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"Lack of Natural Light in Architectural Building and Psychological Influence of Colors "

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ABSTRACT
As the world developed throughout history and everything else with the addition of electricity, or current, people destroyed natural light and relaxed too much. Through various literature and scientific articles, it can be seen that natural light can never be compared to artificial light. This scientific paper explores the importance and significance of natural light and colors. It also explains what happens to our body when there is no natural light. In various articles and books, we can see research on how important natural light is. Natural light has numerous advantages that the authors have presented in their books. In my paper, I want to write about the psychological reactions that occur to us when we have and when we do not have light. The research is designed as a literature review study. Through my research, I think I have proven the effect of light on the body.

Key words: *light, natural light, architecture, color*

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I. INTRODUCTION

The literature we have on the Internet covers quite extensively the topic of light and natural light in general. Researchers and academics have studied this topic extensively, providing insight into the difficulties people face with artificial light and natural light. Through various articles it has been proven how important light is and how much more productive we are when we have it. As the world developed throughout history and everything else with the addition of electricity, or electricity, people destroyed natural light and relaxed too much. Through various literature and scientific articles it can be seen that you can never compare natural light with artificial light.

In architectural design, light serves as a fundamental element that shapes spatial perception, defines the atmosphere, and influences the emotional experience of a building. Beyond its functional role, natural light significantly contributes to the aesthetic and expressive qualities of architecture. Le Corbusier famously referred to architecture as a harmonious play of light and shadow, emphasizing light's essential role in the composition of space. Similarly, Louis Kahn viewed light as a material that reveals and gives meaning to architecture, highlighting its deeper, almost spiritual significance. In modern architectural practice, the thoughtful combination of natural and artificial lighting is increasingly vital for achieving both environmental sustainability and energy efficiency. This idea is explored by authors like Peter Zumthor in Atmospheres, where he reflects on the sensory and emotional impact of light, and Henry Plummer, who delves into the poetic qualities of natural light in his book The Architecture of Natural Light.

OBJECTIVES:

In this essay, in the following sections, we will examine the complex field of color psychology. By conducting a comprehensive analysis of existing research, our goal is to clarify the complex correlation between color and the overall quality of the living environment.

-The advantage of natural light over objects;

-Examine the importance of color in interior design;

II. LITERATURE BACKGROUND

Author Mary Ann Steane explains in her book " The Architecture of Light " that electricity has made it possible to work 24 hours a day, 7 days a week. 'Light' implies one of the most important symbolic structures in the human being.

Author Nina Ugljen Ademović talks about natural light in her book "Arhitektura i Osnove Arhitektonskog Projektovanja ". She explains how natural light affects human mood and helps us orient ourselves in time and space. Using natural light can achieve many advantages for people and space.

An example of a glass window was discovered during the Elamite civilization, between 1300 and 1400 BC. The glass paste tubes were arranged in a frame and were probably used to illuminate the building. The archives of the Median palaces at Dur-Sharrukin contain some of the earliest records and illustrations of doors and windows in Iranian architecture. (Mina, 2016)

The room where the architecture first emerged. It is the mental location. You react to the room's character and spiritual atmosphere as you take in its dimensions, structure, and light, realizing that all a person proposes and creates comes to pass. The room itself must make the room's structure clear. I think structure is the source of light. (Kahn, 1971).

Studies performed in Russia and Czechoslovakia show that workers in workplaces with windows, compared to those without windows experience higher headaches, dizziness, and illness. (Plant 1970).

The lost time due to employee health will raise the cost of the products being produced. According to a Thuringia, Germany study, windowless factories should only be utilized when absolutely necessary. (Collins 1975).

Figure 1: Mirror collecting sunlight and sending it to an underground office 30 meters below ground on the campus of the University of Minnesota (photograph: M. Boubekri)

Daylight affects mood, tiredness, and eye strain. Having a connection to the outside world and maintaining contact with it is one of our fundamental necessities. (Robbins 1986).

