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Light and Experience of Space - Construction of Metaphysical Space

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Key words: Light; Visual perception; History of lighting

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Abstract

The main goal of this research is to perceive the influence of light on the brightness of the architectural space through the different positions of the Sun and its varying intensity at different periods throughout the year. Through a historical review of architectural styles and architectural elements, the influence of daylight on the shaping of the architectural space is presented.

When we talk about architecture, we talk about light, first of all daylight. It is not just physical, its enabling perception of the exterior and the interior, it also provides energetic component to architecture, duality of matter and energy thus generating aesthetic sensation among users.

Introduction

“We find beauty not in the things itself but in the patterns of shadows, the light and the darkness, that one thing against another creates.”

Jun'ichiro Tanizaki

Our visual perception of this world is defined through the perception of material and light, i.e. through the connection of two seemingly completely opposite characteristics inextricably linked to each other. Light is revealed in the human eye through interaction with material, while material visually exists only in the presence of light. This mutual structure of themselves creates and defines the atmosphere and visual environment in which we live. In the architectural composition, light brings an ancient symbolic value. Its control represents a great architectural achievement as Plato said "Light will bring forth the truth". It is the light that defines the thought and culture of civilizations, it reveals the world, gives security to thehuman soul and is a link synonymous with the Divine. Yet the light of the world is ether - an absolute metaphor. The light builds human symbolism, it signifies life, while its absence presents non-existence. Thought reflects Divine Light, artistically presented in space as its reference, with light being the main element. The light defines the space and it transforms and changes during the day.

Material And Methods

The history of lighting in architectural buildings does not develop in a single line. Several independent concepts emerge that are intertwined in the telling of a story, how people have tried to elevate light in the name of spirituality, in the name of social organizations, or with practical or aesthetic intent inthe environment of objects. The evolution of architectural lighting design is always connected with architectural form, new technologies and innovative visions.

Chronological Aspect of Light

The different strategies in the lighting of space and objects in general and historically can be dividedinto three concepts: - Absolute body – absolute space; - The body reacts slightly in itself; - Light penetrates the body.

Absolute body - absolute space is a concept characteristic of Egyptian culture where the lighting of parts of the object dominates the lighting of the space itself. Impressive examples of mastery of light in the ancient world are generally seen in sacred buildings where a ritual connection was established with the mythical in the sky, all in order to achieve monumentality in the axial tunnels of temples such as Karnak and Luxor.

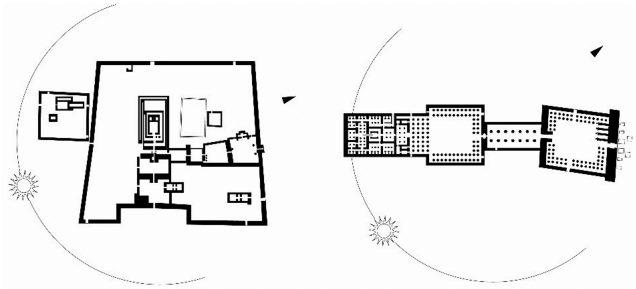

Figure 1: Classical period, Egyptian temples at Karnak Temple of Amun Ra and at Luxor Temple ofAmun, Mut and Konsa

These corridors were directed towards certain points in the desert horizon, where the Sun penetrated deeply into the object during a certain period of the year, leaving a strong impression and meaning. The corridors were imagined as vessels through which light "flowed" once during the year and illuminated, i.e. resurrected perceptually and symbolically the figure of the deity that was placed at the back of the dark part of the temple, with cosmic-mythical energy that could restore their power to the God, thus devoting themselves to life on earth.

The second concept, when the body reacts slightly within itself, can be analyzed historically through a brief overview of styles and their relationship to light.

In the Ancient [classical] period, the attitude towards light was more directed towards rational goals. The doors of ancient Greek temples faced the light of the Sun in the morning. Placed with their longer axis in the east-west direction, they received the red light from the east in the morning which dramatically illuminated the image of the God who was inside the temples.

