Lighting Design: Facets of A Single Phenomenon

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Abstract. Lighting design today is one of the most actively developing types of design project activities. The definition of the profession reflects a wide range of established practice, which implies the presence of various theoretical positions. However, all experts without exception note the multi-level structure of the new profession, its pronounced interdisciplinary nature, which presents an additional burden for the designer. The scope of creative, engineering and social tasks, as well as IT technologies related to lighting design, reflects the nature of a complicated stage in the formation and development of the profession. The purpose of this publication is to acquaint the professional audience with the complex nature of light design, to identify a number of disciplines that make up its basis. This will allow to outline the ways of formation of new kinds and genres of lighting design, to identify its main priorities. The task of the designer is to choose a direction of activity at various levels: functional, applied, or easel direction; adhere to traditional urban light, work in the genre of multimedia light show, author's light sculpture, etc. The multidisciplinary nature of the profession is united methodically by the scientific platform of creative activity. The design and artistic component becomes a priority in the hierarchy of innovative professional synthesis of that particular direction. Thus, lighting design is included in the sphere of project creativity, including the scientific and technical base of the new profession. The innovative potential of that activity has a significant impact on the process of its development, on the creation of a product and as a result - on the quality of life of a wide range of consumers. In the work on the material, an analytical method of art history research was chosen. This allowed us to describe the emerging multidisciplinary problems of lighting design in a fairly broad and comprehensive manner and to outline ways to solve its current problems. The vocational education system is called upon to play a special role in this process.

1. Introduction

Lighting design is a new area of design and artistic activity that is steadily developing due to the needs of society and intensive improvement of technologies. The rise of the new profession stands as a result of its interdisciplinary nature, rooted in engineering, digital, and artistic design. The technical component of that activity has become an initiating force that constantly feeds, transforms, improves and enriches the design and artistic approach to lighting design. This trend captures more and more areas, changing formats and developing imaginative techniques.

In the self-determination of this new profession this aspect becomes the most important. D.N. Makarov notes that "... to determine the line between functional lighting designed by a lighting engineer and lighting design remains a difficult, controversial task ... who is a lighting designer - is this deep engineering education with the addition of architectural and / or design, or vice versa?" [1].
The controversy surrounding the term "light design" includes objects created using lighting technologies, works of "lighting art" and the development of functional lighting design. Taking into account various artistic and technological factors, the task of finding a single definition of the profession becomes extremely difficult and responsible. A number of authors in the definition of lighting design focuses on the architectural basis of the profession: "...the interaction of light with the environment and its impact on visual perception, emotions and health" [2]. Here, the new profession is clearly considered as a section of the discipline "architectural lighting" or "lighting architecture". "Lighting architecture", conceived as a dialogue between architecture and natural and artificial light (Gusev N. M. and Makarevitch V. G.), became the forerunner of such profession as "innovative lighting design", defining a new vector in the aesthetics of light. And the lighting architecture itself as a section of lighting design becomes light-emitting, fundamentally different from the "daytime" light. The definitions "lighting architecture", "architectural lighting engineering" and even "lighting engineering" also speak about the primacy of the architectural component in lighting design [3].

According to the master of lighting design and the founder of lighting urbanism – professor N. I. Shchepetkov, "lighting design is just a figurative component of architecture with artificial light. ...It was born, exists and develops in the bosom of architecture, ... part of the material and engineering structure of an architectural, structural or landscape object. It is fundamentally wrong to pull out, isolate the lighting design from the architecture" [4]. Having given a start to a new profession, defining its aesthetic outline, architecture as a multidisciplinary profession passed the baton to lighting design.

A. Kovshova sees the work of a light designer as a "mix" of the professions of an architect, lighting engineer and artist. D.N. Makarov notes that the light designer: "...is a person who can draw with light, but at the same time understands what his "brushes" are" [5]. Now the leader of the profession is "a specialist who is responsible for designing a lighting installation for ... an environment in which a person is present for a long time", and who acts within the framework of an architectural project, in close contact and under the guidance of the architect [1]. The result of the polemic about the nature of light philosophy is summed up by the phrase belonging to A. G. Khadzhin: "modern worldview on lighting issues" [6].

