

DEVELOPMENT OF VISUAL THINKING OF STUDENTS SPECIALISING IN LIGHTING DESIGN AS PART OF THE LIGHT MODELLING PRINCIPLES AND METHODS DISCIPLINE

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ABSTRACT

Through the examples of global architecture, art and design schools of the 20th and 21st centuries, the authors conduct historical and comparative analyses of the methods of studying form-making elements of composition as a method of development of visual thinking of students. The article discusses applicability and efficiency of integration of a propaedeutic course on primary elements of composition in the Light Modelling Principles and Methods discipline (Lighting Design specialisation, ITMO University), describes the methodological basis of the discipline.

Keywords: lighting design, visual (figurative) thinking, primary elements of composition, light modelling, perception

1. INTRODUCTION

Nowadays, the profession of a designer is trendy and prestigious. This is evidenced by increase in the number of search queries on quick (from two weeks to several months) design training courses. Such design courses are mainly oriented on training technical tools, i.e. various graphics and visualising software, which is definitely important for professionals to know. However, it has long been known that design is directly associated with the functional side of the physical world and constructing of forms; it is primarily art, which solves aesthetic and artistic problems while creating new forms. Therefore, one

of the main tasks of design art is to create a “vision”, i.e. a reflection of sensory perception of things and phenomena as well as to design it for a spectator. “The artist is the hand through which the medium of different keys causes the human soul to vibrate”, as Wassily Kandinsky wrote in his canonical book “On the Spiritual in Art” [1], where “the key” naturally represents the interaction between geometric forms and light affecting a spectator’s perception. In order to create a vision in design, specific level of development of visual thinking and understanding of perception patterns are required and should be formed in future specialists.

L.G. Medvedev formulated a definition of visual thinking that is similar to ours noting that “Visual thinking is a dynamic process consisting of senses, perception, concepts, insights, imagination: it is a capability of human conscience to reflect the reality in a visual form” [2, 3, 4]. Its main function is to create visions and operate them while solving problems. One of the stages of development of visual thinking of a future designer is learning of a universal set of design methods and artistic expression means. This article describes practicability and efficiency of the method of studying of formal composition, one of the main tools of development of visual thinking in lighting designer training. The methodology is analysed on the basis of practical experience of visual thinking training of the first-year Master’s degree students of the ITMO University Lighting Design programme as part of the Light Modelling Principles and Methods discipline.

Table. Key Elements, Objectives and Principles of Propaedeutic Methodologies of Bauhaus and VKHUTEMAS

	Bauhaus	VKHUTEMAS
Elements of visual language	Line, point, spot, plane, volume, space	Line, spot, plane, volume, space
Objective of the course	Development of compositional and artistic thinking, formation of creative freedom including the sensory and emotional component	Training students in the language of plastic forms, patterns of form and colour making
Basic principles and approaches to training in the propaedeutic course	Comprehensive learning of elements of visual language related to programmes of further thematic workshops (sculpture, theatre etc.)	The method was designed as a creative concept of rationalism form-making with 'elements of architecture', from abstract to specific ones, being the basis of composition Modelling as a step of design. Division of plastic culture into separate disciplines used for training separate elements of visual language
Basis of the pedagogical system (artistic movements)	Expressionism, abstractionism, functionalism	Rationalism, constructivism "objective and formal method"

2. THE GENESIS OF FORMAL COMPOSITION TRAINING METHODOLOGY IN ARCHITECTURE AND DESIGN EDUCATION

Just like in the 1920s, when first design schools had been forming, nowadays professional education in the fields of design and architecture is to a large extent based on the principles of creative design that had been formulated and practically implemented by the two main schools: Bauhaus in Germany and VKHUTEMAS (Higher Art and Technical Studios) in Russia. In order to understand the dynamics of the goals of formal composition and primary elements studying, we should address the origins, since it is Bauhaus and VKHUTEMAS that created and applied these methods as propaedeutic disciplines. The main elements, goals and principles of propaedeutic methodologies of Bauhaus and VKHUTEMAS are summarised in the Table.

It is commonly believed that the German Bauhaus appeared due to changes of social and cultural conditions and social and political structure in the early 20th century. The new human attitude towards the world expressed in the art by avant-garde artists could not but influence the system of artistic education itself. The new training methods were originally proposed by J. Itten, a future lecturer of the school, in 1918 and then were integrated in the

Bauhaus school education programme as part of the propaedeutic course.