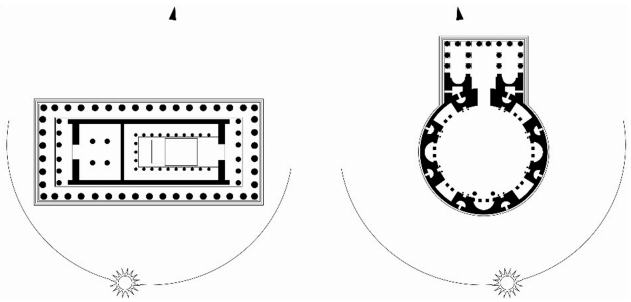

Figure 2: Ancient period, Ancient Temples, Parthenon in Athens and Pantheon in Rome

The distinctive horizontal light of the Sun, as a weapon working in reverse direction, struck deeply inside the temple and helped recognize the image of the place of the God at a particularly significant time of the day. The Parthenon [447-432 BC] is a temple dedicated to the Goddess Athena, protector of the city of Athens, where the statue of the goddess was illuminated by the golden light of the rising sun (Figure 1).

The Pantheon of the Temple of All Gods in Rome [118-28 AD BC] laid the foundations of architecture (Figure 2). The temple is an object with a perfect circular base under a semicircular vault, which forms an absolute volume with its massive structural elements. However, the power of this building is not in its mass, nor in its interior, but in the active dialogue it achieves with the sky. It is the light that remains deeply engraved in human hearts. The circular opening through which the contact with the sky is made is the only opening of the object. Despite that, the object leaves a strong impression of calmness and harmony, without a feeling of heaviness. The building is filled daily internally with zenithal natural light through the sunrays entering through the large opening in the dome. In doing so, the rays construct and shape their own spaces and illuminate and enliven the deities embedded in the walls of the building. The cassette dome is further dematerialized and connected to the cosmos through the gilded surface bathed in light, which attracts attention and directs the observer's eye to the opening, i.e. to the sky. In addition to the impressive atmosphere that can be felt in the space, it is also necessary to mention the impression that everyone feels welcome in that space, without any hierarchy among the visitors.

As a powerful witness to more than two thousand years of our civilization, light and architecture share a common bond. That connection is manifested through the art of light and architecture, through the nature of light manifested through the Sun as a source of light, and through the functional - creative powerof the builders. In both cases, light is a source, not just an illumination, but it is also an inspiration and a meaning.

In Christianity, light, including daylight, on a metaphorical level becomes a symbol of God himself, and the divine light that shines in the darkness is embodied in Christ who declared "I am the light of the world." [1] Byzantine architecture is identified with the "inner light", in the physical and spiritual sense. In a physical sense, it results from the use of golden elements on the mosaics that additionally elevate the spacewith light. Gold as a material has the ability to receive even the smallest amounts of light and reflect theminto darkness. In a spiritual sense, the "inner light" is related to the Ethics of Christianity and its relation to light in space. According to Nicolai Hartmann [2], the goal of church architecture is LIGHT itself, which can be achieved in different ways in principle.

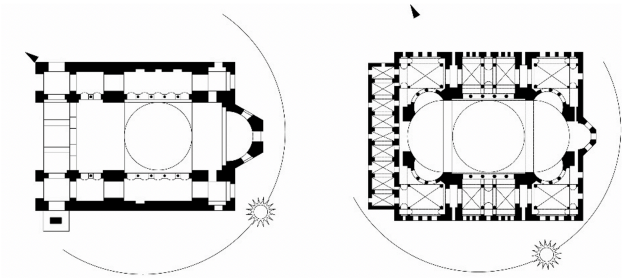

Figure 3: Byzantine period, Churches of Saint Irene and Saint Sophia in Constantinople by Anthemius of Thrale and Isidore of Miletus

In the golden period of Byzantium, [the reign of Justinian 527-565], in architecture, when building religious objects, the most important thing was to create a space that was free from pillars and above that space, a golden roof that seemes to float, i.e. as if it hangs in heaven. The space that was captured in the body of the buildings was subtly combined with proportion and an abundance of sunlight and dazzling reflections. The interior was filled with light that flooded the space. Light entered the space through the openings located on the arches in the north and south and through the openings of the semi-domes in the east and west. The greatest amount of light was provided through the ring of windows in the lower part of the main dome, thus achieving the effect of floating of the dome.

