

ENERGY EFFICIENCY ASPECTS OF COLORISTIC OPPORTUNITIES OF INTERIOR SPACE WITH INCLUSION OF ARTISTIC-DECORATIVE FORMS

Kyiv National University of Construction and Architecture

Summary. The article raised the issue of the urgency of the problem of reducing the energy consumption of interior space by means of coloristics, taking into account the influence of light and color reflexes of the environment, the aesthetic possibilities of colouristry in the interior, which are directly related to the design methods and ecology of the environment. The principles of colors solution harmony, derived from the combination of colors, forming a single color space-color field, able to form an aesthetically full-color space are analyzed.

The necessity of the laws and means of colorization to regulate the subject-spatial environment in the realization of ecological issues and aesthetic improvement of the environment of human life is proved. It was noted that in the conditions of sustainable development of the environment, in search of innovative approaches to ways of reducing the energy costs of objects of the interior of various purposes, the issues of optimization of energy consumption led to the need for special scientific methods, theoretical and practical techniques that could be tools for contemporary artists and designers.

A number of inevitable factors of the color environment interconnected and which may be instruments in reducing the energy consumption of the premises by means of colorization are determined. Namely: the type of source of light, the color of the light flux, the force or "measures" of brightness, depending

on the material covering the elements of space and the nature of the texture of the artistic-decorative form, its reflective action, which reflects and affects the overall color of the interior.

A number of functional possibilities of artistic-decorative forms, located in the color of the spatial environment, are proposed in order to create optimally comfortable conditions for human being.

With the help of the analysis and examples given by the author of the article, the main methods, which can be the same tool in the work of the artist-designer, will allow him with more professionalism to approach the decision of the tasks of increasing the energy efficiency of the interior environment, as well as the delivered creative task in placing artistic and decorative forms in the color space of the interior.

Keywords: *energy efficiency; color options; light; texture of the material; interior; artistic and decorative forms; design.*

Formulation of the problem. The purpose of the study is due to the need to introduce innovative approaches in reducing energy costs, taking into account scientific methods and structural principles, with which it is possible to estimate in advance the possibility of each logical grounded, color solution in increasing the energy efficiency of the interior environment, and recommend suitable options for use in creating ecology of interior space.

The subject of scientists research in recent years is the problems of ecology. The color is considered according to the questions of videoecology – the direction of theoretical research, which relates the comfort and quality of perception of individual fragments of the visible picture of the world with the physiological features of the structure of the vision organs and the psychology of the perception process. [1,2] The harmony of color decision is not only one of the means of aesthetic

environmental impact that can be a source of beauty, obeying the laws of beauty in design, capture, inspiration, and excitement, but it can also be an effective technique that promotes a more rational energy resources consumption. [3]

Accordingly, innovative approaches to reducing energy costs in creating an ecology of interior space by means of color opportunities are relevant.

Analysis of previous studies. Today, there are many fundamental works on the color, the possibilities of colorization, lighting, light and color reflexes and the ecological approach in the design of the interior environment, for example: Leru R. [1], Gibson J. [2], Voronetc L.A. [9], Frieling H. [6,7], Padham C., Saunders J. [13], Fleury P. [14], Itten I. [15], Bribba C.A., Greated C., Collins M.N. [16], Zeugner G. [17], Deribere M. [18], Auer K. [6,20], Meerwein G., Rodeck B. [22] and other. The article by the Dutch researchers van Assen J.J.R., Wijntjes M., Pont S. [19], concerning the influence of the illumination of the spatial structure on the perception of brilliance in the works of arts in the environment deserves the particular attention. Also, it should be noted that today there is a shortage of literature and scientific and methodological support in practical use in relation to energy-efficient possibilities of color space of the interior space. Modern literature on color, interior coloring, lighting and artistic form is mostly oriented to the experience of past years. Many encyclopedias, manuals and textbooks and atlases of practical use of coloring in the interior and artistic-decorative forms, focused on the creative work of the artist, the designer, the architect, etc., are created. Accordingly, there is a need to find new methods for purposeful design, in relation to our question.