W. Kandinsky, one of the ideologists and creators of the contemporary form-making theory, also played a special part in the history of creation of the Bauhaus propaedeutic course. Being an artist and an art theorist, W. Kandinsky created his own course which was based on scientific achievements of contemporary mathematics, psychology, physiology and other disciplines in order to create the 'Science of Art' (Kunstwissenschaft). His first step was to create a specific language of primary composition elements which allows people to talk about the inner emotional and spiritual meaning of a work of art, to form a spectator's perception corresponding to an artist's idea. He described this language in his book "Point and Line to Plane" [5]. This language consisting of several primary elements, "letters" (points, lines and planes), is analysed using the properties of these primary elements and their changes in the course of interaction in a composition. W. Kandinsky believed that the training methodology should be based on training to interpret primary elements of art and to use them.

At the same time in VKHUTEMAS, where its own art ideology had been forming, the training methodology was mainly based on the students completing research tasks using primary elements of composition as well as studying their proper-

ties and qualities. N.A. Ladovsky was the first in VKHUTEMAS to raise the question of necessity to research the psychology of human perception of architectural and artistic forms [6]. He also established a research laboratory where objective patterns of psychological and physiological perception of physical environment were experimentally studied. At the same time, thanks to N.A. Ladovsky, separate formal primary elements have begun to be studied in terms of their perception as part of specific composition combinations, which has definitely enhanced the artistic pedagogics of the school as well as has become a technique actively adopted by co-thinkers.

The analysis of the experience of architecture and design schools in their work with primary elements of the plastic language makes it clear that the set of the primary elements remains unchanged. In particular, the transformation involves the objectives of the training courses regarding the search for the language of formal composition which were considered as **the basis of creation of the theories of spaces** in the early 20th century. The situation changed in the 1950s, when P. Ya. Galperin developed the theory of step-by-step formation of mental efforts [7]. After acquiring the psychological and pedagogic grounds, propaedeutic methods reach the new educational level: **they are re-oriented from the result to the process, i.e. from creation of a product (project) to the course of the creative process, development of visual thinking.** Departure from ready techniques, experimenting in the course of creation common for the avant-garde movement has logically led to necessity of “search training” of new form-making patterns and mechanisms of visual thinking.

Many of contemporary educational institutions including architectural and design faculties of such universities as *Bauhaus-Universität Weimar* (Germany), *Illinois Institute of Technology* (USA), *Iuav University of Venice* (Italy), *Yale University* (USA), MGUP (Moscow State University of Press) and MARKHI (Moscow Architectural Institute) are the successors of propaedeutic and creative traditions of VKHUTEMAS and Bauhaus. Development of the methodologies leads to concretising of form-making properties of compositions and their detail interpretation in specific areas of design activity; this article will specifically discuss the lighting design.

3. FORM-MAKING AS A PROPAEDEUTIC COURSE IN THE CONTEXT OF LIGHTING DESIGN

Form-making gains a new interpretation in the field of lighting design due to changes of requirements to the quality of lighting environment. The principles of construction of an object image become more complex; for instance, during interaction between artificial light and a form and material, an object's light image appears which is qualitatively different from its daylight image. The new requirements led to changes in methods of form making and a number of discoveries.

In 1971–1972, a team supervised by N.M. Gusev and N.M. Shchepetkov conducted a search for volumetric light modelling for the ensemble of the Cathedral of Saint Demetrius and the Dormition Cathedral in Vladimir [14]. The models were equipped with small light sources with adjustable luminance and power for modification of the structure of the light composition of the ensemble.

In 1977, the Methodological Recommendations on Design of Outdoor Architectural Lighting of Buildings and Structures handbook was published under supervision of G.V. Kamenskaya [8]. The handbook describes the methodology of selection of lighting and colour arrangement by means of modelling. In order to form luminance distribution over a building facade, a slide projection apparatus was developed for planar modelling of lighting. Luminance and colour of some fragments of the image were changed by means of a control board. The apparatus allowed to find optimal variants of a lighting and colour arrangement of a building or structure which shall be implemented in situ.

In her study, A.G. Batova conducted laboratory lighting modelling using a 1:10-scale model of a wall of the Solovetsky Monastery [19]. In the course of the experiment, optimal variants of light and composition parameters were found (luminance distribution and ranges of luminance contrasts). This work also studied the effect of artificial light on visual perception and interpretation of architectonics.