Interior designers utilize a range of abilities and technological expertise to design rooms that effectively suit human requirements and emotions. They collaborate with contractors, architects, engineers, craftspeople, furniture merchants, and business owners. Proficiency in textiles, materials, color theory, space planning, sustainability, and other related areas is essential. In addition, they utilize software packages for both two-dimensional and three-dimensional computer-aided design and building information modeling. An accomplished interior designer necessitates a comprehensive education and proficiency in diverse fields (nysid.edu, 2012).

Figure 2: Sunlight brought into an underground office 30 meters below ground on the campus of the University of Minnesota (photograph: M. Boubekri).

Color is a characteristic of an object that can be defined by its hue, brightness, and saturation. The phrase refers to electromagnetic radiation that falls within the visible spectrum, which includes a specific range of wavelengths that the human eye is capable of seeing. The perception of color is contingent upon visual perception, the presence of light, and the subjective interpretation of individuals. Colors are categorized based on their hue, saturation, and brightness within the range of visible electromagnetic radiation. The study of color physics involves examining how objects interact with light, whereas the study of color physiology focuses on the responses of the eye and brain to light and sensory information. The psychology of color is engaged when the mind analyzes visual data, juxtaposes it with memory information, and interprets it as color. Comprehending color encompasses the fields of physics, physiology, and psychology (Nassau, 2024).

Figure 3 : An office building in Montreal, Canada, with windows but where most workers don't have access to views to the outside (photograph: M. Boubekri).

Interior design is a discipline that involves the strategic planning and aesthetic arrangement of human-made spaces, which is strongly interconnected with the area of architecture. While the aspiration to establish a pleasing atmosphere has existed since the dawn of civilization, the field of interior design is comparatively recent. Interior design encompasses a wide range of activities and is considered a professional field, with

several European countries even referring to it as interior architecture. Environmental design encompasses the entirety of the discipline focused on the various components that shape artificial settings (Friedmann, 2023).

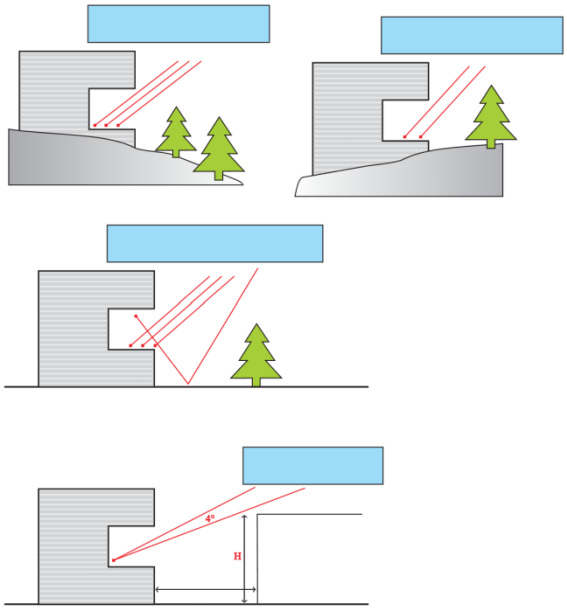

Figure 4: Light Entering the Object

Ugljen in her book "Architecture and Fundamentals of Architectural Design" says that urban and architectural aspects are determined by a properly oriented building. The color and intensity of light depend on the orientation. The architectural conditions that we need to take into account are: type of glass, shape, size of windows, dimensions of rooms and overall dimensions of the building.

The author Ugljen also explains the example of light in the picture. In Figure 4. it can be seen that in the first photo there are no obstacles to the horizon. In the second photo there is a significant obstacle to the horizon. In the third photo the building is located on flat terrain without immediate obstacles. And in the fourth photo the smallest distance from the neighboring building is 1H and allows the entry of natural light of at least 4* free sky.

III. LITERATURE REVIEW

I found the study by Francine Harb, Maria Paz Hidalgo and Betina Martau on Google Scholar. The study included 20 employed persons divided into two groups. Shifts were only daily between (8:00 a.m. and 6:00 p.m.). One group worked in a room with natural lighting and the other group without natural lighting. Only women participated in the research, without significant differences in age. Men were excluded as were workers with a history of brain disease.

