Factors determining modern museum complexes architecture

O Finaeva
Department of Design and Visual Arts, South Ural State University, 76, Lenina av., Chelyabinsk 454080, Russia

E-mail: finaevaov@susu.ru

Abstract. This paper presents a brief analysis of the environmental and functional technology factors determining the architectural and planning concepts of contemporary museum complexes. The introduction provides a brief overview of current trends in the museum architecture design. The main body analyzes the factors affecting the contemporary museum architecture. The role of the sociocultural, economic, and aesthetic functions of contemporary museums in the design of the museum environment is considered. The paper also discusses the role of initial conditions in design. As a result of the analysis, the types of space-planning solutions for buildings are specified, and the requirements for their technical equipment are described. Based on the research, a classification of factors affecting the contemporary museum architecture is proposed. The developed classification is accompanied by examples of specific architectural solutions for museums. The results present two categories of key factors that influence the architectural and planning decisions of contemporary museums: environmental and functional technology factors. In conclusion, we note the need for new approaches to the design of the museum environment, due to the changing role of museums in modern society.

1. Introduction
A museum is a repository of artifacts and/or natural objects that have received iconic value in culture, and one of the means of cultural self-preservation. Such a set of objects is considered to be or may become the standard of a cultural model or nature [1]. The term “museum” comes from the Ancient Greek “Mouseion”, which denotes a place or temple dedicated to the muses. In Greek mythology, the muses were revered as the patron goddesses of sciences, arts, and poetry. Mouseions were intended for study and competitions in the arts and sciences. [2].

Nowadays, the role of museums is not limited to the function of preserving and studying cultural objects. The contemporary museum is not only a place of exposition and storage of cultural artifacts, but also a constantly growing research center. In the current sociocultural situation, the role of museums as public spaces is being strengthened [3, 4].

Most modern researchers [5-8] consider a museum as a social institution, since it performs certain social functions. Museums act as cultural and educational institutions that promote cultivation of moral and patriotic values, education and attraction to culture and art of the population masses.

When designing museums, it is necessary to take into account all areas of the museum activities, with regard to the versatility of processes carried out under the same roof. The main thing in the design of a museum building is to create such a structure for space allocation and interaction that provide the most favorable conditions for acquaintance with the museum collections, perception and
study of the most important exhibits, and the necessary conditions for storing collections, historical and cultural monuments, and organizing research and educational work. The architect faces the complex task of achieving architectural and planning, constructive, and technical unity as well as unity of appearance and functionality, ensuring that all the necessary processes are carried out without interfering with each other.

The space-planning decision of museum buildings depends on a number of factors, which we will consider in this paper.

2. Analysis of factors influencing architectural and planning concepts of museums

Throughout history of the museum architecture evolution, factors influencing the formation of the appearance of a museum building were transformed in accordance with the current demands of society. In a rapidly changing world, a gradual transformation of public views on cultural heritage has taken place. [9, 10]. After analyzing the studies on the design of museums [11-13], we came to the conclusion that the factors affecting the formation of the architectural and planning decisions of the museum can be divided into two categories: environmental and functional technology factors.

2.1. Environmental factors

This group includes sociocultural and regional factors, climatic conditions, and urban planning situation.

2.2. Sociocultural factors

Among these factors, there are traditions in culture, public life, architecture, as well as the state of development of national architectural schools in the period of time concerned, the level of development of the regional economy, the universalization of the architectural environment as a result of globalization, and the rethinking of national architectural and cultural traditions.

In a rapidly changing world, museums are trying to establish a relationship between the economic, social, cultural attitudes of society and reduce the information gap between professional views on the essence of museum work and the expectations formed in the public mind at the end of the 20th century [14]. The task of the modern museum is to go beyond the traditional beliefs, presenting a museum in a new quality, with those new approaches, methods, and forms of existence that become its integral attributes.