These methods include search for patterns of construction of a lighting composition of specific elements of an object or an architectural composition of an ensemble when changing the luminance ratio in the field of view. The effect of lighting parameters on changes in perception of spatial arrange-

ment gives a perspective of construction (recovery) of perception of the form of its visible components such as specific elements, building proportions and tectonics under natural lighting.

There are no many methods utilising formal properties of primary elements even in international practice; *Aalborg University* (Denmark) and *Jefferson University* (USA) are among the universities training such methods. Lighting design educational programmes are mostly focused on studying natural effects and materials (which are, in turn, also a fundamental element) [9,10,11,12].

In international practice (Hochschule Wismar (Germany), Royal Institute of Technology (Sweden)), form making is mostly considered within the framework of laboratory-based light modelling using architectural models.

In 1999, A.B. Matveev's article *Aesthetics of Lighting* was published. The author identified several important methods of work with light and primarily the necessity to find the limits for creation of the 'light language': "...light acts as one of components of the language by means of which the image of an environment is recreated. Like any language of a work of art, light and other expressive means should be used in accordance with the patterns and limitations natural for the language of this work" [16]. This points out not only to necessity of finding a language but also to understanding of "properties of this work of art", i.e. properties of composition in lighting aesthetics. This methodology has developed on the basis of architectural lighting principles, where, defining boundary parameters of specific elements of a building (portico, pillar, entablement, pediment, etc.), proportions of perception of the composition of classic form-making architecture were experimentally established [17].

In 2008, methods of space interpretation as a situation with specific environmental nature were developed in the Architectural Environment Design sub-department of MARhKI. As part of the Spatial Senses Pavilion task, the students, future architects and spatial light characteristic designers, used formal composition means when creating a model using the 'cut and bend' technique. The task aimed at creating a small object for 'increased sensing' based on solutions of architects of the 20th century, detail familiarisation with the principles of spatial arrangement of architecture using works of VKHUTEMAS and Bauhaus and some masters (F.L. Wright, Le Corbusier, T. Ando, S. Hall,



Fig. 1. "Volume, Contrast, Colour"
(Student A. Dubinovskaya; Lighting Design Programme,
ITMO University, 2014)

Z. Hadid, etc.) as examples. Graphic analysis allows students to learn various compositions means when arranging the space and inspires them to create their own design solutions [15].

In 2015, N.V. Bystryantseva defended her thesis at the same sub-department under supervision of A.V. Efimov. This work suggested a method of design search for interaction between parameters of different types of lighting within the borders of a visual plan or spatial area based on primary means of light and composition construction, namely points, lines, spots and their structure as well as spectral and luminance characteristics taking information about urban environment into consideration [14]. Such approach supplemented the design with a new stage of search for form-making properties and light-composition interactions between elements inside spatial arrangement without reference to their urban-planning composition. It means that, while designing, an author uses not geometric patterns for constructing a form but perceptive ones which create visual and informational links using W. Kandinsky's 'inner composition' principle. The 'inner composition' principle seems to perfectly demonstrate the grounds for creative visual design: "life of exceptionally and perpetually artistic forms and forms randomly thrown on canvas" [18]; working with an abstract composition, an author may depart from artistic forming of details and work with the nature of form making (both the one existing inside an object after being put by an architect and the new one under artificial light). This technique provides an author with a capability not to 'look at a picture from outside' but 'to whirl inside a picture, to live inside it' [18]. In the context of such problem statement, not only interpretation of artistic properties of light-engineering and optical parameters but

MODELS OF SPATIAL SENSES PAVILION



Fig. 2. Models of the spatial senses pavilion, MARKHI, 2008

also change of attitude to urban architecture, its spatial arrangement, renewal of perception of its semantic meaning has become important. Definition of formal composition properties allowed to ‘reset to zero’ the decorative value of architecture and to work with basics of compositional arrangement using stable artistic paradigms: the classic, modern and post-modern ones [14].

This first step towards formation of a meta-language in lighting design is being further developed in the methodological course of the Lighting Design programme. Since 2014, this method has been being tested by the Lighting Design programme employees of the ITMO University as part of Principles and Methods of Light Modelling discipline. The methodology forms the basis of development of visual thinking in design. This means that, in the course of training, a lighting designer learns a set of compositional form-making elements, their properties, ways of their interaction in which light is used as the main material, Fig. 1. Being a tool, which is capable ‘to create many different values of the same item via its light image, light form’, [16], light, in turn, may supplement the methodology of the work with primary elements. A number of methodological approaches was tested in this course.