The ‘‘with window’’ group comprised employees who worked in environments with natural light, i.e. where they received natural light through a window in addition to electrical lighting. Alternatively, the ‘‘without window’’ group comprised employees who worked in environments with only electrical lighting with no visual contact to the outdoors or outdoor light.

Assessment of hormonal levels Concentrations of melatonin and cortisol were measured from saliva samples. Participants were instructed to collect saliva during the last day of use of the actigraph at 08:00 am, 4:00 pm and 10:00 pm. Collector device called sterilized salivettes were used. These tubes were labeled with identifying information and were immediately frozen in 1.5-ml eppendorf-type tubes for further analysis. The samples were subsequently analyzed by radioimmunoassay. The subjects wore wrist actigraphs with light sensors for seven days.

Respondents were given questionnaires in which they had to answer 20 questions. Based on which, according to the measurement units of certain scales, they were categorized according to their psychological state.

Rayleigh analysis shows that the two groups "with windows" and "without windows" showed similar levels of activity. In relation to exposure to light, the measurement was significantly higher than in the group without windows. The measure and the amplitude of the general activity level did not differ between the two groups. Groups with a window showed a higher level of activity during the night, because people had natural light during the day. The difference in cortisol levels between the two groups reached a difference at 10 pm when the group without windows had higher cortisol levels than the group with windows. While insignificant differences in cortisol between the two groups were found in the period between 8 am and 4 pm. The window group presented a lower level of melatonin at 8 am but a higher level at 10 pm. The correlation between these hormonal levels and the results for minor psychological disorders, depressive symptoms, sleepiness and sleep quality were calculated. The results were positively correlated with cortisol levels at 10 pm and negatively correlated with melatonin levels at 4 pm.

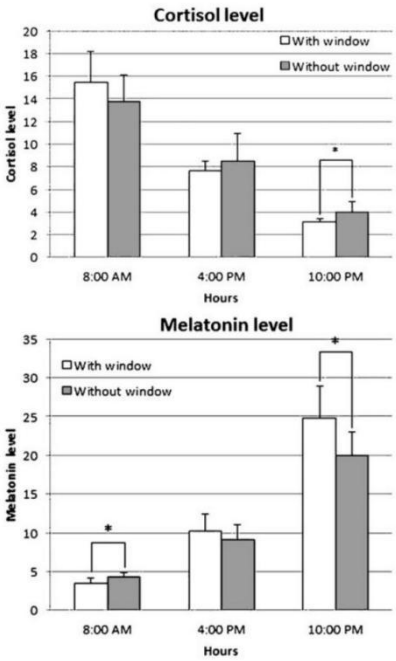

Figure 5: Differences between melatonin and cortisol levels in the morning, afternoon and night periods

As expected, greater exposure to light was observed in the window group. While both groups showed similar exposure to light at night. In this research, symptoms of depressive behavior are positively correlated with cortisol levels and negatively correlated with melatonin levels in two periods during the day (4 in the afternoon and 10 in the evening).

Many authors have described that there is a connection between cortisol, melatonin and light in the building with mood disorders. This may be due to the existence of numerous steps that later lead to depression.

In this process, we came to the conclusion that there are hormonal changes that can later contribute to the development of depression. Therefore, it is to be expected that subjects who work in an environment with a lack of natural light may already show changes in psychological behavior and be much more prone to developing depressive symptoms.

According to my observation and thinking, the results were obvious, and I hope that more managers and other people who wonder will provide their workers with as much light as possible for work.

IV. RESEARCH METHODOLOGY

Research Design

The goal of researching light (natural and artificial) and the effects achieved with it can be investigated thoroughly and can be very detailed and comprehensive.

It is best to give a detailed analysis of the light and when it began to be taken into account and recognize its quality and extract the most important from it. Many articles mention healthy orientation and using only natural light and the benefits of natural light.