2.3. Regional factors

Proximity to or remoteness from large cities, economic and cultural centers affect the volume of visitors, investment attractiveness and the level of financing of the cultural object, the level of innovative activity of the museum. The presence of local places of interest or unique collections is an additional means of increasing the attractiveness of the museum in organizing tourist services. Regional museums create a full-fledged image of the history and culture of the region, giving people the opportunity to better understand themselves through familiarization with their history and culture, and thereby fully realize their opportunities in modern life [15].

The Lofotr Viking Museum in Borg has an interesting architecture which is a reconstructed chieftain's house. During the construction of the museum, pebbles and turf were used, and the interior of the Museum is made of wood. The Norwegian Glacier Museum is built of concrete and glass. The combination of simple volumes with clear geometric shapes forms an extended building of complex configuration. The building is organically integrated into the natural landscape. It seems to grow into the glacier above it. The sloping planes of windows and walls and the textured surface of concrete resemble the outlines of mountains.
2.4. Natural and climatic conditions
The difference in climatic conditions significantly affects the architectural and planning decisions of the designed objects, so we will consider them in detail. This especially applies to the temperature regime of the region.

Territories with critically low temperatures are characterized by architectural and planning decisions with the development of the shape of the building in a single volume with minimal glazing. This allows creating a comfortable microclimate inside the building by means of architecture, ensuring optimal operating conditions of the building while saving money on heating and air conditioning. If there are decorative elements and a complex volume, large snow deposits are formed on and around the building. Therefore, in the North, it is undesirable to use balconies, loggias, deep-sinking openings, platbands, moldings, and other decorative elements. All this determines the compactness and laconism of the three-dimensional solution for the building, which is demonstrated by the Taimyr Local Lore Museum in Dudinka.

At the same time, the architectural solutions for museum buildings remain diverse and unique, such as the Fram Museum on the Bygdoy Peninsula or the Vancouver Maritime Museum, the building of which is a high gable volume with triangular glass inserts on a triangular facade. The ridge of the building is made of translucent material, which allows for diffused natural lighting in any weather. The steep slope of the side walls provides quick snow flow and the resistance to wind loads.

For areas with a mild and warm climate, it is preferable to have gallery-type buildings with a complex planning structure, covered galleries or passages, with courtyards, terraces, trafficable roofs, etc. to create an optimal ventilation mode and include exterior elements in the composition of the museum complex.

The concept of museum openness, put forward by a number of museologists and architects [16–18], is embodied in the construction of new museum and exhibition centers, such as, for example, the Centre Pompidou-Metz, a museum of modern and contemporary art located in Metz, France. Its building seems to float above the ground, disappearing into the surrounding Park. The smooth curves of the enclosing structures flow gently into the surrounding landscape.

For areas with specific construction conditions (areas of seismic activity, mining, with collapsible soils, etc.), buildings with dividing the volume into separate compartments are required.

The humidity regime of a region affects the choice of construction and finishing materials used in the construction of the building and the production of finishing work. Also in regions with high humidity, equipping the museum building with special air conditioning systems is required.

Territories with the threat of flooding require a high basement or the location of the museum building on a hill, and the arrangement of storage facilities not in the basement, as it is common for most museums, but in attics. Sometimes large museums have freestanding fund buildings. For example, the Restoration and Storage Center of the State Hermitage “Old Village” is a group of buildings of the State Hermitage with a total area of 35,000 square meters, which includes a storage facility, exhibition, lecture, restoration, and engineering and administrative buildings.

2.5. Urban planning situation
The location of a museum as a public building is connected with the solution for a large urban planning problem. Being a unique object for a city in its social significance, the museum building, regardless of its size, should correspond to its ideological and educational role and become a landmark of the city. This makes the architect responsible for the artistic expressiveness of the designed building.

The place for the museum building should be chosen with particular care, taking into account the factor of accessibility and high attendance. A site that has convenient transport links with the center and other areas of the city is preferred for the museum building. When choosing a site, the environment and territory are evaluated from the perspective of the possibility of the museum developing over time.
There are several main variants for placing museum buildings and complexes in the urban environment.