The first stage of testing of light modelling methods included the following tasks:

- Analysis of form-making principles (classic, modern, post-modern), their recognition and destruction or identification of the patterns of their light composition (picture, model, photo);
- Analysis of form-making principles of classic composition (plane, volume, space) and their inter-

action with natural light at different daily changes and cloudiness (contrast, nuance, incidence angle), recreation of these effects when arranging a lighting environment (picture, model, photo);

- Analysis of interaction between form-making principles of space composition and their interaction with lighting techniques (recreation of effects in a model).

Analysis of an architect’s own method (Tadao Ando, Le Corbusier, Kenzō Tange, Steve Hall, etc.), formation of a spatial senses pavilion (a pavilion where different light and space compositions are used to submerge people in specific emotional states and people acquire new experience of interaction with space) using this author’s method (based on early practice of MARKHI: picture, model, photo), Fig. 2.

This methodology allowed us to formulate practical knowledge of the patterns of light composition construction in architectural lighting, namely to understand: the effect of incidence angle, luminance and lighting techniques on perception of the form of an object; distinctions and differences of artificial and natural lighting; interaction between an object’s colour range and spectral characteristics of light sources. However, utilisation of specific existing lighting techniques, approach to visual forms of buildings in models and insufficient freedom to create optical effects have limited a capability to develop research experience and creative intuition of students. The scale of perception of a solution designed as a model did not allow us to gain specific practical experience for its utilisation in actual design.



Fig. 3. Paper plastics (Student A. Bondar; Lighting Design Programme, ITMO University, 2015)



Fig. 4. Vision of an object (Student A. Gafurov; Lighting Design Programme, ITMO University, 2015)



Fig. 5. A photo portrait (Student E. Smirnova; Lighting Design Programme, ITMO University, 2015)

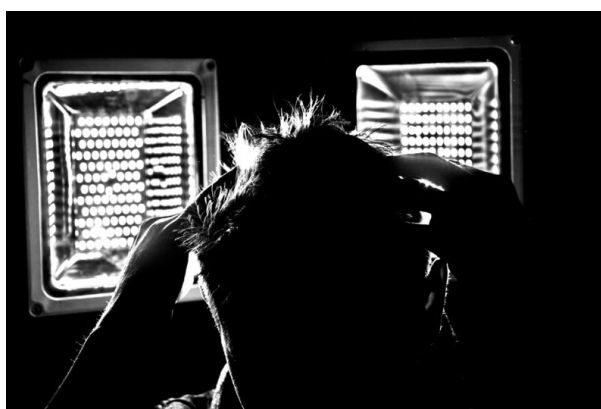


Fig. 6. A photo portrait (Student I. Domashkevich; Lighting Design Programme, ITMO University, 2015)

The second stage of testing was based on early practice of paper form making adopted in GHPA (Saint Petersburg Stieglitz State Academy of Art and Design). Its main principles are: departure from formal composition, work with “natural images (sunset, noon, fog, light spots), abstract volumetric and spatial construction of paper (analysis of: Kazimir Malevich – philosophical grounds of special interpretation of a plane in artistic space; Vladimir Tatlin – form beyond a flat canvas; Alexandr Rodchenko’s paper plastics – volume interpretation of artistic space; V.F. Koleychuk – typology of constructive methods of plane transformation, Fig. 3. B.N. Rachmaninov’s paper plastics course (“By squeezing paper you unchain your mind”) plays a special role.

The work in accordance with this methodology includes:

- Formation of experience of interaction between a form and light and understanding of distinctions of light distribution over different shapes

- (round and rigid), design of a clear-obscure by the form of canvas itself (model, photo);

- Learning and formation of optical properties of light, understanding of a material via properties of paper (self-glowing, reflected, direct light), spectral characteristics and colour of light (experiments with scale models, results are shown using photos);

- Learning of primary elements of formal composition on a plane;

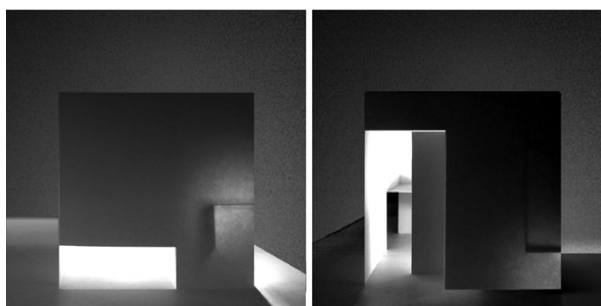


Fig. 7. External volume and Artificial lighting (Student A. Khvatova; Lighting Design Programme, ITMO University, 2018)