Main study. The colorful solution of interior space, obtained as a result of a combination of colors, forms a single color space-colored field, capable of forming aesthetically complete color space – a harmony of artificial environment, which does not cause irritation, which can lead to a sense of comfort, simultaneously solve the problem of stimulating color effect. Color combinations also have the ability to increase or decrease the overall illumination of the in-

door environment, and therefore include the possibility of solving the tasks of increasing energy efficiency. In the realization of these tasks, first of all, you need knowledge of the properties of color – a scientific explanation of the nature of color, the basic laws of color perception and the mechanism of perception of color combinations, which binds different sciences in one and complementary: optical (the appearance of visual sensation of their characteristics), physical (distribution of light flux, power and wavelengths of radiation), physiological, environmental, psychological and emotional. [4-7] Accordingly balanced harmony of color, based on energy efficient means and environmental principles in the room, can be achieved only with all the elements of the interior, as well as factors associated with it. Ultimately, the color in the interior should bring the optimal psychological state to a person, a sense of positive emotions. It is known that solving the problems of reducing energy losses and its effective use at all stages is the essence of energy conservation. [8]

Similarly, it is necessary to take a number of external factors into account – this is an exterior, where the influence may be geographic (northern or southern regions), the orientation of the room on the world side, the texture of the neighboring surfaces, as well as a certain number of light beams with their brightness and reflectivity force. [1,10,11] It should not be forgotten that light rays have natural environmental colors that are typical for the area, can vary significantly depending on the season, and their intensity and brightness depending on the light, penetrating through the holes in the interior environment, also influence and change the color. [1,12,13] French researcher in the field of the science of human ecology Robert Leroux [1], which is one of the first founders of physiological and hygienic requirements for housing, suggested solving of the issues of visual fatigue (physiological needs, heat – cold), visual comfort, the impact of solar energy, seasons, climate, location of the house in a residential area.

Human physiology is also of great importance, its visual system in the perception of the level of illumination of the environment, in the process of adaptation (Latin adapto – adaptive) – the adaptation of the eyes to the change of lighting conditions. [10,14] Thanks to these basic parameters in the creation of the interior space, one can see that the nature of the lighting source in the interior plays a paramount role, since all space is directly dependent on it.

A clear example of the influence of color on a person, the general colored environment and one of the main ways of aesthetic formation of space are the works of painting and polychrome objects of fine art. Artistic-decorative forms, while in an interior environment, can not exist without the influence of this environment. The entire interior space interacts with each other and merges into a certain "color mass", while creating a unique visual environment characterized by the presence inherent only to it, visual associations, images, the level of general brightness and illumination, and which is characterized by a degree of comfort and harmony.

Artistic-decorative forms, in addition to emotional and figurative influence, can carry in the interior and semantic value, and also in some situations have to perform a functional role. One of them is the energy efficiency factor. For example, it is known that a certain color range of works of art can contribute to an increase in the psychological sense of heat, or cold, the same effect can cause the plot line. [15-18] It should not be forgotten that one of the most important functions of artistic and decorative surfaces located in the color of the spatial environment is the creation of optimally comfortable conditions for the person in it. Being in an architectural environment, they are in a common space, while the environment carries a circle, circulates, respectively obeys the general light flow, which has an entire system of reflection and absorption of light, the presence of light and color reflexes.

Artistic-decorative surfaces, having a certain shape, given the compositional idea, depending on the source of light, the color environment, as well as

its texture and volume, will have different areas, respectively, the degree of color intensity, the presence of their own and the falling shadow. [19] In the field of physics, we know that color is capable of absorbing that all objects in the surrounding world are sources of own or reflected light. According to the theory of English physicist, mathematician and astronomer I. Newton – the angle of incidence is equal to the angle of reflection. Reflection of light is the return of the light wave when it falls to the surface of two media with different indicators of refraction "back" – in the first medium. [10]