Today, the field of artificial lighting is based on the "three pillars" – the fundamental basic aspects of "lighting design": aesthetic perception, ergonomic component – lighting functionality and energy efficiency [7]. Lighting design is recognized as an interdisciplinary specialty that requires fundamental knowledge of engineering, architecture, history, design, and culture [8]. By integrating in its basis artistic-figurative expressiveness and compositional techniques of fine art, design aesthetics of functionality, as well as the latest scientific and technical achievements in the field of optics and engineering, lighting design is now becoming an essential element of visual culture” [9].

The priority of the "architectural nature" of lighting design located at the intersection of science, lighting technology, fine art, engineering creativity and architecture has become the creative and design basis of the profession. “Designer” is by no means an artist ... “design” means “design”, “construction”, and thus “lighting design” means lighting decoration [10] (J.B. Eizenberg). "Lighting design is the design of light or design using light", where bivalence is shown in the priority of the aesthetic and functional components of lighting design [11].

1.1 The Factor of Design Technologies in Lighting Design

The project component of the new profession has become the basis on which the integration of technical and technological and artistic and aesthetic aspects is possible. The range of the profession simultaneously initiates the development of a number of areas of science, art and design creativity. In the field of engineering this is the limitless potential of lighting technologies. It contributes to the birth of new methods of working with "luminous matter" and is a vast spectrum of materialized innovations. First of all, these are products created on the basis of energy-saving technologies (LED lamps, projects
based on organic light-emitting diodes (OLED), shadowless light source technologies). The rational format of energy-saving technologies and a large selection of light sources have created a background favorable for large-scale lighting projects in the surrounding artificial and natural environment. The lighting design covered giant elevation surfaces, series of lighting showpieces of exhibition projects, art objects of light festivals and much more.

The festival environment fully implemented the innovations of the LED industry, making the previously unthinkable possible: large installations, huge spaces filled with light, light sculpture with an interactive format, etc. This includes national and international festivals such as: "Lighting architecture" (project of the Union of Moscow architects); project of the Moscow Government – international festival "Circle of light"; festival of light "Polar dawn" in the Arctic; festival of light in Lyon – one of the brightest events in France, held according to the tradition every year in late December and originated in the XIX century; festival of light "Derry-Londonderry" in Northern Ireland; festival of light in Singapore – the third in scale and conceptual integrity, quality of performance and organization after Lyon and Sydney; New York Light festival held since 2014, etc.

1.2 Factor of Innovative Lighting Technologies in Lighting Design
Minimizing the parameters of energy-saving light sources has formed a special section of the innovative fashion industry. "The integration of technological innovations including lighting design with the morphology of a modern suit, techniques for using retroreflective, reflective fabrics, LEDs etc. created new conditions for fashion design technology, contributed to the improvement of aesthetic and ergonomic qualities of the suit associated with increased visibility of the luminous suit in the dark" [12].

The implementation of LED technology into the field of costume design is wide enough; it includes various examples: Little slide Dress - a dress with LEDs, during the day it is ordinary, and in the dark it glows brightly; a special phone dress that shines when you call your smartphone. The product connects to a mobile device using Bluetooth. This includes the Confluens dress, designed by graduates of the Kosygin textile Institute. In a deserted room it is absolutely transparent. A special system of sensors gives it color and texture with the appearance of a person. This outfit also shields electromagnetic radiation, protects from moisture and allows the skin to breathe [13]. This "urban space suit" adopts the technology of "smart glass", which becomes opaque when a person approaches. Such glass is used in fitting rooms of expensive boutiques. Philips is working on adapting its Lumalive development, which is a "smart" LED fabric.

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2. Method
2.1 The New Paradigm of Light in The Design Culture

The methodology of forming the components of light design of interdisciplinary connections is quite diverse in nature and depends on the forms and methods of a new design and artistic approach developed on the basis of light technologies. Thanks to the minimization of lighting equipment, the range of project strategies in lighting design has significantly expanded, which is directly related to the cardinal change in the paradigm of light in project activity. Almost all the problems of light environment formation that concern the scientific and practical community are concentrated here. Light is intended to be a tool for shaping and modeling space in the visual arts, architecture, and design, encompassing experiment and practical design. Methodically, the process of light development is described in following terms: from "lightplastics", "light-forms" and "light-space" [14] to the concept of designing a light panorama of the city as a large-scale "light-outline component" [15].