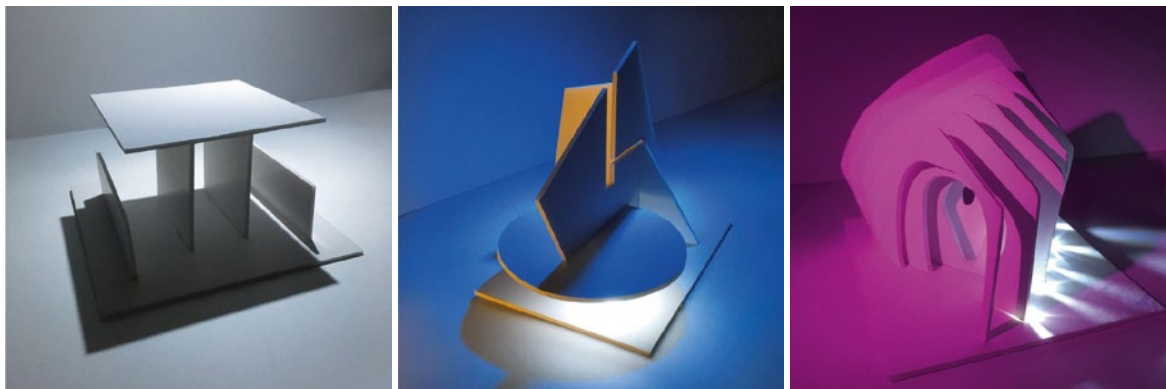


Fig. 8. Classics. Modernism and Postmodernism (Student L. Angelova; Lighting Design Programme, ITMO University, 2018)

– Learning of techniques: proportioning (fifth portions, module) and proportion of volumes in a planar and spatial composition, colour and graphic coding of information, learning of form-making principles (statics and dynamics, rhythm (changing repetition) and metre (repetition without changes), etc.);

– Experimental learning of capabilities of different materials, learning of composition patterns in the format of experiments, learning of techniques: scale, work with light and form, the effect of light graphics on perception of a form, and experimental modelling and compositional breakdown (model, photo);

– Experimental learning of changes of light and space, learning of techniques: contrast and nuance lighting, silhouette, creation of dynamics in a frame, work with a shade form and an object image (model, photo), Fig. 4;

– Formation of experience of meaning transition on the border between illustration and sign, transition from material and physical perception to formal and visual perception, establishment of conditions and factors exit from which always lies within the area of simplification and archetypisation, learning of compositional techniques: silhouette and background, large and small, contrast and nuance, statics and dynamics, graphics and sense, and understanding of distinctions of perception of

natural light-and-dark structures (patterns) (meaning transition), and also work with the concepts of time, contrast, movement (graphics, model, photo), Figs. 5, 6.

This methodology allowed students to form research experience. In visual terms, students' works had broad nature, however, the experiments were not naturally determined; there was a lack of research and conclusions. It was necessary to reduce the amount of effects and to increase accuracy of used compositional techniques of natural changes identification during light modelling.

The third stage included alignment of formal composition with searching light modelling (plane, volume, space), concretising and studying of light-composition principles, studying of the effect of different characteristics of luminous flow (point, line, spot) on form-making properties of an environment, search for an author's artistic language, Fig. 7. Methodological objectives of the course are presented below.

- Learning of luminous flow modelling techniques by means of optics, reflectors, limiters. Analysis of techniques of work with light at a model level (incidence angle, reflection angle, luminance, spectre, natural patterns). Accumulation of a set of modelling techniques.

- Analysis of interaction between artificial lighting and plastic techniques of form making (classic,

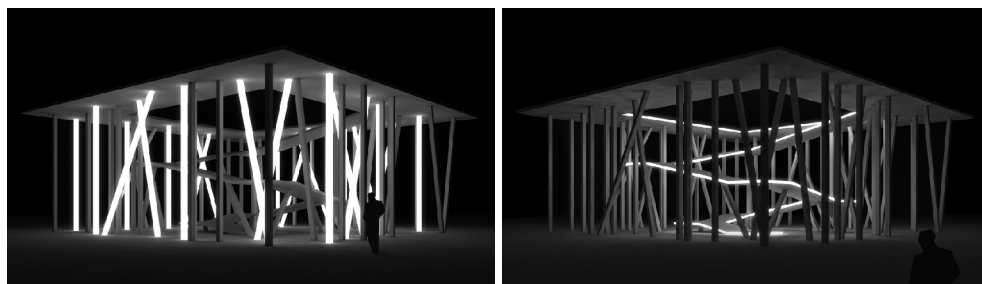


Fig. 9. The spatial senses pavilion (Student Yu. Lyubakova; Lighting Design Programme, ITMO University, 2016)