The most impressive examples from this period are the Church of the Holy Wisdom, St. Sophia [532-537] and St. Irena in Constantinople [537] (Figure 3). In the basilicas of San Apollinare Nuovo [Basilica di Sant'Apollinare Nuovo] and the church of San Vitale [Basilica di San Vitale] in Ravenna as well as the church of St. Sophia in Ohrid, (Figure 4) the light entry is basilical through the windows located immediately under the roof structure of the central nave, while the openings of the side naves additionally filled the space with pleasant natural light. In Byzantine art, light, specifically in fresco and icon painting, was, and still is, an element that is painted, in contrast to the Western schools of painting where the shadow was the one that was drawn.

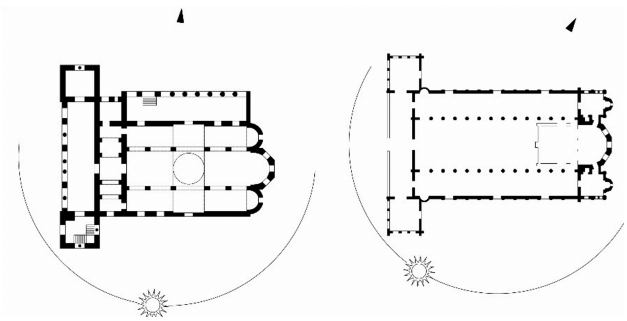

Figure 4: Byzantine period, Churches of Saint Sophia in Ohrid and Basilica of Saint Apollinare (Basilica di Sant'Apollinare Nuovo) in Ravenna

The light that was input or as it was also called “revival”, is an element that gave spirituality to the saints. In the icons and frescoes, the halo above the heads of the saints seems to shine from within as a divine symbol. While the golden leaves of the halos reflect light towards the human eye, the original source of light, which is either an ambience created by daylight or the flickering of candles, goes unnoticed in thedark church surroundings. Also, the contrast between the luminosity of the halo and the dark colored faces reveals a figure in silhouette, adding to the mystery of divine light. Unlike the Byzantine concept where the space was filled with a large amount of Divine daylight, the input of light at different periods varied from the rationally uniform to the spiritually mystical.

In the Romanesque [10th-13th century], light was used as an element to increase the spirituality of the religious rituals. The light with the help of the constructive system was directed to emphasize the religious and spiritual ceremony, in order to exalt the divine. The interior was illuminated through the openings in the massive walls in the upper zone of the central naves, in a basilica manner, illuminating the stone vaults that, under the influence of the openings and the light, freed the ceiling from the body of the building, and emphasized the load-bearing construction of the stone ribs, as in the example of the churches Saint Ambrosio (Basilica of Sant'Ambrogio) in Milan and Saint Remigius (Saint Remigius) in Reims (Figure 5).

The altar in the east was illuminated with morning light from inside and that light spreads in the space towards the believers, while in the afternoon the light from the west was directed towards the altar itself. In medieval European architecture, the systematic approach to architectural form served the purpose of symbolizing subordination to the Christian cosmos. Just as Christianity is based on spirit as an existential reality, so is the medieval articulation which aimed to "dematerialize" and negate anthropomorphic class orders. Dematerialization was understood as a function of light, as a divine manifestation. That is why it can be said that the medieval man "built" light, as the most immaterial natural phenomenon. Since then, light has been a basic means of architectural characterization.

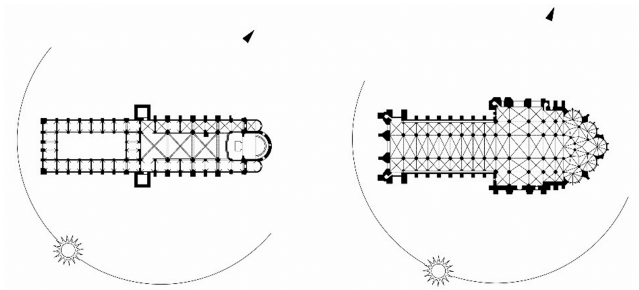

Figure 5: Romanesque period, churches of Saint Ambrosio (Basilica of Sant'Ambrogio) in Milan and Saint Remigius (Saint Remigius) in Reims