Data Collection

Literature Review: The main source of information I used were books that were published on the Internet, as well as various articles and magazines that write about light in general. A detailed review of the literature can be found on the Internet as well as on Google Scholar. In general, books have been written about light and health using natural light.

Published Works: The literature search was randomly conducted using Google Scholar search engine on the internet. The Google search engine was employed because it is one of the most popular and widely used internet search tools. The keywords used for the search are: natural lighting in architecture, lack of natural light. The literature search was largely limited to open access documents that were published in the last twenty year.

The research I paid the most attention to and relied on the most was the research conducted by Francine Harb, Maria Paz Hidalgo, and Betina Martau. They divided 20 people into 2 groups. One group worked in a room with windows and the other without windows. They wanted to prove how important it is to work in a room with natural light and how much healthier it is.

Analysis of data

Thematic analysis: In order to find the basic things about light and when it started to be used and when architects started paying attention to it, I used literature. The research focused on the human psyche, health and feelings with and without light. Thematic analysis was used. The research focused on working in a space with and without natural light.

Comparative analysis: In order to understand the topic as well as possible and do as much research as possible. I did a comparison of the literature I found and the research that was conducted. At the beginning of the research, I set the results. A comparison was made as to whether natural light is so important and whether it has anything to do with health, productivity and motivation for work.

Synthesis

During the synthesis phase, reviews of the literature that were found were made and a correlation was made between natural light and the connection with the human psyche and health. The primary goal of this is to prove that natural light has something to do with the human psyche and health, and that we can use natural light to ingest vitamin D and increase health.

V. RESULTS AND DISCUSSION

Natural light has an effect on the human body

Through the research that was conducted, the conclusion was that there are hormonal changes that later contribute to the onset of depression. It was expected and my conclusion is that respondents who work in an environment without natural light have changes in psychological behavior and are more prone to depression. According to all the literature that I took into account in my work, it is best to work under natural light and there are no exceptions for working without natural light.

The presence of windows and daylight will reduce sleepiness and improved mood

Processing the articles I found on the Internet and reading the literature, this hypothesis can be positive and correct. In the research that was conducted and on which I based myself the most, we see that people who worked in an area without windows showed greater fatigue and a higher level of stress.

Daily need for exposure to daylight

We need sunlight to maintain our health. Our exposure needs to be controlled. The design of the building cannot meet the daily need for the normal amount of time we would need in natural light (sun).

All the articles I've read and the research I've analyzed and based on only show the fact that natural light is good and that there are no disadvantages. I hope that as many people as possible will be interested in this topic and that they will put more effort into their health and the natural environment, since this research has shown that.

Positive things that an architect can do if he uses a good orientation of the rooms in the apartment can also be more financially efficient, that is, greater savings in electricity if we have a good layout in the apartment.

VI. CONCLUSION

Studying the articles I found on the internet, it can be concluded that light is one of the most important things in architecture. Architects need to take into account the size and location of the building in order to contribute to people's greatest well-being and functionality. Natural light provides more productivity, which can be concluded from this thesis.

By skillfully selecting and combining colors, designers can influence the emotional reactions of individuals. Therefore, we should not ignore how important it is for designers and other experts to correctly interpret the knowledge they have about color psychology. People generally choose colors for their homes according to some current decoration trends or personal preferences. However, this can sometimes unconsciously lead them to make their homes uncomfortable to live in.

When designing interior spaces, it is crucial to take into account the harmony and balance of colors, including factors such as color temperature, intensity, and the use of complementary or analogous color schemes. Creating a well-balanced color palette ensures that the colors blend together and create a visually pleasing ambiance.

Color contrast is key in color perception, and the complementary contrast between orange, red, and green can be too stimulating and tiring for visual perception. In order to create a home that is visually and operationally pleasing, it is necessary to harmonize many key features with each specific living space. Using the principles of color composition is not easy because it requires consideration of user requirements and physiological-psychological reactions to the space. I hope that this article will help future generations and architects to devote more attention to natural light and to understand its benefits.

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