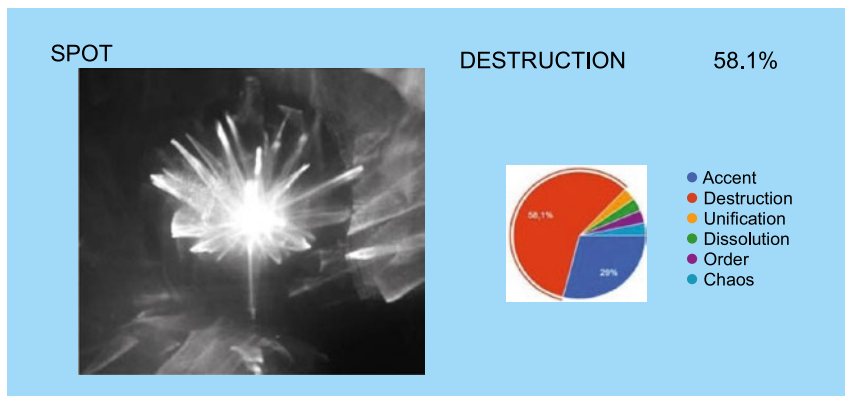


Fig. 10. The results of the questionnaire (Student M. Ivleva; Lighting Design Programme, ITMO University, 2018)

modern and postmodern) on a plane, in a volume and in a space, Fig. 8. Works are divided into separate light-composition tasks (rhythm – metre, statics – dynamics, symmetry – asymmetry, contrast – nuance, destruction – unification).

- Analysis of the effect of the sequence of perceived fragments, establishment of visual and informational links based on the principles of “inner composition” (semiotics, time, space, model, research and photo).

- Analysis and studying of authorial methods of architects, lighting designers and designers in their work with the spatial senses pavilion (presentation, model, photo), Fig. 9.

- Prototyping and search for new forms of interaction between light and various types of spaces, practical research of the effect of a light solution on emotional reactions of people (model, photo, research).

- Analysis and uncovering of patterns of perception of the received visual images by a user (social questionnaire), Figs. 10, 11.

This method demonstrated high results in terms of development of visual thinking of students, formation of their own artistic language as well as capability to understand the mechanism of formation of human psychological and physiological state by the effect of light and to control this mechanism.

4. CONCLUSION

Both light as a tool and work with it have a number of specific distinctions related to its nature.

- Light modelling is a continuous process of experimental search. Continuous practical studying of variability of light environment, unpredictable effects and nuances occurring in the course of works with optical lenses, stencils, reflecting and scattering materials pre-determine appearing of an unique

image and develop a lighting designer’s creative intuition.

- The differences in the nature of light as a tool are determined by its broader means of visual expressivity. This is associated with the fact that “keeping its conventional ‘applied’ function of one of the artistic expressivity means, over the 20th century, light had gradually acquired characteristics of a self-consistent form of creativity in synthesis with different types of art such as music, stage art, architecture, sculpture or, less frequently, with monumental painting” [13].

- It is important that properties and interactions between primary elements are studied not only using paint, marker pens, pencils but also using artistic qualities of light, a tool of future project work. Alongside with creation of an image in composition, the properties and nature of light are being studied, an authorial methodology is being established: students form their own “light language”, individual technique of work with light and its nature.

- The most significant distinction of light as an instrument of creation of a formal composition is its spatial and temporal value in the course of interaction with a user. When we look at a light spot, we understand that there is a light source somewhere, we understand its intensity, the way it has passed between the source and the object, we can see the relation to a reflecting, absorbing or translucent surface. When creating visual and informational links within a light environment, we look at a series of light spots but see an image possessing specific information.

Capability to think with images, to construct relations and to understand their effect on a person is a basic category of formation of a lighting designer’s professional mind-set. Moreover, compiling of a basic ‘dictionary’ of techniques for learning professional language of light is a methodological necessity.

