylight as a building element while designing the architectural place creates different and original results in the design. Concepts of daylight, place, design, and perception affect the physical and symbolic design of natural light in architectural places (Ünver, 2003, Fitöz and Erkin, 2007:Arias, 1993:Ünver, 2000:Aksugür, 1977:Djalilova and Sahin, 2020:Köknel Yener, 2002:Ander, 1995). In this context, the use of daylight and its effect on the design of the building should be examined in the context of place. For this purpose, the use of daylight in the designs of modern architects of the recent period has been examined. A selection was made among the main architects who used natural light in various forms in their designs and accepted this as a design principle. By comparing the physical use of daylight, that is, the way the light is taken into place, the places where the light spreads horizontally and vertically are examined through examples. According to the evaluation made, the differentiation of natural light according to the hours of the day and the seasons creates richness in the place where the light is used. Daylight is used symbolically in some buildings. It is seen that it is used in the example religious buildings of the selected architects by referring to a symbol in the luminous place (Ünver, 2000:Aksugür, 1977:Djalilova and Sahin, 2020:Köknel Yener, 2002:Ander, 1995).

Daylight has always had an important place in human life. The use of natural light, which has psychological and physiological effects, in places of worship and in religious activities has continued since ancient times. In the early ages, the penetration of daylight into the place was provided through small holes in the buildings, but the presence of glass made the use of daylight in the place very effective. With the use of glass, the boundaries between indoor and outdoor environments have weakened. In this way, the use of daylight as a design element in architectural places has led to the emergence of different meanings and original results in the interior environment of religious buildings. Daylight is a building element that gives physical and symbolic meanings to the architectural place. The importance of using daylight in place has increased in today's world when energy policies are directed towards natural resources and serious investments are made in this field. Daylight has been used for centuries not only to create a bright place but also to create behaviorally effective places (Arheim, 1974:Arheim, 1976:Baeze, 1991). Daylight, which has gained new meanings in the designs of master architects, still maintains its mystery today and is a source of inspiration for architects. In this study, the sketches, plans, sections, appearances, etc. of 5 architects selected from among the modern architects who are known for their buildings living in various parts of the world, who successfully use natural light as a design element in their works today and in the recent past, are presented. A detailed comparison was made with the help of drawings and building photographs. The physical or symbolic use of natural light in the sample buildings of these architects, the horizontal or vertical light coming into the place, and the use of light directly or by reflection were analyzed. According to this analysis, the physical and symbolic effects of natural light on the use of place are explained. Finally, it has been understood that light is the most effective element for the perception of architectural work (Louis Kahn, Le Corbusier, Frank L. Wright, Tadao Ando, and Steven Holl are modern architects who include natural light as a design element in their works and realize the designs of world-renowned religious buildings (Balamir, 2000:Erzen, 2003:Kahn, 1991:Tanyeli, 2000: Kahn, 1957:Yamamato, 1995:Kahn, 1962:Üçüncü, 1995:Kahn, 1968: Tanyeli, 2002:Tümer, 1988: Tying 1984: Kahn, 1971: Curtis, 1992Kahn, 1974Ando, 1990:Ando, 1996:Kahn, 1972: Öztürk, 1997).

2. Interaction of Daylight and Place in Religious Buildings

Daylight is a very effective factor in perceiving and using place. Structure, material, color, and form create the place, but it provides light in relation to the whole and to each other. Therefore, the role of light is important in the visual perception of the place. Daylight is a part of the interior place, and the way the light is taken into the interior, its intensity, the type of building elements, the form of the limiting elements that make up the place are necessary to create the desired semantic effect. With the effect

of daylight in a place, the activities planned to be done in it become easier. In various uses of daylight, it is possible to draw attention to a direction or to the desired point and thus to give this point a meaning other than measurable values. From past to present, architects have sought ways to use daylight more efficiently and effectively in their buildings. With the understanding that emerged in the historical process, the use of daylight to provide brightness and visibility in the place has become widespread, while the use in the symbolic sense is decreasing (Kaynaklı et. al. 2018:Cengiz and Cengiz, 2021: Eren et. al. 2017:Cengiz and Cengiz, 2018:Çıbuk and Cengiz, 2020:Cengiz, 2020:Cengiz, et. al. 2017:Aykal et. al. 2011:Unver et. al. 2003). Because it is more difficult to use light in a symbolic sense.