Today the potential of light as an object and subject of design includes a number of parameters that ensure the search for new solutions. Light is integrated with various surfaces of design and architecture objects, the attitude to light as a material (material as a light source) is changed, light color dimming is developed that controls the viewer's emotions, and digital scenarios of light objects are created. The close connection of lighting design with scientific and technological progress is obvious. The era of innovative technologies determines the content of design and artistic scenarios. As an example of this is the numerous city holidays that actively exploit the emotional potential of light objects one can name "Travel to Christmas" (Moscow), "Crimson Sails" (St. Petersburg), etc.

2.2 Multimedia Lighting Scenarios

The transition from the use of functional architectural lighting to the dominance of commercial lighting design of an entertainment nature has become a catalyst for the development of one of the areas of lighting design associated with digital design. Digital multimedia development of lighting scenarios remains an area of experimentation with light and form, creating new types of light presentations such as: video mapping in the form of 2D and 3D projections, laser installations, holographic sculptures, light - and color-dynamic art objects, etc. Light becomes part of the art director's "game" with the audience and an effective means of visual communication. "For each form of leisure, you can choose your own convenient scenario. Although the scenario is appropriate everywhere, even in the bathroom..." [16].

A technological breakthrough allowed lighting design to create new genres of video art in multimedia format. D. Friedman's theatrical shows (LUX AETERNA theater of light founded in 1982) create light-musical images that appeal to the viewer's sensory perception. They are based on the light-musical developments of the composer Alexander Scryabin. Such synesthetic ideas have become extremely popular in art and design due to the suggestive impact of theatrical productions on society. "A characteristic feature of modern artistic culture is the emergence of diverse artistic practices associated with the development of interactive technologies and the emergence of numerous synthetic art forms which are based on the phenomenon of synesthesia ... such as theatrical performances, museum, design, advertising, media and other installations and projects have a new synesthetic quality ..." [17].

Laser shows, laser mapping and animation performances are incomparable in terms of the dynamics of color images. Interior and exterior projections on various surfaces create an indescribable festivity effect, causing genuine surprise of the audience with the magic of the show. The nature of such shows which have the effect of psychoemotional influence formed the basis for the use of such artistic techniques in light advertising.

The search in the depths of artistic practice for the formative potential of light on a kinetic basis, started by designers of the avant-garde era of the 20s, continued throughout the twentieth century and was embodied in experiments with light based on the latest digital technologies. A wide range of lighting media objects becomes discernible in the creative dialogue of engineering, directing and artistic components that actively use technological innovations in the media and light industry. This new vector can be described by the term "intelligent light".
2.3 Technologies of A "Smart Light"

The improvement of the software product and the use of IT technologies open up new opportunities for creating interactive objects, where the viewer is a participant in a game with a "smart" light source. iBar technology is an intelligent bar surface with an integrated video projector, as well as an intelligent tracking system for objects that interact with movements on the bar, including highlighted and virtual touch objects. The intelligent lighting technology – Light ID (Panasonic), which allows reading information from any object illuminated by an LED source, was used by the Pushkin State Museum of fine arts in Moscow.

The "smart city" project opens up broad prospects for improving the "smart light" program – from media applications and up to virtual traffic signs and multi-level architectural lighting systems. The development of "smart city" lighting technologies follows the line of enhancing and saturating of interactive component. Man and his entire environment are included in the sphere of creative interests of design, moving away from the "smart home" technology and subjugating the entire space of life.