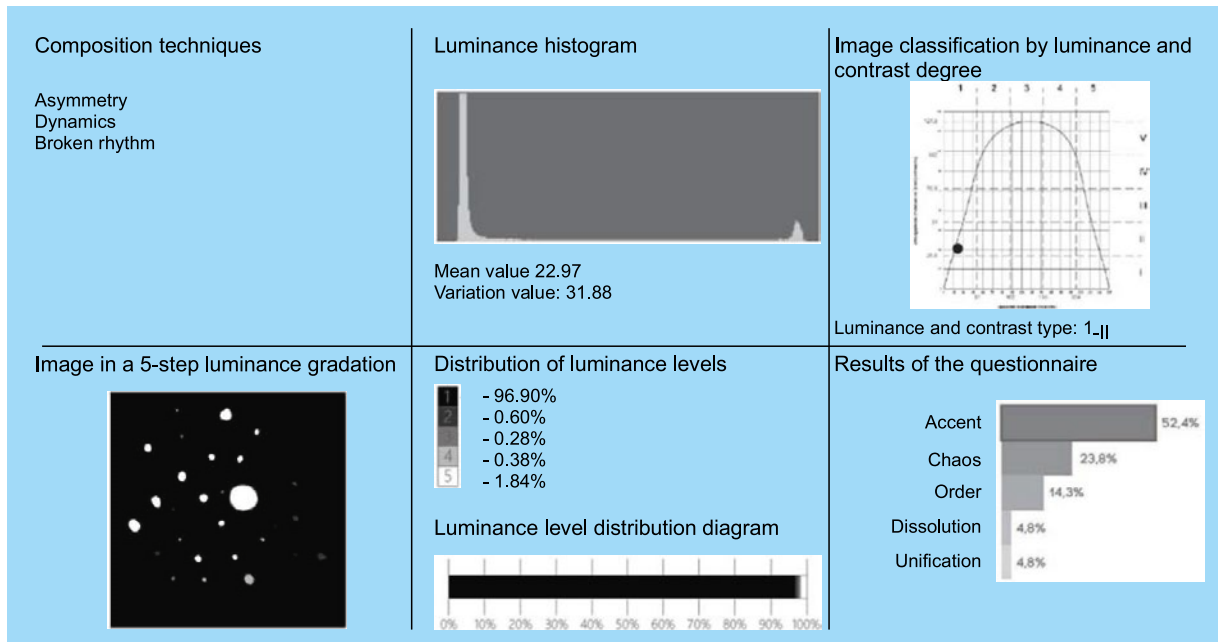


Fig. 11. Analysis of luminance and contrast (Student A. Khvatova; Lighting Design Programme, ITMO University, 2018)

ty when working with students having unequal level of art education. This is caused by different professional and educational experience: from designers, architects, actors to technical (laser opticians, engineers, IT) and natural-science (chemists, physicists) specialists. The question of differences between students' skills is important for many schools, which is determined by inter-disciplinary nature of lighting design as a subject of communication and cooperation between specialists in many professional areas.

In our opinion, the gap between technical and artistic skills and knowledge of students educated in different areas of science, art and design in the said schools can be closed and the balance between them can be found by integrating the disciplines studying human perception of light that determine the human-oriented approach to projects. However, application of the form-making methodology based on utilisation of primary properties of composition and artistic properties of light could significantly supplement formation of professional mind-set of future lighting designers, enhancement of their creative thinking and departure from template thinking.

REFERENCES

1. Kandinsky W. On the Spiritual in Art [O dukhovnom v iskusstve]. Moscow: Arkhimed, 1992, 112 p.
2. Medvedev L.G. Formation of a Graphic Imagery in Drawing Classes: A Study Guide for Students of Art and Graphic Faculties of Pedagogical Institutes [Formirovaniye graficheskogo khudozhestvennogo obraza na zanyatiyakh po risunku]. Moscow: Prosvechsheniye, 1986, 159 p.

rovaniye graficheskogo khudozhestvennogo obraza na zanyatiyakh po risunku]. Moscow: Prosvechsheniye, 1986, 159 p.

3. Zinchenko V.P. Osip Mandelshtam's Walking Stick and Mamardashvili's Pipe. On Basics of Organic Psychology [Posokh Osipa Mandelshtama i trubka Mamardashvili. K nachalam organicheskoy psikhologii]. – Moscow: Novaya shkola, 1997, 336 p.

4. Yakimanskaya I.S. Main Lines of Visual Thinking Research [Osnovnyie napravleniya issledovaniy obraznogo myshleniya]. Moscow: Voprosy psikhologii, 1985.