The most important factor in the realization of the work in a place is the daylight entering the place. Without daylight, the person cannot see the place and the equipment and cannot perform the work he will do. Different levels of light are required for different actions. For example, in a place of worship, a necessary level of illumination is needed to see the environment. When the light is below this level, this place of worship cannot be used effectively. Similarly, when the level of daylight entering is high, the place of worship cannot be used effectively, as people are disturbed by reflection and glare (Caracristi, 1999:Cimcoz, 2001:Fitöz, 2002: Arpacıoğlu, 2012).

The daylight level taken into the place should be well calculated in order to use the place for the activities for which it is designed. In the design of the building, attention should be paid to the aspects of the use and duration of use of the places. The effects of daylight on the use of place can be psychological and physical. Although the effects of light are physiologically the same, it creates different psychological effects (Fontoynont, 1999:Göker, 2006:Klee, 1956:Kortan, 1986). Because light has many meanings according to the psychological state and creates different perceptions according to people with its color, movement, and direction. Light can be grouped as a perceptual, physical, sacred element that varies according to different areas of expertise.

Daylight has lighting and heating properties. In places with a cold climate, where sunlight is not very effective, daylight is a desired design element in the place, while in hot places where the sun is very effective, the disturbing, excessively bright, and warming effect of daylight is tried to be prevented by different methods. Reflective, permeable, or semi-permeable wall materials change the effect of daylight on the place (Kostof, 1995:Ksiazek, 1993:Kuban, 1992). The texture of the materials adds richness to the place with the shadows it creates. Reflective surfaces can provide more luminosity to the place and create impressive places with the animated plays of light, depending on whether the surface is flat or textured. When the light comes to the source or to the place, some of it is swallowed, some of it is broken and reflected. The physical properties of light can be listed as reflection, refraction, and absorption, and the surfaces they come from can be grouped as permeable, impermeable (opaque), semi-impermeable, and reflective (Kutlu, 2001:Cengiz and Cengiz, 2021: Küçükdoğu, 1976:Özdeniz, 1995). These physical features enrich the place in vision, perception, and use. The quality of the light changes when the sunlight enters the place directly, indirectly by reflecting from the cloudy sky or from the floor and surrounding structures. However, even on a cloudy day, much of the light required for visual perception can be obtained from daylight.

2.1. Receiving Daylight to Religious Places

Daylight has given various expressions to the place with its different sources, forms of arrival, tones, reflection, and refraction. The use of natural light in different ways by architects in their designs creates different effects in the interior as well as affects the exterior of religious buildings. Permeable facades or solid masses, window modules, horizontal or vertical shading elements are provided to shape the facade according to the quantity and quality of daylight to be taken into place (Özorhon, 2002:Cengiz and Mamiş, 2015:Kazanasmaz and Örsfırat, 2014: Şerefhanoğlu, 1974:Kazanasmaz et. al. 2016:Şerefhanoğlu, 1992:Ünver, 1985:Kazanasmaz, 2003:Kazanasmaz et. al. 2009). The religious buildings and designs of 5 architects selected among the architects who used natural light in their designs were examined and compared. The criteria used in the comparison of these 5 architects, who are considered as representatives of modern architecture, are shown below.

- The purpose of using daylight in design,
- Preferred method of taking daylight,
- The way daylight receives light into the place (window type, size, window ratio),
- The desired effect to be created in the place with daylight,
- Elements using daylight shading

Architects, who use daylight as a design element, have also considered the effects of natural light in the selection of horizontal or vertical surface materials. When light hits a surface, the reflected wavelengths reveal the color of the surface. The properties of the materials used to create different visual effects, and since these materials affect the light, they can sometimes be considered as a second light source in places (Yücel, 1981:Mangkuto et. al. 2016:Köknel Yener, 2003:Şerefhanoğlu et. al. 1999:Şerefhanoğlu, 2005:Arpacıoğlu et. al. 2020:Kurtay and Esen, 2019:Şerefhanoğlu and Arifoğlu, 1999:Sözen, 2005).

3. Daylight and Religious Buildings as Design Elements

Louis Kahn, Le Corbusier, Frank L. Wright, Tadao Ando, and Steven Holl are the architects who use daylight as a design element and prefer to use daylight intensively in religious building works. The symbolic or physical use of natural light in religious buildings, the horizontal-vertical arrival of light in the place, or the direct-reflected light reaching the place have been examined comparatively.