The insulated free location of the museum on an open natural site involves an all-around view of the building from different points. This situation requires linking the architectural solution with the natural environment (the Tsiolkovsky Museum in Kaluga on a high open hill and the Leger Museum in Biota). The position of the museum in the park facilitates the connection of the interior with the external environment, the organization of an outdoor exhibition, the terracing of the territory, the inclusion of greenery and water in the composition (the Maeght in Saint-Paul de Vence), and creates the prerequisites for the aesthetic expressiveness of the museum complex and its protection from dust and polluted air.

Another option is to place the museum in the area of the reconstructed street or square of the city. When placing the museum in the ensemble of the old city, the problem of the relationship of the old and the new arises. First of all, it is necessary to determine for what purpose a new object is included in the ensemble. If it is to become the leading element in the composition, it should have the value of a static dominant. If an object is included in the existing spatial composition, it is given a subordinate character, and the integrity of the ensemble is achieved by means of proportionality of scales, unity of rhythm and modulus. In a cramped urban environment, a museum building, contrasting with the existing development, gets a larger volumetric solution (the Solomon Guggenheim Museum and the Whitney Museum in New York). Another example of a bold and bright architectural solution is the China Art Museum in Shanghai. The building has the shape of an inverted pyramid. Given the shortage of urban space, the development of the building volume in height among the existing buildings makes it possible to free up space on the ground for organizing transport and pedestrian flows.

When the museum is located in the cultural center of the city, it is considered as part of a new ensemble. When placing a Museum in a one-time created ensemble, the structure of the object is subject to creative design and is endowed with the appropriate plastic qualities and proportional structure. The location of the museum in the cultural center increases its attendance.

2.6. Functional technology factors

Functional technology factors include those ones that ensure imagery and functional development of a museum, such as its specialization, types and scope of the events performed, and technological infrastructure. The architectural and spatial structure of a museum should contribute to its thematic and exposition concept while the technical equipment of the building should provide a comfortable temperature, humidity, light, and acoustic mode.

2.6.1. Specialization

The museum content, that is, the character of its unique collections wields major influence on the architectural and space-planning design and composition of the museum building. There are different types of museums including art museums, memorial museums commemorating the outstanding persons of art, literature, or theatre, science museums (such as geological, paleontological, zoological, or oceanographic), and many others.

A new direction in the architecture of museum buildings is an exhibit building, when the museum is not being built to house any collection, but as a self-value piece of architecture for various exhibitions. The museum building itself and its unique appearance serve to attract visitors and exhibition organizers. The pragmatic function of architecture in these cases is almost completely replaced by its ability to actively communicate with the environment. So, the task of museum architecture is to create a space that is attractive to visitors and can raise monetary profit, and not best adapted for storing and displaying museum items [19, P. 11-12]. A striking example of such construction is the Guggenheim Museum Bilbao, Spain [17].
2.6.2. Types and scope of the events performed
Along with the museum specialization, the types and scope of events held and the capacity of the building, that is its absolute size influence its structure and artistic image. A contemporary museum is a multifunctional facility where various types of activities are developed and improved. These include the storage and restoration of collections, exhibition activity, education, character building, mass education, scientific research, and methodological activity. Souvenir shops, cafes, information centers, travel agencies and much more become an integral part of a contemporary museum. To implement educational and leisure functions, museums need extensive recreational space since they have become centers of up-to-date information and communication [20]. Large museums hold various lecture courses, interactive exhibitions, exhibitions with laser show elements, and other events.

2.6.3. Technological infrastructure
Today a high level of technical equipment is an integral part of the museum quality work. Conventionally, this equipment can be divided into two groups.

The first group includes systems that ensure the operation of the building itself and the exposure work. These are lighting, water supply and sanitation systems, security systems, heating, ventilation and air conditioning systems that can provide optimal temperature and humidity conditions for both visitors and museum employees, as well as for exhibits located in it.

The second group is equipment for performing specific museum activities such as interactive excursions, lectures, etc. This group includes multimedia tools, interactive tables, control systems, scenic holograms, 3D graphics, animation, inquiry and communications systems and many other tools that are intelligently integrated into the museum space and tactfully interact with the museum objects at an exhibition [21].