5. Kandinsky W. Point and Line to Plane [Tochka i liniya na ploskosti] / trans. from German by E. Koziina. Saint Petersburg: Azbuka, 2001, 236 p.

6. Khan-Magomedov S.O. Architecture of Soviet Avant-Garde: in 2 books. Book One: Problems of Form Making. Masters and Movements [Arkhitektura sovetskogo avangarda: v 2 kn. Kniga pervaya: Problemy formoobrazovaniya. Mastera i techeniya]. Moscow: Stroyizdat, 1996.

7. Galperin P. Ya. Mind Action as a Basis for Formation of a Thought and an Image [Umstvennoye deistviye kak osnova formirovaniya mysli i obraza]. Voprosy psikhologii, 1957, Vol. 6.

8. Kamenskaya G.V. The Methodological Recommendations on Design of Outdoor Architectural Lighting of Buildings and Structures [Metodicheskiye rekomendatsii po proektirovaniyu naruzhnogo arkhitekturnogo osveshcheniya zdaniy i sooruzheniy] / G.V. Kamenskaya, L.I. Petrova et al. Moscow, TsNIIEP of Eng. Equipment, 1977, 63 p.

9. The MSC programme. URL: <https://www.light.aau.dk/msc-education/> (date of reference: 15.09.2018).

10. Professional studies master programme lighting design. URL: https://studieren.de/fileadmin/europe/germany/_study/docs/Master_Lighting_Design.pdf (date of reference: 15.09.2018).

11. Lighting M.S. URL: http://catalog.rpi.edu/preview_program.php?catoid=11&poid=2431&return-to=256 (date of reference: 15.09.2018).

12. Architectural lighting design courses. URL: <https://www.kth.se/en/studies/master/architectural-lighting-design/course-overview-1.268138> (date of reference: 15.09.2018).

13. Lekus E. Yu., Bystryantseva N.V. Lighting Design: Light as Material, Technology, Form: Joint Monograph [Svetovoy dizain: svet kak material, tekhnologiya, forma] // Proceedings of the international scientific conference “Material-Technology-Form as the Universal Triad in Design, Architecture, Fine and Decorative Arts”. Moscow: Stroganov Moscow State Academy of Arts and Industry, 2018, 537 p.

14. Bystryantseva N.V. Comprehensive Approach to Establishment of a Light Environment in a Night-Time City: extended abstract of Cand. Arch. Dissertation [Kompleksniy podkhod v sozdaniy svetovoy srede vechernego goroda]. Moscow: Moscow Architectural Institute (State Academy), 2015, 27 p.

15. Sokolova M.A. View from Inside. Design of Architectural Space: Interior. Study Guide [Vzglyad iznutry. Proektirovaniye arkhitekturnogo prostranstva: interier]. – Moscow: BooksMArt, 2016.

16. Matveev A.B. Aesthetics of Lighting [Estetika osvashcheniya] // Svetotekhnika, 1995, Vol. 4–5, pp. 2–4.

17. Shchepetkov N.I. Lighting Design of a City [Svetovoy dizain goroda]. Moscow: Arkhitektura-S, 2006. – 317 p.

18. Feshchenko V., Koval O. Creation of a Sign. Articles on Linguistic Aesthetics and Semiotics of Art [Sotvoreniye znaka. Ocherki o lingvoestetike i semiotike iskusstva]. – Moscow: Yazyki slavyanskoj kultury, 2014.

19. Batova, A.G. Principles of Design of Outdoor Lighting of Architectural Objects: extended abstract of Cand. Arch. Dissertation [Printsipy proektirovaniya naruzhnogo osvashcheniya arkhitekturnykh ob'ektov]. Moscow: Moscow Architectural Institute (State Academy), 2012, 27 p.



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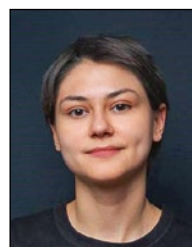
“Lighting Design” of the ITMO University and of the Light Environment workgroup of the Smart Saint Petersburg project management office, member of the RULD union of lighting designers, Moscow Government award winner in nomination of Architecture and Design 2014, author of 20 papers, developer of such disciplines as ‘Problem-oriented Approach to Design of Lighting Solutions’, ‘Principles and Methods of Light Modelling’, ‘Creative Technologies’, and co-developer of the concept of the international Master's degree programme Art & Science of the ITMO University



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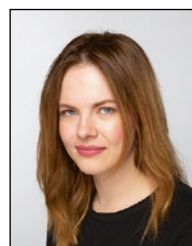
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