2.4 Technology of Light Art and Media Art

The ever-emerging creative and technological formulas of lighting design are consistent with its interdisciplinary nature. The new paradigm of light as an independent artistic "form" created new trajectories of connections in the genre variety of lighting design. Light today is intended to be a tool for shaping and modeling space not only in architecture and design, but also in easel art. Lighting design has become an object of author's creativity. Luminous "paintings", sculptures and installations by the famous American minimalist artist Dan Flavin, his Light Icons, empty walls framed by light bulbs have become true "icons" of the genre. "He later became quite famous for his installations comprised of commercially available colored neon tubes which take control of their surroundings, often blocking viewers' movement as Light Barriers, and creating colored light spaces that evoke sensual experiences. ... Wafting fog penetrated by diffuse yellow light from an artificial sun — visitors to »The Weather Project, « an exhibition at the Tate Museum of Modern Art in London (2003) could hardly believe their eyes. And that must have pleased the Danish artist Olafur Eliasson (*1967), for his theme is the relationship between nature and our perception of nature, between the artificial and the natural—in short, "perceiving what we know and knowing what we perceive." Many of the light and mirror installations he designs in this context resemble set-ups for scientific experiments" [18]. Colorized light becomes a work of art, filling the space of the museum halls.

The light art trend and lighting sculptures and installations created within this genre form a new luminous exhibition space of light and color that is creating an emotionally intense field of images full of associations. Light art is closely connected with the psychology of viewer's perception. While working on such objects, the subtle psychological nuances of the personality forming an emotionally rich environment should be taken into account. According to the theory of "emotional design" in the interpretation of the Russian light designer Sergey Sizy, any light environment is created not only to perform the necessary functions, but also taking into account the sensory experience of users, emotions close to them, and mood suitable for the context [19].

Projects of the media art trend are marked with a special appearance. Objects such as virtual sculptures, on-screen exhibits and dynamic installations take their rightful place on exhibition grounds. AR and VR technologies transform the perceived space, placing the viewer in the world of artist’s and designer’s fantasies. "New media art is located in an interdisciplinary space and easily connects all possible forms of expression, sound and light, cinema and theater, architecture and television, science and religion. New media create virtual reality that takes us headlong. We understand that everything is fake, but such is the power of the new art that all our feelings are drawn into a fictional world that we don't really belong to" [20].

3. Results
Innovative synthesis of artistic and creative design components (including easel plastic arts, music, scenography, photography, animation, etc.), achievements of lighting engineering, IT technologies all together and in various proportions create unique genres of a new discipline: lighting design. Interdisciplinarity becomes the most important principle of the profession's existence. However, despite the importance of the engineering and technical component, the priority of the creative impulse - according to the Dutch lighting designer R. van der Heide - remains. "You must discover new lighting techniques, understand the optical properties of the sun, artificial light sources, to find new solutions. Also, never reject good ideas if it seems that there are no suitable technologies for them. Sometimes you just need to search for these technologies" [21]. Priority in this interdisciplinary synthesis belongs to the design and art initiative.

The method of interdisciplinary interactions based on lighting engineering (lighting industry) determined the further development of the profession. This is clearly seen in the constantly multiplying new hybrid formats of light and art projects. For example, within multimedia light genres which include holographic projections, mapping projections, etc., new branches of applied nature are emerging: multimedia posters and photo frames, multimedia tapestries, etc. On the periphery of the profession, new multidimensional professional structures are emerging that can stand out as independent areas of creative activity. New scientific professions include lighting psychology, lighting ecology, color and lighting therapy, lighting agricultural technology, etc.

4. Conclusion
An integrated approach and interdisciplinary prospects for the development of lighting design are beginning to take visible shape beyond the existing aesthetics of the architectural environment. The development of the profession should take into account "the multi-level nature of light design (scientific, artistic and aesthetic, technological, socio-cultural, environmental, and other aspects)" [22]. They are the basis for new formats of the lighting design profession always aimed at a person in all the diversity of his needs, desires and emotions.

The growth of a multi-disciplinary structure should be regulated by science-based criteria for evaluating the final "product" being created, whether it is a materialized project, service, etc. Expert councils of competitive programs, research programs, professional communities and creative associations are designed to maintain the quality level of a new profession, blocking the path of unscrupulous, low-qualified specialists. But the main criterion for the competent development of a multidisciplinary profession will be the system of multi-level education in the field of lighting design. Training high-quality personnel is an integral part of any creative and technological progress.

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