3. Results
As a result of the study, we defined two main categories of factors that influence the formation of the architectural and planning solutions for contemporary museums. They exist in parallel, exerting mutual influence on each other and on the formation of the museum architecture concept.

The transformation of public views on cultural heritage and the extension of museum functions in the contemporary world require taking into account, first, objective environmental factors in the formation of architectural and planning solutions, namely:

- sociocultural factors;
- regional conditions;
- natural and climatic conditions;
- urban planning situation.

Second, the development of the museum architectural and planning concept depends directly on functional technology factors, such:

- specialization of the museum;
- types and scope of events held;
- technological infrastructure.

4. Conclusion
Changing the role of museums in modern society inevitably requires a modification of approaches to their design. Since a museum is no longer a closed environment, intended only for the conservation of artifacts, but becomes a sociocultural center with diverse educational, cultural, and social functions, it is necessary to organize a number of additional spaces for these activities. Museums are no longer static, and the architectural space is no longer just a case for collections of exhibits. Thus, the design of contemporary museums should be performed taking into account environmental and functional technology factors for the full implementation of modern requirements for the interactive nature of collaboration of the museum and its visitors.
References

[1] Museum great Russian Encyclopedia 2012 (Moscow) 21 387–392
[2] Shilov L A 1969 From the history of the Faculty of Law of St. Petersburg University (1819-1917) Bulletin of Leningrad University 5(1) 107–119
[3] Chuvorkina O A 2011 The social facets of a contemporary museum, or an art institution working for a human being Articult 3 1–8
[4] Ermolenko E V 2017 Spatial core in the museum structure Architecture and modern information technologies 2 68–80
[5] Surikova K V 2015 Form and function in 20-century museum architecture Bulletin of St. Petersburg State University 17(2) 79–84
[6] Fedotova N Yu 2014 Contemporary trends in modernization of museums: an analysis of new architectural projects Articult 4 49–53
[7] Chugunova A V 2013 «Home» for a museum: to the question of museum architecture functions Bulletin of St. Petersburg State University 4 126–128
[8] Kuklinova I A 2019 Development of universal museums in 21st century Bulletin of Saint Petersburg State University of Culture 1 109–113
[9] Ovchinnikova Z A 2017 The museum in the context of social and cultural transformations in the information society Culture and Arts Herald 3 43–48
[10] Giebelhausen M 2006 The architecture is the museum New museum theory and practice: an introduction (Oxford: Blackwell Publishing Ltd.) I Marstine J pp 41–42
[11] Chugunova A V 2011 Museum architecture within the framework of the “new museology” movement Bulletin of Herzen Pedagogical University 131 372–376
[12] Surikova K V 2012 The evolution of the museum: from the museum to the white cube Voprosy muzeologii 2 11–17
[13] Petrushikhina S V 2018 The architectural-artistic appearance of the museum in the early 21st century Articult 2 144–148
[14] Budko A A 2015 The image of the museum in the XXI century Proceedings of Saint Petersburg State University of Culture 212 11–18
[15] Chugunova A V 2010 Museum architecture in the context of contemporary culture Voprosy Muzeologii 1 34–43
[16] Sirotina T A 2013 Historical and theoretical foundation of principles of studying up-to-date problems of the museum environment Yaroslavl Pedagogical Bulletin 1(3) 208–211
[17] Mastenitsa E N 2015 Museum world in the XXI century: development vectors Proceedings of Saint Petersburg State University of Culture 212 19–26
[18] Bakushkina E S 2016 Architecture of modern museum buildings: formation of semantic models Bulletin of Kemerovo State University of Culture and Arts 34 102–108
[19] Zeiger M 2005 New Museums: contemporary museum architecture around the world (New York: Universe) p 208
[20] Skripkina L I 2015 The construction of new museums in the context of the global challenges Bulletin of Moscow State University of Culture and Arts 6 148–155
[21] Lermontova E N 2015 Phenomenological analysis of museum environment based on materials of domestic and foreign museum experts The BSU Bulletin 14 122–126

Acknowledgments
The work was supported by Act 211 Government of the Russian Federation, contract № 02.A03.21.0011.