In Gothic cathedrals, the tall massive elements of the walls and the openings, form a wonderful view of medieval cities across Europe. But what is immediately apparent upon entering is the large number of colorful stained-glass windows, displayed in a way in which physical reality is completely subordinated to the mysticism of twilight in the air with hints of shadows that dominate the stone openings of the interior elements. The color in the space becomes substantial. The colored light of the stained-glass windows functions as a symbolic "bridge" between the eternal and ineffable realm of the Divine Spirit and the temporal world of human perceptual experience. The walls and the ceiling are in semi-darkness, and their negation enhances the aerial fusion of colorful light emitted inside the building. Through the stone rosette window, the space is filled with a palpable light mist that comes and goes as time passes depending on the weather conditions.

The stone body of these heavenly buildings was a means to achieve a certain aim, and is not an aim itself and that is why many beliefs of the church could not be incorporated in the spirit of the building. The body is a translucent light, as shown in Notre-Dame de Sartre and Notre-Dame d'Amiens cathedrals (Figure 6). The reading of the interior space of the Gothic cathedrals can be related to the desire of the builders for its transparency and thus the idea of God as the primary light and space is prsesented.

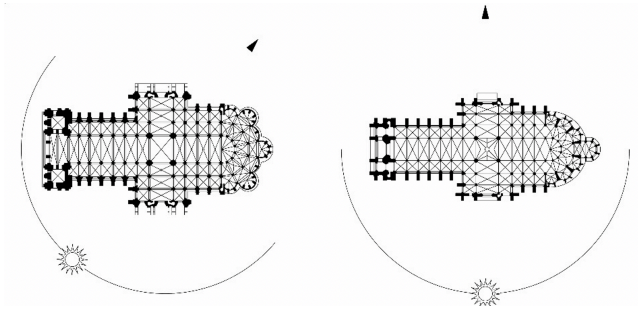

Figure 6: Gothic period, Notre-Dame de Sartre and Notre-Dame d'Amiens cathedrals, France

Ever since the aesthetics of Hegel, [Georg Wilhelm Friedrich Hegel], [3] the Gothic cathedral has been explained as a paradigm of the physical expression of an immaterial idea. Of course, no one can escape themagic of the supernatural atmosphere that prevails in many Gothic cathedrals, but the question remains whether this effect of spaciousness was directly inspired by the medieval scholastic concept of space.

Even today it is difficult to verify whether the stylistic and structural changes from Romanesque to Gothic were caused by parallel changes in theological thought. Historically, the relationship to light can be understood as a continuous change of two references: spirit and matter, and the divine and the corporal. The Gothic has its own identification, "Gothic style = religiosity," an identification that no doubt rests on other earlier systems of connotation, such as "flight high in the sky = ascension of souls to God," or "contrastof light passing through church windows and naves in penumbra = mysticism". Such connotations of Gothic are still rooted in our perception today. Because of this, a large number of the newly built religious buildings in the world are built in neo-Gothic style, in order to express the presence of the divine.

The Renaissance interrupts the period of the Middle Ages of spiritualism, i.e. spirituality of the space and introduces a soothing and uniform treatment of light with the use of grayish softness, such as inthe Basilica of San Lorenzo [Basilica of San Lorenzo 1429] by Filippo Brunelleschi in Florence (Figure 7).

And where the space was lit differently, there is a subtle gradation, and the goal was for the light to articulate rather than to captivate the space. The main purpose of the quattrocento light was to improve the clear vision in the modeling of the form, which allowed an easy and total understanding of the space. It was devoid of any mystery.

Light became a discrete and neutral medium indistinguishable from air, in order to emphasize the aspects of architecture: accuracy, completeness, proportion, order and geometry. Renaissance materialistictheorists, such as Leonardo [Leonardo di ser Piero da Vinci], were concerned with the perception of form analyzed through light, and it became a scientific tool for understanding reality. The avoidance of natural shadow softened and smoothed the Gothic interior surfaces, raising the sensation of perception to the levelof immateriality.