In Kahn's designs, in religious building (church) examples, daylight is both symbolic and physical use in accordance with the function of the building that comes to the fore. While taking the natural light into the place, Kahn has established a relationship with the structure of the building and often reflects the natural light from the structure to the place. According to Kahn, who set out from the idea "There can be no place without light", daylight is a very important element for the comfortable use of the building. The architect used different elements in the buildings he realized in different geographies and climates to bring daylight into the place. It indirectly lets the daylight in with the large places it has designed in the buildings it has built-in in countries such as India and Pakistan. It affects the perception of the building with the texture it creates on the deaf walls. The features of modern architecture can be seen in all his works, in which the architect

tried to enter as much sunlight as possible into closed places. Roof lights or skylights are the daylight elements that Architect Kahn used frequently. Seen in the Unitarian Church-Rochester Figure 2, designed by Louis Kahn (URL 2).

Figure 2. Louis Kahn - Unitarian Church-Rochester

Le Corbusier used natural light physically in residences, symbolically in religious buildings, and both functionally and symbolically in public buildings. It is seen that the architect takes the light into the place in horizontal and vertical directions, mostly linear. Le Corbusier used the effect of light and shadow and texture as an architectural element in his buildings by using traces of wood mold on concrete surfaces. The architect creates contrast with concrete surfaces and glass surfaces. It is observed that Le Corbusier used modular band windows in his buildings. Wide eaves are used as shading elements (Notre Dame du Ronchamp). In addition, it is observed that modular shading elements placed on the outer surface are used in their structures, together with the placement of window joinery inside the thick walls. Le Corbusier defines the structure as a machine. According to Le Corbusier, the building must have a purpose. For this reason, a unique style should be designed for each building, but first of all, the functions should be met. The architect expressed the importance of daylight and achieved bright places in his first works by using lane windows, one of the five basic principles he advocated. Later, he gave meaning to the light by using daylight as a design element in La Tourette Monastery and Ronchamp Sapeli. Le Corbusier created the facade view of the buildings by repeating the window module horizontally and vertically. In addition, shading elements are used on the facades. Le Corbusier created a dim environment suitable for function in the religious buildings he designed. In this way, he wanted to give a mystical effect to the light entering the place (Notre Dame du Ronchamp). Contrasting with small deep windows and skylights, he defined the structure of the building with daylight. From time to time, he used wide eaves as shading elements or deep windows as in La Tourette Abbey. It can be seen in Sainte Marie de La Tourette Figure 3 (URL 4)., designed by Le Corbusier, and Notre Dame du Ronchamp Figure 4 (URL 5)., also designed by Le Corbusier.

Figure 3. Le Corbusier - Sainte Marie de La Tourette

Figure 4. Le Corbusier - Notre Dame du Ronchamp

Wright used natural light in a symbolic sense in the religious buildings he designed. While he used physical light in residences, he used to light both physically and symbolically in offices. It is observed that Wright usually takes the natural light vertically and directly into the place. The architect has consciously established a balance between artificial light and daylight. In his works designed in an open plan, it is seen that the walls do not extend to the ceiling, thus the place feels open and receives more light. In climates where the sun is irritating, Wright used large windows but optimally blocked excess light with wide eaves as shading elements. The windows in buildings designed by Wright are at a human scale. Wright masterfully brings the light used by a professional photographer to illuminate the shadows from the windows into the place. First Christian Church designed by Frank L. Wright seen in Figure 5 (URL 6)..

Figure 5. Frank L. Wright- First Christian Church

It has been observed that Ando uses daylight symbolically in the examined residential and religious buildings. The architect took the daylight into the place more in the vertical direction and preferred wide glass windows against the concrete surfaces in the horizontal direction. Ando establishes a relationship with nature in his designs, therefore he prefers massive masses in buildings where the function is appropriate, creating a sharp contrast of light and shadow on the walls with the light taken in through long and narrow strip windows. In their buildings, light adds depth to the place. The architect uses glass surfaces as thin horizontal stripes or on large surfaces. In his works, it is seen that his relationship with light design is at the forefront. Seen in Light Church Figure 6, designed by Tadao Ando (URL 7).