The reflection ability of the color is characterized as a percentage. For example, 100% means that all the incident on the surface reflects light. [14] A bunch of light carries the wave of all seven colors of the rainbow. Falling on an object, only light waves of the same color as the object's color are absorbed from the beam of light, other waves of the object are absorbed. Objects that reflect the incident light, modify the local color of the neighboring objects with their reflected color. [16,18] Neighboring objects also affect those objects that are close by their reflective color. From this mutual influence of objects on each other there are new color combinations, there is an increase in the impression of volume and space, objects receive a color relationship with the whole environment. So all the objects, or rather the colors of objects that are perceived by us, are determined also by reflected rays – reflexes, which objects send to each other. Reflex (from Latin reflexus – turned back, reflected). [10,14] It can also be said that the reflex is the environmental impact on the object.

The forces of influence of a light stream in an interior space influence first of all on its color decision. In this case, the interior consists of a combination of colors where the proportion in which these colors are used is important. Overexposure, imbalance can cause color fatigue, and the disadvantage is colored fame. [15-17] According to the laws of color, in order to remove the color fatigue, it is best to look at the additional color. [14] The same effect can cause both color reflexes. When the ray moves from the source of illumination from the top to

the bottom, the beam will be affected from the base or interior equipment, which is below the level of the artistic-decorative form, with the bottom of the artistic-decorative shape will be painted with rays of color and light reflected from it. The top of the artistic-decorative form will be exposed to the color of the sky or ceiling. The reflex from the side walls will color its own shadow, and from the side of the light will be painted in color by the reflected from the color environment. In the own shadow of the artistic-decorative form, an additional (or contrasting) color will appear to the main local color of the reflected rays. The color and tone of the falling shadow belonging to the artistic-decorative form will depend not only on the degree of contrast of the illumination, but also on the color of the area on which it falls, with the falling shadow becoming cold or warm, depending on the heat-cooling of the light, according to the law of the simultaneous contrast – color change under the influence of surrounding colors. [10] The reflex first of all depends on the color of objects and a mixture of colors of the rays of light, which is displayed, respectively, not only the subject comes under the influence of the surrounding environment, but the object itself is able to influence the color of the environment. The decorator in his work should take into account the fact that the color environment of the interior space is in relation to the type of lighting source (natural or artificial), the color of the light flux, the brightness of the surface of the finishing materials and the artistic-decorative forms which are included in the interior. For example, natural light is the primary energy stored in natural sources which act through a color range, the texture of the coating of the surrounding decoration influences more rational consumption of energy and can be converted into secondary (electric or thermal). [8] Knowledge of the principles of the relationship of color and light, provides an opportunity to pre-evaluate the strength of the brightness of color reflexes and creates conditions for increasing the overall illumination of the interior. Also, we should not forget that every interior has its own unique situation.

Thus, the amount of indoor energy consumption will depend on a number of factors:

1). Type of lighting – daylight natural light (morning, daytime, evening lighting, twilight) and artificial (directional light source, diffused, reflected). [20] Also, with the help of knowledge of the laws of light, one can most achieve the expressiveness of the artistic form – the quality of an artistic work associated with the artist's skills, sharpen, emphasize characteristic in the figurative phenomenon, concentrate it to influence the viewer. [3]

2). Textures of artistic and decorative forms. matte, semigloss, glossy, as well as the degree of external volume, relief work, which also have the ability to enhance or reduce the overall illumination of the room. [21] Tab. 1 (1-9)

3). The forces or "measures" of brightness, which depends on the nature of the texture of the artistic and decorative form. Each color has a certain power of absorption and reflection of light, depending on its spectral composition, and sources of

illumination. If the color belongs to a particular texture of the material, then the effect of its reflection, or the power of brightness, will change, and the perception of the form, the carrier of the given color, will change accordingly. The German authors