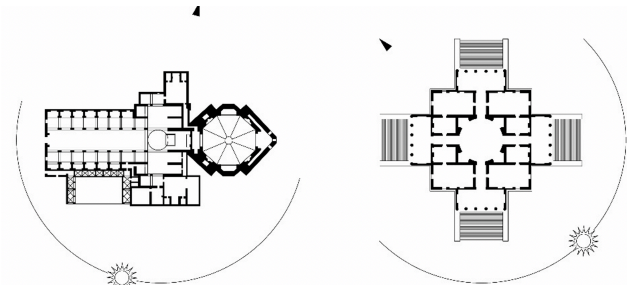

Figure 7: Renaissance period, Basilica of San Lorenzo in Florence by Filippo Brunelleschi (1377-1446) and Villa Capra - La Rotonda in Vicenza by Andrea Palladio (1508-1580)

In the Baroque era, contrary to the reform instinct of the Renaissance, the need to reaffirm the mystical aspect and bring spiritual excitement to widespread religious sentiments was encouraged, through theatrical lighting that affected the senses of believers. As in painting, in church architecture of the 17th century in Italy, with the use of chiaroscuro contrasts, unexpected breaks in form and space were achieved, with light from hidden sources, thus earthly and worldly elements merged into one whole, in order to visualize and popularize sacred beliefs. As examples, we can mention the church of Bernini [Gian LorenzoBernini] - St. Sant'Andrea al Quirinale, the church of Francesco Borromini - St. Carlo of the Four Fountains [San Carlo alle Quattro Fontane] (Figure 8) and especially the church of Guarino [Guarino Guarini] in Turin, in which the spectacle given by the light elevating upwards promises a future in the heavens.

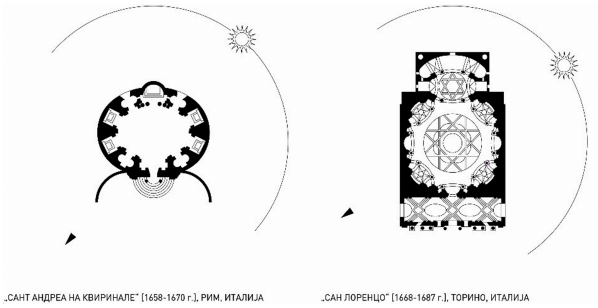

Figure 8: Baroque period, Churches of Sant'Andrea al Quirinale in Rome by Gian Lorenzo Bernini 1598-1680 and Church of San Lorenzo in Turin by Camillo Guarino Guarini (1624-1683)

The Rococo period is characterized by the replacement of the calm and steady lighting of the Baroque with a turbulent (restless) energy inspired by an atmospheric perspective, where light was used to corrode the wall masses, exploding into the space with unreal depth. Such tendencies only accelerated the abundance of light used to illuminate and corrode the envelopes of buildings in the 18th century,culminating in the so-called German Rococo, for example in Balthasae Neumann's buildings in Nersheim and Vierzehnheiligen. The connection of light phenomena became a tool through which the eyes of the visitors were dazzled, thereby emphasizing the infinite power of the state in the 18th century. Examples of this approach can be seen in the objects intended for the legislative power - the courts in France and Germany (Figure 9).

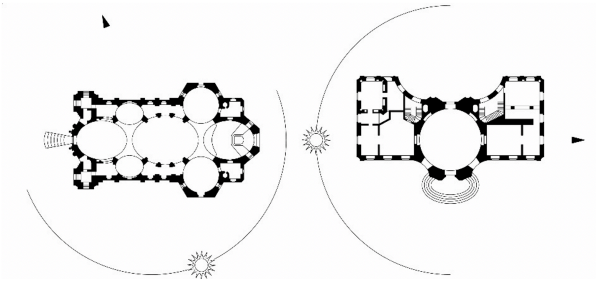

Figure 9: Rococo period, Basilica of the Fourteen Holy Helpers, in Bavaria by architect Johann Balthasar Neumann (1687-1753), and Amalienburg Palace in Munich by architect François de Cuvilliés (1695-1768)

The advent of industrialization in the 19th and 20th centuries, (Figure 10) combined with mass production and the use of steel and glass as building materials, imposed the illumination of buildings with natural light as a component of the design process itself and radically transformed architecture. Technical progress was also stimulated by the health benefits provided by the quality of natural light in buildings where people stayed, worked and lived.

