

## INTERIOR LIGHTING

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*The article considers general issues connected with lighting. The main focus is on interior lighting. It is an integral part of almost any interior and plays a significant role in human perception of the environment.*

One of the key roles in interior creation belongs to light. In a room lighting helps people to feel visual comfort. Therefore, when designing and arranging interiors, it is necessary to take into account the sources of illumination and its types in order to avoid problems that cause inconvenience or threaten human health.

The purpose of this study, the initial part of which is presented in the article, is to determine the optimal lighting options in the interior as the result of studying factors having impact on the quality of light and to consider them separately and in interaction.

There are two types of lighting: natural and artificial.

Natural lighting is the result of natural processes and depends on the geographical data of an area, the time of year, the time of day and the state of atmosphere.

Natural lighting is necessary for any person, but nowadays there is a need for other sources of light in order to provide people with comfortable way of life. Therefore, natural lighting can be supplemented with artificial lighting in an optimal way.

There are practical and decorative features of natural, artificial and combined lighting.

An interior designer, being an artist, with the help of lighting is able to set certain compositions that correspond to the subject of the created interior. Lighting allows to highlight the desired items, as well as to hide certain disadvantages of a room. In addition, lighting can set the "mood" of the interior or, in other words, create the desired emotional atmosphere of the subject-spatial environment.

Light is inextricably linked to one of the most important properties of objects – color. A designer, as a rule, uses properties and characteristics of light and color when creating an interior as a whole. Thus, the color can change its qualities depending on how bright the light in the room is and what its temperature is. For some interiors, the choice in favor of one or another type of lighting according to light temperature is preferable. Light is "warm" and "cold." The ability to choose the tone of lighting often plays a significant role in the light interior design [1].

The most often used sources of artificial lighting are LED, fluorescent, and halogen lamps. Incandescent lamps are less frequently used due to their inefficiency. At the same time all of these light sources have a certain color temperature.

The temperature describes the color of the light. Three main light colors are:

- warm-white – less than 3300 K;
- cold-white – from 3300 to 5300 K inclusive;
- daylight – more than 5300 K.

In this case, lamps with the same color may have different color characteristics due to the spectral composition of the color emitted. The color rendering value reflects the level of conformity of the natural color of the body with the visible color of this body when it is illuminated with a specified light source.





An important aspect when choosing lighting is the energy efficiency of lighting devices. It means the quantity of light emission by some source at a certain cost of electricity. Energy efficiency of various means of lighting is presented in table 1.

According to the International System of Units (SI), the luminance unit is lux (lux), the unit of luminous flux is lumen (lm).

In addition to light, meaning the amount of light emitted by some source, there is a concept of luminosity. Luminosity is the process by which light is reflected, absorbed, or passes through an illuminated object. A related concept of luminosity is reflected brightness. It results from the presence of reflective bright surfaces in sight.

Artificial lighting can be set differently. There are four main types of artificial lighting: general, local, combined and emergency.

Table 1. – Energy efficiency of various means of lighting

Energy efficiency	Less		Higher	
Types of lamps				
Luminous flux, lm	Incandescent lamps	Halogen lamps	Fluorescent lamps	LEDs
450	40 W	29 W	9 W	5 W
800	60 W	43 W	14 W	7 W
1100	75 W	53 W	19 W	9 W
1600	100 W	72 W	23 W	11 W
Approximate life span	1 year	1–3 years	6–10 years	15–25 years
Comparative savings	–	up to 30% and more	up to 70% and more	up to 80% and more

In general lighting and light sources are selected and arranged so that light in a room is distributed evenly.

Local lighting is given by luminaires that concentrate the flow of light specifically on surfaces that require lighting. Basically this type is used for decorative purposes. For example, in order to highlight a designed object or to adjust a room from a compositional point of view.

Combined lighting involves combination of light sources with different characteristics. This type of lighting is especially good in places where precise work is done.

Emergency lighting is useful in case of emergency and performs a coordinating function, highlighting the signs that direct to an exit. Also, an emergency type of lighting can be used when conducting particularly hazardous work, when it is life-threatening if the main lighting fails.

Requirements for natural room lighting are:

1. Uniformity;
2. Ensuring the required illumination of working surfaces;
3. Elimination of directional blinding and reflected sunlight;
4. Ensuring the necessary brightness of the surrounding space due to a sufficient level of illumination and color finishing of the interior surfaces [2, p. 110].

In architecture, a daylight factor (DF) is a parameter characterizing the amount of natural light entering a room [3]. The normalized values of DF in a room are selected depending on two factors: the complexity of visual work and natural lighting system [4, p. 100].

The coefficient of natural lighting is determined by the following formula:

$$DF = \frac{E_i}{E_0} \times 100 \%$$

where  $E_i$  is a natural illumination at a certain point inside a room;

$E_0$  – external illumination on a horizontal surface.

To find out the DF, it is necessary to carry out measurements outdoors and indoors simultaneously. To ensure sufficient measurement accuracy, the instrument, that is used, should be calibrated and, if necessary, synchronized with other devices.

A luxmeter is a device used to measure the amount of light. You can learn the principles of its operation using a smartphone. A smartphone application that performs the function of a luxmeter can be installed from the Play Store or the App Store, an app store from Google and Apple, respectively. For more accurate measurements the instrument should be configured.

To ensure a comfortable human life, there is a need to combine natural and artificial types of lighting. This is mainly required in the morning and evening hours.

If the DF in a room of a certain type does not meet the standards of lighting, artificial light sources are used. At the same time, it is important to choose a lighting device with characteristics as close as possible to the characteristics of natural lighting so that the space can be felt most holistically in the daytime [2, p. 162].

One of the most important characteristics of light in the interior is light comfort. It is created by the optimal selection of light sources.



Figure 1. – Luxmeters

You cannot underestimate the effect of lighting on the human body, since it defines how accurately the biological mechanisms will work in a body. Poor lighting negatively affects human condition. For instance, uneven lighting has a negative effect on vision and its adaptation to the environment. Strong fluctuation of light flux increases not only the fatigue of the visual apparatus, but that of central nervous system too causing headaches, dizziness and insomnia. Poor lighting leads to rapid fatigue, reduces performance, causes discomfort and adversely affects the mental state of a person.

The objectives of the organization of light in the interior in relation to the impact on human health are the following:

1. Ensuring clarity in distinguishing objects;
2. Reducing fatigue of the visual apparatus [5].

The next stage of the research will be connected with the detailed analysis of software products and rating the parameters necessary for solving problems related to the type of lighting.

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