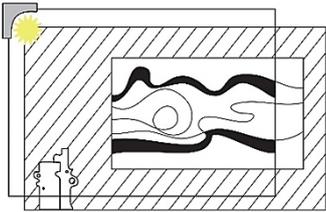
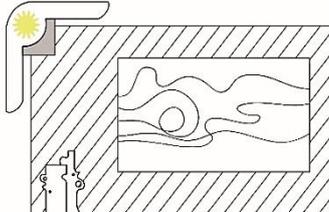
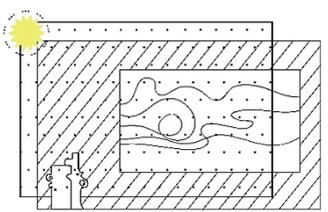
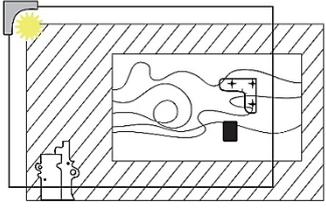
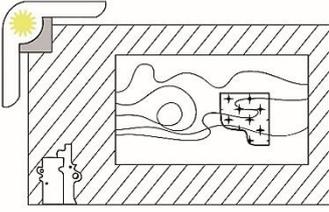
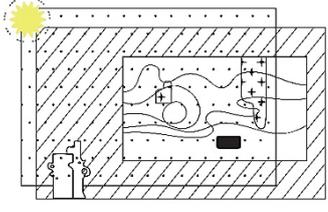
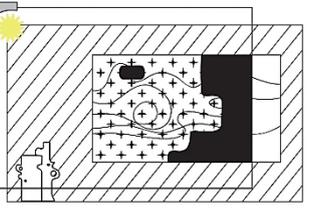
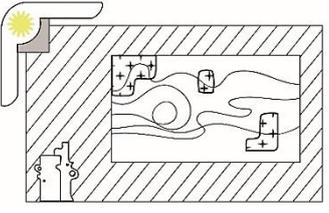
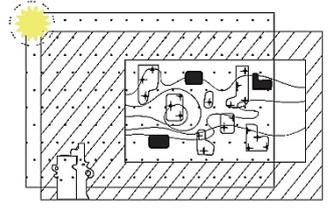
G. Meyerwine and B. Rodek [22], who introduced the notion of "brightness signal", considered the "measure of brightness" or "brightness impression", which determines the contrast, and depends on the nature of the illumination, by defining this

phenomenon not studied, as understanding of it is designed primarily for sensation, but a decisive in the visual impact of the lighting system.

4). The general coloring of the environment. Color (from the Latin "color") – a general aesthetic assessment of color qualities. Color is a process of an impression that occurs in the eye when exposed to light, the property of light causes certain visual sensations in accordance with the spectral composition of

Table 1.

Graphic models of principles of light distribution in the interior environment, depending on the type of light source and on the factory of artificial-decorative form

	Directional (NP) illumination source	Displayed (D) light source	Scattered (Sc) light source
Matte texture of artis- tic and decorative forms	 <p>1. Gradual distri- bution of light flux. To- tal, contrast light</p>	 <p>2. Reducing the light flux. Total darkness</p>	 <p>3. Uniform distri- bution of light flux. Total uniform illumination</p>
Semigloss texture of artistic and decorative forms	 <p>4. Gradual distri- bution of the flood light stream with the presence of spot and glowing darkened zones</p>	 <p>5. Reducing the light flux with the pres- ence of glittering dot zones</p>	 <p>6. Uniform distri- bution of light flux with a large number of glare and dotted darkened ar- eas</p>
Glossy texture of artistic and decorative forms	 <p>7. Gradual distri- bution of light flux flow. Increase the area of glit- tering and darkened are- as</p>	 <p>8. Reducing the light flux with a large number of glowing zones</p>	 <p>9. Uniform distri- bution of light flux with a large number of glowing and darkened zones</p>

reflected or emitted radiation. The light of different wavelengths excite various color sensations. At wavelengths approximately: 460 – violet, dark blue – 470 nm, blue – 480 nm, 520 nm – green, 580 nm – yellow, 600 nm – orange, 640 nm – red. [10] Coloration is warm and cold, light and dark, with a relatively general tonality and saturation. The degree of light of polychromy changes with the change in the color of the illumination, which is associated with the reflection coefficient. Therefore, the successful use of certain color combinations based on the physical basis of color is very effective in the environment of the energy-efficient interior.