The trend of wide use and control of natural light in buildings was a model that was used in the design and construction of all kinds of buildings: houses, offices, schools, libraries, factories or museums, as well as in the construction of sacred buildings. Such a revolution was not only a quantity for the rise of new democratic systems and concern for human individuality, but it also brought architectural freedom in the expression of ideas about light and lighting. These ideas were no longer just dogma or propaganda, they could offer people a spectrum of undefined and indeterminable experiences.

In the last century, the fascination with daylight grew in many ways, which was also associated with changing worldviews, starting with static and unchangable absolutes that led to a more liberating reality. From the mentioned above, it can be concluded that one of the most powerful allies in the construction of buildings is light. For us, the act of inhabiting was mainly in agreement with the Sun and its power.

"The sun never knew how beautiful it was until it fell on the wall of a building" - Louis I. Kahn

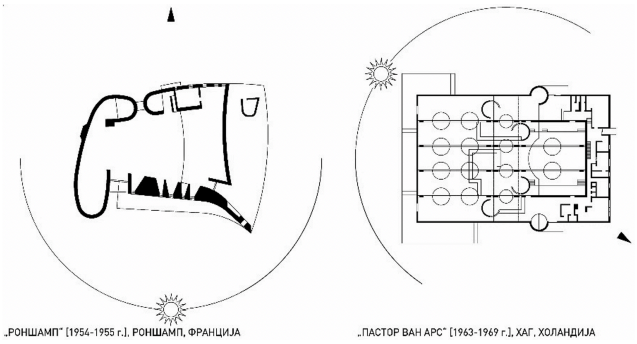

Figure 10: The Modern Period, Ronchamp Church in Ronchamp by Le Corbusier (1887-1965) andPastor van Ars Church in The Hague by Aldo van Eyck (1918-1999)

In the culture of the East, (Figure 11) the treatment of light in objects developed in a different way. There, in addition to light, darkness and shadows have their own role in shaping the space, i.e. through their communication, one's own beliefs about life and existence were transmitted. If we were to compare the way of building shrines in the west and Japanese temples, there is one essential difference in the building principle. In Gothic cathedrals, the roof was raised as high as possible in order to place the peak as high as possible towards the sky, while in Japanese temples, the roof and heavy tiles were placed first, and the rest of the construction was additionally built in the thick shadows of the canopy. This method of construction

was not only characteristic of temples, it was used and adapted depending on the climatic conditions and for everyday buildings. If we were to analyze an example of a roof in a traditional Japanese house, placed over porous walls through which it developed as an umbrella, it intercepted both the sun and the rain, but also served as a horizontal filter that spread the light without obstacles.

This unique relationship between peace and mystery is also recognized in the Japanese psyche. What stands out in these simple wooden houses is the atmosphere shaped by the dim light that turns into shadow, or like the glow of white shoji paper that brings life into the darkness.

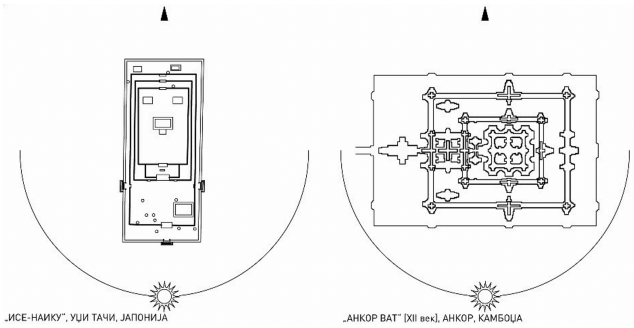

Figure 11: In the culture of the East, the relationship to light and shadow is equally important in thecreation of architectural space

This synergy between light and matter in space creates a subtle attraction.

Phenomenological Aspect of Light – Subjective Becomes Objective

Phenomenology in architecture appears in the experiential potential of architecture itself, independent of pre-existing inherent meaning. It can also be interpreted as a "the manner of thinking about architecture". [4] The main interest of phenomenology nowadays is the indefinite aspect of perceptive experiences. Steven Hall emphasizes the experiential potential of architecture, on the manner and life experience which contributes to thinking over architecture which becomes the base for phenomenology concerning architecture.