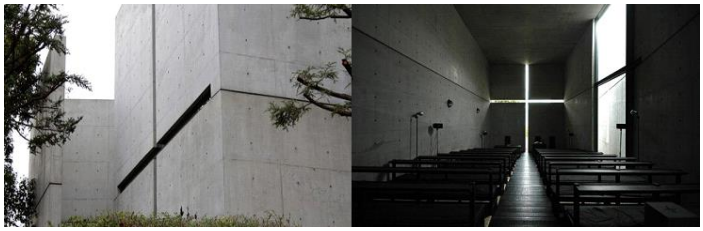

Figure 6. Tadao Ando-Light Church

4. Results and Discussion

He carefully observed the works of Ando, Wright, Kahn, and Corbusier and applied some of the elements they used in their designs by passing through his own cultural filter and interpreting them. By reflecting the light from the water element is placed in the exterior, it sometimes brought it into the place from low windows and brought interesting light plays to the place. He used the water element frequently, reflected the sunlight to the structure like a mirror with the water elements used, and tried to control the light reflected from the water.

In his works, Holl used daylight functionally in residences, museums, and dormitories, and symbolically in office and religious buildings. It is seen that he uses daylight horizontally or vertically, linearly or reflected, depending on the meaning he wants to give to the place. The architect uses the most appropriate way by calculating the reflection and refraction of the daylight of the region in his designs. It is observed that he uses human-scale modular windows in his buildings. Like Ando and Corbusier, he used light by reflecting it from water elements.

Kahn uses daylight in a symbolic sense by taking the place vertically. Ando interprets the light used in the place with the traditions of the East and takes it into the place from the wall and floor combinations in general. In the buildings he designed, dim places attract attention. On the other hand, Holl is seen to create a soft and colorful atmosphere by reflecting the sunlight to the place. It is observed that Holl and Le Corbusier sometimes use colored glasses or reflect them on colored surfaces while taking the sunlight into the place. Kahn, while giving symbolic meaning to daylight, used it in accordance with the function of the place. Wright balanced daylight and daylight by considering function. By using light, Le Corbusier brought luminosity and Ando poetry to the place. Holl used daylight physically or symbolically according to the effect he wanted to create in the place.

Since Le Corbusier lived on the shores of the Mediterranean, he considered the issue of protection from the disturbing effects of daylight, especially in summer, as a design criterion in his buildings. In his designs, Le Corbusier used horizontal band windows and corner windows by retracting the load-bearing structure on the façade in order to let the daylight into the place as much as possible. Similarly, Ando and Wright made designs that would not be affected by the summer conditions of the climate they lived in. On the one hand, while using vertical windows throughout the place to let the daylight in as much as possible, wide eaves and fixed shading elements were designed to control the disturbing effect of the sun. It is seen that all architects pay attention to the occupancy-place ratios in their facade designs.

It is observed that Le Corbusier used the golden ratio and designed the façade to benefit as much as possible from daylight. It is seen that all architects try to include sunlight indirectly in their buildings in hot climates. For this purpose, the slits and gaps left on the façade and their balance with each other are important.

5. Conclusions and Recommendations

While examining the effects of natural light in place design, modern period architects who used natural light as an architectural element in their designs and had world-renowned buildings were examined. These architects are distinguished architects specializing in their fields such as Frank L. Wright, Le Corbusier, Louis Kahn, Steven Holl, and Tadao Ando. Kahn and Ando used daylight in the religious buildings they designed, generally symbolically and by reflecting the daylight. In Holl's and Le Corbusier's designs, the use of daylight by reflecting it from colored surfaces was used more intensely. Wright, on the other hand, used natural light in his projects by reflecting it or taking it into the place linearly b the functions. Architects, who used daylight as a design element and included it in their works, were able to transform the indoor environment into an architectural place with daylight. In this way, they have brought unique qualities to their designs. In other words, daylight has gained a unique meaning on the surfaces by reflecting in the interior.

Daylight, which is used as a symbol, is taken into place at a low level in some religious buildings, and a mystical atmosphere is created. In some, the light is taken into the place from all directions, making people feel the fact that "Allah" is everywhere and sees everything. In these works, daylight illuminates the place on a human scale, symbolizing that sacred life is intertwined with daily life.

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