In designing an energy efficient interior, one must remember that the colorful solution of the whole space includes not only the general polychrome of architectural and structural elements but also the colorful interconnection of functional equipment, including artistic and decorative elements, as well as light streams that inextricably linked with the general environment.

Conclusions and perspectives for further studies. Accordingly, we conclude that in terms of environmental sustainability, searching for innovative approaches to ways to reduce the energy costs of interior objects for various purposes, the optimization of consumption led to the need for special scientific methods, theoretical and practical techniques that could be the tool for contemporary artists and designers. Knowledge of the laws and possibilities of color, whether to use color, especially important in the design of an energy efficient human environment. The influence of color and light reflexes environment plays a significant role in shaping the overall interior space. Art designer at work, at an early stage creative and compositional except aesthetic factors influence of color in the interior, to apply to the means that contribute to sustainable space – namely, to minimize the cost of energy consumption.

Also, it should be noted that consistently observing all conditions, it is possible not only to reduce energy consumption, but also to achieve the necessary emotional perception (visual ecology) from the space used, gain the greatest

expressiveness and integrity of perception in revealing the creative idea, create a certain image and appropriate atmosphere, that in the end can lead to a comfortable psychological and emotional state of the person.

Prospects for further research are to analyze other structural constituents and functional possibilities of the interrelations of the color space of the space and the artistic and decorative form in the interior environment.

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АСПЕКТИ КОЛОРИСТИЧНИХ МОЖЛИВОСТЕЙ ЕНЕРГЕТИЧНОЇ ЕФЕКТИВНОСТІ ІНТЕР'ЄРНОГО ПРОСТОРУ З ВКЛЮЧЕННЯМ ХУДОЖНЬО-ДЕКОРАТИВНИХ ФОРМ

Оксана Пилипчук Дмитрівна

Анотація. В статті підняте питання про актуальність проблеми зниження енергетичних витрат інтер'єрного простору засобами колористики з урахуванням впливу світлових і кольорових рефлексів оточуючого середовища, естетичних можливостей колористики в інтер'єрі, що безпосередньо пов'язані з методами дизайну та екології середовища. Проаналізовано принципи гармонії колірної рішення, отриманої в результаті поєднання кольорів, що утворює єдине колористичне просторово-колірне поле, здатне сформуванати естетично повноцінний колорит приміщення.

Доведено необхідність законами і засобами колористики в порядкувати предметно-просторове середовище в реалізації екологічних питань і естетичного вдосконалення середовища життєдіяльності людини. Зауважено, що в умовах сталого розвитку навколишнього середовища, при пошуку інноваційних підходів до способів зниження енергетичних витрат об'єктів інтер'єру різного призначення, питання оптимізації споживання енергоресурсів зумовили потребу в спеціальних наукових методах, теоретичних і практичних прийомах, які могли б бути інструментами для сучасних художників і дизайнерів.

Визначено ряд невід'ємних факторів колір-ного оточення, пов'язаних між собою і, які можуть бути інструментами в зниженні енергетичних витрат приміщення засобами колористики. А саме: тип джерела освітлення, колір світлового потоку, сила або “міри” яскравості, що залежать від матеріалупокриття елементів простору і характеру фактури художньо-декоративної форми, її рефлексної дії, яка відбиває та впливає на загальний колорит інтер'єру.

Запропоновано ряд функціональних можливостей художньо-декоративних форм, розташованих в колористиці просторового середовища з метою створення оптимально комфортних умов для перебування в ньому людини.

За допомогою зробленого аналізу та приведених прикладів, які виконані автором статті, наведені основні методи, які можуть бути так само інструментом в роботі художника-дизайнера, що дозволить йому з більшим професіоналізмом підійти до рішення задач підвищення енергетичної ефективності інтер'єрного середовища, а також поставленого творчого завдання в розміщенні художньо-декоративних форм у колористичному просторі інтер'єру.

Ключові слова: *енергоефективність; кольорові можливості; світло; фактура матеріалу; інтер'єр; художньо-декоративні форми; дизайн.*