As phenomenological aspects of light are a matter on interest, they can be analysed as aspects being based on the essence of experience. The analysis and describing of the empirical and phenomenal aspects include three elements: matter, space and light. These three elements also include the sense (emotion) which can either be subjective or objective. Matter and space have objective impact, while light, which as a phenomenon is easily measured, has subjective impact on us. It is not impossible to analyse these three elements separately. All of them perceived as “a whole” reveal the phenomenological aspect of the space i.e. the subjective becomes objective in our memory.

Matter And Light as A Concept of Lighting; Space Perceived Phenomenologically; Light Perceived Phenomenologically

The first impression of the atmosphere in the space is the material presence of things through the light that illuminates them. The matter lives with the help of light and everything in the material world is light which can be consumed by itself. “The matter is infinite. A stone, for example, can be cut, carved, divided in parts or polished always transforming into something else. Then, take a small amount of the same stone or a huge amount of it. It will further transform into something “third”. Then when exposed to light, it is different again. There are thousands of different possibilities concerning one kind of material”. The visual understanding of the world is defined by getting more knowledge of the matter and light i.e. through the connection of these two evidentially quite different phenomena, permanently connected one with the other. Light reveals in the human eye through interaction (mutual action) with matter itself, usually existing only in the presence of light. This mutual dependence creates and defines the atmosphere and theusual surroundings in which we live.

Discussion And Conclusion

Light as a definition is energy and its effects exceed the limit of science and get into the limit of empirical. It makes our world a sequence of infinite visual permutations, discovering colors, textures, distances and the course of time. These and other qualities of light, can also have an influence on the emotions and memories, through creating specific characteristics of a certain location. What we most often remember about a certain location is the feeling the place evoked, not the formal details. Practically, light provides visibility and by defining visual limits, it establishes the hierarchy of the space as well as sequences or spaces for action and relaxation. The mutual relation of the two media that enable us to feel and experience the space through the basic geometrical parameters, is the way to perceive matter and light as a unique sense. That sense can be experienced in two ways as: - Sense dominated by matter and its qualities under the influence of light (low light); - Sense when light dominates the matter, thus making the matter “vanish” (bright light).

The most frequent hypothesis about space is that the presence of light enlarges it, while the absence diminishes it. In reality, the mutual relation of light and dark, and the way by which they change the perception of space is much more complex. The changeable nature of light and darkness and their ability to cause the sense of fullness and emptiness is described by the historian of architecture Steen Eiler Rasmussen in the following quotation: “Light itself creates the effect of an enclosed space. A campfire in the dark night creates a cave of light bounded by a wall of darkness. Those who are in the circle of light have the sure feeling that they are together in the same room." [5] With these words, Rasmussen illustrates the didactic quality of lights and darkness i.e. they become personification of the presence and absence of form of the material and the immaterial aspect. As light has the possibility to present the concrete form and the atmosphere of the space, light and architectural elements are used as a tandem, when determining the limits of the concerned space. The light can suggest the presence of unlimited space or definitive limits, transparent openings or non-transparent surroundings. Together with the building form, the light, the darkness, and their intertones, represent a very strong palette, which constructs and supplements our understanding of the architectural space.

In the short essay by the Japanese writer Junichiro Tanizaki “The Glory of Shadows” [6], written in 1933, he describes the aesthetic of the Japanese culture concerning the subtlety of light and the abundant presence of shadows for which he believes are the basis of his country’s culture. His observations refer to the way by which the dim lighting reveals theessence of the material, its delicate texture and nuanced (shadowed) form.

The architect Peter Zumthor in the ninth chapter of his book “Atmosphere” [7], writes about the influence of light upon things, the influence of light upon materials, about the quality of light, where and how it falls upon things, where the shadows are, where the surfaces are dim or sparkling and what it feels like when the material or the things have depth. Zumthor expresses the relationship on how to approach the choice and method of lighting through two ideas. The first idea is “…to plan the building as mass created by total shadow, and then to install light to deepen the darkness, as if the light were a new flowing mass.” The second idea “…to illuminate materials and surfaces systematically and to follow the way how they reflect the light. In other words, it is essential to choose materials knowing the way they reflect and to set everything on the basis of that knowledge.”8 These ideas of Zumthor are a good approach to the relationship between light and material as a process, which should start at the very beginning, when thinking about the space. Meaning the light should be the cause and not the consequence, which is to be defined additionally.

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